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Technical Support Document for Land Application of Sewage Sludge

Volume II

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FOR

LAND APPLICATION OF SEWAGE SLUDGE

VOLUME II

APPENDICES

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APPENDIX A

40 CFR Part 503 Standards for the Use or Disposal of Sewage Sludge, Subparts A, B, and D

Subchapter O in chapter I of title 40 of the Code of Federal Regulations is amended by adding part 503, which reads as follows:

SUBCHAPTER O—SEWAGE SLUDGE

PART 503—STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

Authority: Sections 405 (d) and (e) of the Clean Water Act, as amended by Pub. L. 95–217, Sec. 54(d), 91 Stat. 1591 (33 U.S.C. 1345 (d) and (e)); and Pub. L. 100–4, Title IV, Sec. 406 (a), (b), 101 Stat., 71, 72 (33 U.S.C. 1251 *et seq.*).

Subpart A—General Provisions

§ 503.1 Purpose and applicability.

(a) *Purpose.* (1) This part establishes standards, which consist of general requirements, pollutant limits, management practices, and operational standards, for the final use or disposal of sewage sludge generated during the treatment of domestic sewage in a treatment works. Standards are included in this part for sewage sludge applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator. Also included in this part are pathogen and alternative vector attraction reduction requirements for sewage sludge applied to the land or placed on a surface disposal site.

(2) In addition, the standards in this part include the frequency of monitoring and recordkeeping requirements when sewage sludge is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator. Also included in this part are reporting requirements for Class I sludge management facilities, publicly owned treatment works (POTWs) with a design flow rate equal to or greater than one million gallons per day, and POTWs that serve 10,000 people or more.

(b) *Applicability.* (1) This part applies to any person who prepares sewage sludge, applies sewage sludge to the land, or fires sewage sludge in a sewage sludge incinerator and to the owner/operator of a surface disposal site.

(2) This part applies to sewage sludge applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator.

(3) This part applies to the exit gas from a sewage sludge incinerator stack.

(4) This part applies to land where sewage sludge is applied, to a surface disposal site, and to a sewage sludge incinerator.

§ 503.2 Compliance period.

(a) Compliance with the standards in this part shall be achieved as expeditiously as practicable, but in no case later than February 19, 1994. When compliance with the standards requires construction of new pollution control facilities, compliance with the standards shall be achieved as expeditiously as practicable, but in no case later than February 19, 1995.

(b) The requirements for frequency of monitoring, recordkeeping, and reporting in this part for total hydrocarbons in the exit gas from a sewage sludge incinerator are effective February 19, 1994 or, if compliance with the operational standard for total hydrocarbons in this part requires the construction of new pollution control facilities, February 19, 1995.

(c) All other requirements for frequency of monitoring, recordkeeping, and reporting in this part are effective on July 20, 1993.

§ 503.3 Permits and direct enforceability.

(a) Permits. The requirements in this part may be implemented through a permit:

(1) Issued to a "treatment works treating domestic sewage", as defined in 40 CFR 122.2, in accordance with 40 CFR parts 122 and 124 by EPA or by a State that has a State sludge management program approved by EPA in accordance with 40 CFR part 123 or 40 CFR part 501 or

(2) Issued under subtitle C of the Solid Waste Disposal Act; part C of the Safe Drinking Water Act; the Marine Protection, Research, and Sanctuaries Act of 1972; or the Clean Air Act. "Treatment works treating domestic sewage" shall submit a permit application in accordance with either 40 CFR 122.21 or an approved State program.

(b) Direct enforceability. No person shall use or dispose of sewage sludge through any practice for which requirements are established in this part except in accordance with such requirements.

§ 503.4 Relationship to other regulations.

Disposal of sewage sludge in a municipal solid waste landfill unit, as defined in 40 CFR 258.2, that complies with the requirements in 40 CFR part 258 constitutes compliance with section 405(d) of the CWA. Any person who prepares sewage sludge that is disposed in a municipal solid waste landfill unit shall ensure that the sewage sludge meets the requirements in 40 CFR part 258 concerning the quality of materials disposed in a municipal solid waste landfill unit.

§ 503.5 Additional or more stringent requirements.

(a) On a case-by-case basis, the permitting authority may impose requirements for the use or disposal of sewage sludge in addition to or more stringent than the requirements in this part when necessary to protect public health and the environment from any adverse effect of a pollutant in the sewage sludge.

(b) Nothing in this part precludes a State or political subdivision thereof or interstate agency from imposing requirements for the use or disposal of sewage sludge more stringent than the requirements in this part or from imposing additional requirements for the use or disposal of sewage sludge.

§ 503.6 Exclusions.

(a) *Treatment processes.* This part does not establish requirements for processes used to treat domestic sewage or for processes used to treat sewage sludge prior to final use or disposal, except as provided in § 503.32 and § 503.33.

(b) *Selection of a use or disposal practice.* This part does not require the selection of a sewage sludge use or disposal practice. The determination of the manner in which sewage sludge is used or disposed is a local determination.

(c) *Co-firing of sewage sludge.* This part does not establish requirements for sewage sludge co-fired in an incinerator with other wastes or for the incinerator in which sewage sludge and other wastes are co-fired. Other wastes do not include auxiliary fuel, as defined in 40 CFR 503.41(b), fired in a sewage sludge incinerator.

(d) *Sludge generated at an industrial facility.* This part does not establish requirements for the use or disposal of sludge generated at an industrial facility during the treatment of industrial wastewater, including sewage sludge generated during the treatment of industrial wastewater combined with domestic sewage.

(e) *Hazardous sewage sludge.* This part does not establish requirements for the use or disposal of sewage sludge determined to be hazardous in accordance with 40 CFR part 261.

(f) *Sewage sludge with high PCB concentration.* This part does not establish requirements for the use or disposal of sewage sludge with a concentration of polychlorinated biphenyls (PCBs) equal to or greater than 50 milligrams per kilogram of total solids (dry weight basis).

(g) *Incinerator ash.* This part does not establish requirements for the use or disposal of ash generated during the firing of sewage sludge in a sewage sludge incinerator.

(h) *Grit and screenings.* This part does not establish requirements for the use or disposal of grit (e.g., sand, gravel, cinders, or other materials with a high specific gravity) or screenings (e.g., relatively large materials such as rags) generated during preliminary treatment of domestic sewage in a treatment works.

(i) *Drinking water treatment sludge.* This part does not establish requirements for the use or disposal of sludge generated during the treatment of either surface water or ground water used for drinking water.

(j) *Commercial and industrial septage.* This part does not establish requirements for the use or disposal of commercial septage, industrial septage, a mixture of domestic septage and commercial septage, or a mixture of domestic septage and industrial septage.

§ 503.7 Requirement for a person who prepares sewage sludge.

Any person who prepares sewage sludge shall ensure that the applicable requirements in this part are met when the sewage sludge is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator.

§ 503.8 Sampling and analysis.

(a) *Sampling.* Representative samples of sewage sludge that is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator shall be collected and analyzed.

(b) *Methods.* The materials listed below are incorporated by reference in this part. These incorporations by reference were approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. The materials are incorporated as they exist on the date of approval, and notice of any change in these materials will be published in the **Federal Register**. They are available for inspection at the Office of the Federal Register, 7th Floor, suite 700, 800 North Capitol Street, NW., Washington, DC, and at the Office of Water Docket, room L–102, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC. Copies may be obtained from the standard producer or publisher listed in the regulation. Methods in the materials listed below shall be used to analyze samples of sewage sludge.

(1) *Enteric viruses.* ASTM Designation: D 4994–89, "Standard Practice for Recovery of Viruses From Wastewater Sludges", 1992 Annual Book of ASTM Standards: Section 11—Water and Environmental Technology, ASTM, 1916 Race Street, Philadelphia, PA 19103–1187.

(2) *Fecal coliform.* Part 9221 E. or Part 9222 D., "Standard Methods for the Examination of Water and Wastewater" 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

(3) *Helminth ova.* Yanko, W.A., "Occurrence of Pathogens in Distribution and Marketing Municipal Sludges", EPA 600/1–87–014, 1987. National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (PB 88–154273/AS).

(4) *Inorganic pollutants.* "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA Publication SW–846, Second Edition (1982) with Updates I (April 1984) and II (April 1985) and Third Edition (November 1986) with Revision I (December 1987). Second Edition and Updates I and II are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (PB–87–120–291). Third Edition and Revision I are available from Superintendent of Documents, Government Printing Office, 941 North Capitol Street, NE., Washington, DC 20002 (Document Number 955–001–00000–1).

(5) *Salmonella sp. bacteria.* Part 9260 D., "Standard Methods for the Examination of Water and Wastewater" 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005; or

Kenner, B.A. and H.P. Clark, "Detection and enumeration of *Salmonella* and *Pseudomonas aeruginosa*", Journal of the Water Pollution Control Federation, Vol. 46, no. 9, September 1974, pp. 2163–2171. Water Environment Federation, 601 Wythe Street, Alexandria, Virginia 22314.

(6) *Specific oxygen uptake rate.* Part 2710 B., "Standard Methods for the Examination of Water and Wastewater" 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

(7) *Total, fixed, and volatile solids.* Part 2540 G., "Standard Methods for the Examination of Water and Wastewater" 18th Edition, 1992, American Public Health Association, 1015 15th Street, NW., Washington, DC 20005.

§ 503.9 General definitions.

(a) *Apply sewage sludge or sewage sludge applied to the land* means land application of sewage sludge.

(b) *Base flood* is a flood that has a one percent chance of occurring in any given year (i.e., a flood with a magnitude equalled once in 100 years).

(c) *Class I sludge management facility* is any publicly owned treatment works (POTW), as defined in 40 CFR 501.2, required to have an approved pretreatment program under 40 CFR 403.8(a) (including any POTW located in a State that has elected to assume local program responsibilities pursuant to 40 CFR 403.10(e)) and any treatment works treating domestic sewage, as defined in 40 CFR 122.2, classified as a Class I sludge management facility by the EPA Regional Administrator, or, in the case of approved State programs, the Regional Administrator in conjunction with the State Director, because of the potential for its sewage sludge use or disposal practice to affect public health and the environment adversely.

(d) *Cover crop* is a small grain crop, such as oats, wheat, or barley, not grown for harvest.

(e) *CWA* means the Clean Water Act (formerly referred to as either the Federal Water Pollution Act or the Federal Water Pollution Control Act Amendments of 1972), Public Law 92–500, as amended by Public Law 95–217, Public Law 95–576, Public Law 96–483, Public Law 97–117, and Public Law 100–4.

(f) *Domestic septage* is either liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receives only domestic sewage. Domestic septage does not include liquid or solid material removed from a septic tank, cesspool, or similar treatment works that receives either commercial wastewater or industrial wastewater and does not include grease removed from a grease trap at a restaurant.

(g) *Domestic sewage* is waste and wastewater from humans or household operations that is discharged to or otherwise enters a treatment works.

(h) *Dry weight basis* means calculated on the basis of having been dried at 105 degrees Celsius until reaching a constant mass (i.e., essentially 100 percent solids content).

(i) *EPA* means the United States Environmental Protection Agency.

(j) *Feed crops* are crops produced primarily for consumption by animals.

(k) *Fiber crops* are crops such as flax and cotton.

(l) *Food crops* are crops consumed by humans. These include, but are not limited to, fruits, vegetables, and tobacco.

(m) *Ground water* is water below the land surface in the saturated zone.

(n) *Industrial wastewater* is wastewater generated in a commercial or industrial process.

(o) *Municipality* means a city, town, borough, county, parish, district, association, or other public body (including an intermunicipal Agency of two or more of the foregoing entities) created by or under State law; an Indian tribe or an authorized Indian tribal organization having jurisdiction over sewage sludge management; or a designated and approved management Agency under section 208 of the CWA, as amended. The definition includes a special district created under State law, such as a water district, sewer district, sanitary district, utility district, drainage district, or similar entity, or an integrated waste management facility as defined in section 201(e) of the CWA, as amended, that has as one of its principal responsibilities the treatment, transport, use, or disposal of sewage sludge.

(p) *Permitting authority* is either EPA or a State with an EPA-approved sludge management program.

(q) *Person* is an individual, association, partnership, corporation, municipality, State or Federal agency, or an agent or employee thereof.

(r) *Person who prepares sewage sludge* is either the person who generates sewage sludge during the treatment of domestic sewage in a treatment works or the person who derives a material from sewage sludge.

(s) *Place sewage sludge or sewage sludge placed* means disposal of sewage sludge on a surface disposal site.

(t) *Pollutant* is an organic substance, an inorganic substance, a combination of organic and inorganic substances, or a pathogenic organism that, after discharge and upon exposure, ingestion, inhalation, or assimilation into an organism either directly from the environment or indirectly by ingestion through the food chain, could, on the basis of information available to the Administrator of EPA, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunction in reproduction), or physical deformations in either organisms or offspring of the organisms.

(u) *Pollutant limit* is a numerical value that describes the amount of a pollutant allowed per unit amount of sewage sludge (e.g., milligrams per kilogram of total solids); the amount of a pollutant that can be applied to a unit area of land (e.g., kilograms per hectare); or the volume of a material that can be applied to a unit area of land (e.g., gallons per acre).

(v) *Runoff* is rainwater, leachate, or other liquid that drains overland on any part of a land surface and runs off of the land surface.

(w) *Sewage sludge* is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works.

(x) *State* is one of the United States of America, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Trust Territory of the Pacific Islands, the Commonwealth of the Northern Mariana Islands, and an Indian Tribe eligible for treatment as a State pursuant to regulations promulgated under the authority of section 518(e) of the CWA.

(y) *Store or storage of sewage sludge* is the placement of sewage sludge on land on which the sewage sludge remains for two years or less. This does not include the placement of sewage sludge on land for treatment.

(z) *Treat or treatment of sewage sludge* is the preparation of sewage sludge for final use or disposal. This includes, but is not limited to, thickening, stabilization, and dewatering of sewage sludge. This does not include storage of sewage sludge.

(aa) *Treatment works* is either a federally owned, publicly owned, or privately owned device or system used to treat (including recycle and reclaim) either domestic sewage or a combination of domestic sewage and industrial waste of a liquid nature.

(bb) *Wetlands* means those areas that are inundated or saturated by surface water or ground water at a frequency and duration to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Subpart B—Land Application

§ 503.10 Applicability.

(a) This subpart applies to any person who prepares sewage sludge that is applied to the land, to any person who applies sewage sludge to the land, to sewage sludge applied to the land, and to the land on which sewage sludge is applied.

(b)(1) *Bulk sewage sludge.* The general requirements in § 503.12 and the management practices in § 503.14 do not apply when bulk sewage sludge is applied to the land if the bulk sewage sludge meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

(2) The Regional Administrator of EPA or, in the case of a State with an approved sludge management program, the State Director, may apply any or all of the general requirements in § 503.12 and the management practices in § 503.14 to the bulk sewage sludge in § 503.10(b)(1) on a case-by-case basis after determining that the general requirements or management practices are needed to protect public health and the environment from any reasonably anticipated adverse effect that may occur from any pollutant in the bulk sewage sludge.

(c)(1) The general requirements in § 503.12 and the management practices in § 503.14 do not apply when a bulk material derived from sewage sludge is applied to the land if the derived bulk material meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

(2) The Regional Administrator of EPA or, in the case of a State with an approved sludge management program, the State Director, may apply any or all of the general requirements in § 503.12 or the management practices in § 503.14 to the bulk material in § 503.10(c)(1) on a case-by-case basis after determining that the general requirements or management practices are needed to protect public health and the environment from any reasonably anticipated adverse effect that may occur from any pollutant in the bulk sewage sludge.

(d) The requirements in this subpart do not apply when a bulk material derived from sewage sludge is applied to the land if the sewage sludge from which the bulk material is derived meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

(e) *Sewage sludge sold or given away in a bag or other container for application to the land.* The general requirements in § 503.12 and the management practices in § 503.14 do not apply when sewage sludge is sold or given away in a bag or other container for application to the land if the sewage sludge sold or given away in a bag or other container for application to the land meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

(f) The general requirements in § 503.12 and the management practices in § 503.14 do not apply when a material derived from sewage sludge is sold or given away in a bag or other container for application to the land if the derived material meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

(g) The requirements in this subpart do not apply when a material derived from sewage sludge is sold or given away in a bag or other container for application to the land if the sewage sludge from which the material is derived meets the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8).

§ 503.11 Special definitions.

(a) *Agricultural land* is land on which a food crop, a feed crop, or a fiber crop is grown. This includes range land and land used as pasture.

(b) *Agronomic rate* is the whole sludge application rate (dry weight basis) designed:

(1) To provide the amount of nitrogen needed by the food crop, feed crop, fiber crop, cover crop, or vegetation grown on the land; and

(2) To minimize the amount of nitrogen in the sewage sludge that passes below the root zone of the crop or vegetation grown on the land to the ground water.

(c) *Annual pollutant loading rate* is the maximum amount of a pollutant that can be applied to a unit area of land during a 365 day period.

(d) *Annual whole sludge application rate* is the maximum amount of sewage sludge (dry weight basis) that can be applied to a unit area of land during a 365 day period.

(e) *Bulk sewage sludge* is sewage sludge that is not sold or given away in a bag or other container for application to the land.

(f) *Cumulative pollutant loading rate* is the maximum amount of an inorganic pollutant that can be applied to an area of land.

(g) *Forest* is a tract of land thick with trees and underbrush.

(h) *Land application* is the spraying or spreading of sewage sludge onto the land surface; the injection of sewage sludge below the land surface; or the incorporation of sewage sludge into the soil so that the sewage sludge can either condition the soil or fertilize crops or vegetation grown in the soil.

(i) *Monthly average* is the arithmetic mean of all measurements taken during the month.

(j) *Other container* is either an open or closed receptacle. This includes, but is not limited to, a bucket, a box, a carton, and a vehicle or trailer with a load capacity of one metric ton or less.

(k) *Pasture* is land on which animals feed directly on feed crops such as legumes, grasses, grain stubble, or stover.

(l) *Public contact site* is land with a high potential for contact by the public. This includes, but is not limited to, public parks, ball fields, cemeteries, plant nurseries, turf farms, and golf courses.

(m) *Range land* is open land with indigenous vegetation.

(n) *Reclamation site* is drastically disturbed land that is reclaimed using sewage sludge. This includes, but is not limited to, strip mines and construction sites.

§ 503.12 General requirements.

(a) No person shall apply sewage sludge to the land except in accordance with the requirements in this subpart.

(b) No person shall apply bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) to agricultural land, forest, a public contact site, or a reclamation site if any of the cumulative pollutant loading rates in § 503.13(b)(2) has been reached.

(c) No person shall apply domestic septage to agricultural land, forest, or a reclamation site during a 365 day period if the annual application rate in § 503.13(c) has been reached during that period.

(d) The person who prepares bulk sewage sludge that is applied to agricultural land, forest, a public contact site, or a reclamation site shall provide the person who applies the bulk sewage sludge written notification of the concentration of total nitrogen (as N on a dry weight basis) in the bulk sewage sludge.

(e)(1) The person who applies sewage sludge to the land shall obtain information needed to comply with the requirements in this subpart.

(2)(i) Before bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) is applied to the land, the person who proposes to apply the bulk sewage sludge shall contact the permitting authority for the State in which the bulk sewage sludge will be applied to determine whether bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) has been applied to the site since July 20, 1993.

(ii) If bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) has not been applied to the site since July 20, 1993, the cumulative amount for each pollutant listed in Table 2 of § 503.13 may be applied to the site in accordance with § 503.13(a)(2)(i).

(iii) If bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) has been applied to the site since July 20, 1993, and the cumulative amount of each pollutant applied to the site in the bulk sewage sludge since that date is known, the cumulative amount of each pollutant applied to the site shall be used to determine the additional amount of each pollutant that can be applied to the site in accordance with § 503.13(a)(2)(i).

(iv) If bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) has been applied to the site since July 20, 1993, and the cumulative amount of each pollutant applied to the site in the bulk sewage sludge since that date is not known, an additional amount of each pollutant shall not be applied to the site in accordance with § 503.13(a)(2)(i).

(f) When a person who prepares bulk sewage sludge provides the bulk sewage sludge to a person who applies the bulk sewage sludge to the land, the person who prepares the bulk sewage sludge shall provide the person who applies the sewage sludge notice and necessary information to comply with the requirements in this subpart.

(g) When a person who prepares sewage sludge provides the sewage sludge to another person who prepares the sewage sludge, the person who provides the sewage sludge shall provide the person who receives the sewage sludge notice and necessary information to comply with the requirements in this subpart.

(h) The person who applies bulk sewage sludge to the land shall provide the owner or lease holder of the land on which the bulk sewage sludge is applied notice and necessary information to comply with the requirements in this subpart.

(i) Any person who prepares bulk sewage sludge that is applied to land in a State other than the State in which the bulk sewage sludge is prepared shall provide written notice, prior to the initial application of bulk sewage sludge to the land application site by the applier, to the permitting authority for the State in which the bulk sewage sludge is proposed to be applied. The notice shall include:

(1) The location, by either street address or latitude and longitude, of each land application site.

(2) The approximate time period bulk sewage sludge will be applied to the site.

(3) The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) for the person who prepares the bulk sewage sludge.

(4) The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) for the person who will apply the bulk sewage sludge.

(j) Any person who applies bulk sewage sludge subject to the cumulative pollutant loading rates in § 503.13(b)(2) to the land shall provide written notice, prior to the initial application of bulk sewage sludge to a land application site by the applier, to the permitting authority for the State in which the bulk sewage sludge will be applied and the permitting authority shall retain and provide access to the notice. The notice shall include:

(1) The location, by either street address or latitude and longitude, of the land application site.

(2) The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) of the person who will apply the bulk sewage sludge.

§ 503.13 Pollutant limits.

(a) Sewage sludge. (1) Bulk sewage sludge or sewage sludge sold or given away in a bag or other container shall not be applied to the land if the concentration of any pollutant in the sewage sludge exceeds the ceiling concentration for the pollutant in Table 1 of § 503.13.

(2) If bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site, either:

(i) The cumulative loading rate for each pollutant shall not exceed the cumulative pollutant loading rate for the pollutant in Table 2 of § 503.13; or

(ii) The concentration of each pollutant in the sewage sludge shall not exceed the concentration for the pollutant in Table 3 of § 503.13.

(3) If bulk sewage sludge is applied to a lawn or a home garden, the concentration of each pollutant in the

sewage sludge shall not exceed the concentration for the pollutant in Table 3 of § 503.13.

(4) If sewage sludge is sold or given away in a bag or other container for application to the land, either:

(i) The concentration of each pollutant in the sewage sludge shall not exceed the concentration for the pollutant in Table 3 of § 503.13; or

(ii) The product of the concentration of each pollutant in the sewage sludge and the annual whole sludge application rate for the sewage sludge shall not cause the annual pollutant loading rate for the pollutant in Table 4 of § 503.13 to be exceeded. The procedure used to determine the annual whole sludge application rate is presented in appendix A of this part.

(b) Pollutant concentrations and loading rates—sewage sludge.

(1) Ceiling concentrations.

TABLE 1 OF § 503.13.—CEILING CONCENTRATIONS

Pollutant	Ceiling concentration (milligrams per kilogram) [1]
Arsenic	75
Cadmium	85
Chromium	3000
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7500

[1] Dry weight basis.

(2) Cumulative poll[illegible]nt loading rates.

TABLE 2 OF § 503.13.—CUMULATIVE POLLUTANT LOADING RATES

Pollutant	Cumulative pollutant loading rate (kilograms per hectare)
Arsenic	41
Cadmium	39
Chromium	3000
Copper	1500
Lead	300
Mercury	17
Molybdenum	18
Nickel	420
Selenium	100
Zinc	2800

(3) Pollutant concentrations.

TABLE 3 OF § 503.13.—POLLUTANT CONCENTRATIONS

Pollutant	Monthly average concentrations (milligrams per kilogram) [1]
Arsenic	41
Cadmium	39
Chromium	1200
Copper	1500
Lead	300
Mercury	17
Molybdenum	18
Nickel	420
Selenium	36
Zinc	2800

[1] Dry weight basis.

(4) Annual pollutant loading rates.

TABLE 4 OF § 503.13.—ANNUAL POLLUTANT LOADING RATES

Pollutant	Annual pollutant loading rate (kilograms per hectare per 365 day period)
Arsenic	2.0
Cadmium	1.9
Chromium	150
Copper	75
Lead	15
Mercury	0.85
Molybdenum	0.90
Nickel	21
Selenium	5.0
Zinc	140

(c) Domestic septage.

The annual application rate for domestic septage applied to agricultural land, forest, or a reclamation site shall not exceed the annual application rate calculated using equation (1).

$$AAR = \frac{N}{0.0026} \quad \text{Eq. (1)}$$

Where:

AAR=Annual application rate in gallons per acre per 365 day period.

N=Amount of nitrogen in pounds per acre per 365 day period needed by the crop or vegetation grown on the land.

§ 503.14 Management practices.

(a) Bulk sewage sludge shall not be applied to the land if it is likely to adversely affect a threatened or endangered species listed under section 4 of the Endangered Species Act or its designated critical habitat.

(b) Bulk sewage sludge shall not be applied to agricultural land, forest, a public contact site, or a reclamation site that is flooded, frozen, or snow-covered so that the bulk sewage sludge enters a wetland or other waters of the United States, as defined in 40 CFR 122.2, except as provided in a permit issued pursuant to section 402 or 404 of the CWA.

(c) Bulk sewage sludge shall not be applied to agricultural land, forest, or a reclamation site that is 10 meters or less from waters of the United States, as defined in 40 CFR 122.2, unless otherwise specified by the permitting authority.

(d) Bulk sewage sludge shall be applied to agricultural land, forest, a public contact site, or a reclamation site at a whole sludge application rate that is equal to or less than the agronomic rate for the bulk sewage sludge, unless, in the case of a reclamation site, otherwise specified by the permitting authority.

(e) Either a label shall be affixed to the bag or other container in which sewage sludge that is sold or given away for application to the land, or an information sheet shall be provided to the person who receives sewage sludge sold or given away in an other container for application to the land. The label or information sheet shall contain the following information:

(1) The name and address of the person who prepared the sewage sludge that is sold or given away in a bag or other container for application to the land.

(2) A statement that application of the sewage sludge to the land is prohibited except in accordance with the instructions on the label or information sheet.

(3) The annual whole sludge application rate for the sewage sludge that does not cause any of the annual pollutant loading rates in Table 4 of § 503.13 to be exceeded.

§ 503.15 Operational standards—pathogens and vector attraction reduction.

(a) *Pathogens—sewage sludge.*

(1) The Class A pathogen requirements in § 503.32(a) or the Class B pathogen requirements and site restrictions in § 503.32(b) shall be met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site.

(2) The Class A pathogen requirements in § 503.32(a) shall be met when bulk sewage sludge is applied to a lawn or a home garden.

(3) The Class A pathogen requirements in § 503.32(a) shall be met when sewage sludge is sold or given away in a bag or other container for application to the land.

(b) *Pathogens—domestic septage.*

The requirements in either § 503.32 (c)(1) or (c)(2) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site.

(c) *Vector attraction reduction—sewage sludge.*

(1) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(10) shall be met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site.

(2) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) shall be met when bulk sewage sludge is applied to a lawn or a home garden.

(3) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) shall be met when sewage sludge is sold or given away in a bag or other container for application to the land.

(d) *Vector attraction reduction—domestic septage.* The vector attraction reduction requirements in § 503.33(b)(9), (b)(10), or (b)(12) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site.

§ 503.16 Frequency of monitoring.

(a) *Sewage sludge.* (1) The frequency of monitoring for the pollutants listed in Table 1, Table 2, Table 3 and Table 4 of § 503.13; the pathogen density requirements in § 503.32(a) and in § 503.32(b)(2) through (b)(4); and the vector attraction reduction requirements § 503.33 (b)(1) through § 503.33(b)(8) shall be the frequency in Table 1 of § 503.16.

TABLE. 1 OF § 503.16.—FREQUENCY OF MONITORING—LAND APPLICATION

Amount of sewage sludge[1] (metric tons per 365 day period)	Frequency
Greater than zero but less than 290.	Once per year.
Equal to or greater than 290 but less than 1,500.	Once per quarter (four times per year).
Equal to or greater than 1,500 but less than 15,000.	Once per 60 days (six times per year).
Equal to or greater than 15,000.	Once per month (12 times per year).

[1] Either the amount of bulk sewage sludge applied to the land or the amount of sewage sludge received by a person who prepares sewage sludge that is sold or given away in a bag or other container for application to the land (dry weight basis).

(2) After the sewage sludge has been monitored for two years at the frequency in Table 1 of § 503.16, the permitting authority may reduce the frequency of monitoring for pollutant concentrations and for the pathogen density requirements in § 503.32 (a)(5)(ii) and (a)(5)(iii), but in no case shall the frequency of monitoring be less than once per year when sewage sludge is applied to the land.

(b) *Domestic septage.* If either the pathogen requirements in § 503.32(c)(2) or the vector attraction reduction requirements in § 503.33(b)(12) are met when domestic septage is applied to agricultural land, forest, or a reclamation site, each container of domestic septage applied to the land shall be monitored for compliance with those requirements.

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§ 503.17 Recordkeeping.

(a) *Sewage sludge.* (1) The person who prepares the sewage sludge in § 503.10(b)(1) or (e) shall develop the following information and shall retain the information for five years:

(i) The concentration of each pollutant listed in Table 3 of § 503.13 in the sewage sludge.

(ii) The following certification statement:

"I certify, under penalty of law, that the Class A pathogen requirements in § 503.32(a) and the vector attraction reduction requirement in [insert one of the vector attraction reduction requirements in § 503.33(b)(1) through § 503.33(b)(8)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements and vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(iii) A description of how the Class A pathogen requirements in § 503.32(a) are met.

(iv) A description of how one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) is met.

(2) The person who derives the material in § 503.10 (c)(1) or (f) shall develop the following information and shall retain the information for five years:

(i) The concentration of each pollutant listed in Table 3 of § 503.13 in the material.

(ii) The following certification statement:

"I certify, under penalty of law, that the Class A pathogen requirements in § 503.32(a) and the vector attraction reduction requirement in [insert one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements and the vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(iii) A description of how the Class A pathogen requirements in § 503.32(a) are met.

(iv) A description of how one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) is met.

(3) If the pollutant concentrations in § 503.13(b)(3), the Class A pathogen requirements in § 503.32(a), and the vector attraction reduction requirements in either § 503.33 (b)(9) or (b)(10) are met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site:

(i) The person who prepares the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The concentration of each pollutant listed in Table 3 of § 503.13 in the bulk sewage sludge.

(B) The following certification statement:

"I certify, under penalty of law, that the pathogen requirements in § 503.32(a) have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(C) A description of how the pathogen requirements in § 503.32(a) are met.

(ii) The person who applies the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The following certification statement:

"I certify, under penalty of law, that the management practices in § 503.14 and the vector attraction reduction requirement in [insert either § 503.33 (b)(9) or (b)(10)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices and vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including fine and imprisonment."

(B) A description of how the management practices in § 503.14 are met for each site on which bulk sewage sludge is applied.

(C) A description of how the vector attraction reduction requirements in either § 503.33(b)(9) or (b)(10) are met for each site on which bulk sewage sludge is applied.

(4) If the pollutant concentrations in § 503.13(b)(3) and the Class B pathogen requirements in § 503.32(b) are met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site:

(i) The person who prepares the bulk sewage sludge shall develop the following information and shall retain the information for five years:

(A) The concentration of each pollutant listed in Table 3 of § 503.13 in the bulk sewage sludge.

(B) The following certification statement:

"I certify under, penalty of law, that the Class B pathogen requirements in § 503.32(b) and the vector attraction reduction requirement in [insert one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) if one of those requirements is met] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements [and vector attraction reduction requirements if applicable] have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(C) A description of how the Class B pathogen requirements in § 503.32(b) are met.

(D) When one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) is met, a description of how the vector attraction reduction requirement is met.

(ii) The person who applies the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The following certification statement:

"I certify, under penalty of law, that the management practices in § 503.14, the site restrictions in § 503.32(b)(5), and the vector attraction reduction requirements in [insert either § 503.33 (b)(9) or (b)(10), if one of those requirements is met] have been met for each site on which bulk sewage sludge is applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices and site restrictions [and the vector attraction reduction requirements if applicable] have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(B) A description of how the management practices in § 503.14 are met for each site on which bulk sewage sludge is applied.

(C) A description of how the site restrictions in § 503.32(b)(5) are met for each site on which bulk sewage sludge is applied.

(D) When the vector attraction reduction requirement in either § 503.33 (b)(9) or (b)(10) is met, a description of how the vector attraction reduction requirement is met.

(5) If the requirements in § 503.13(a)(2)(i) are met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site:

(i) The person who prepares the bulk sewage sludge shall develop the following information and shall retain the information for five years.

(A) The concentration of each pollutant listed in Table 1 of § 503.13 in the bulk sewage sludge.

(B) The following certification statement:

"I certify, under penalty of law, that the pathogen requirements in [insert either § 503.32(a) or § 503.32(b)] and the vector attraction reduction requirement in [insert one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) if one of those requirements is met] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements [and vector attraction reduction requirements] have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(C) A description of how the pathogen requirements in either § 503.32 (a) or (b) are met.

(D) When one of the vector attraction requirements in § 503.33 (b)(1) through (b)(8) is met, a description of how the vector attraction requirement is met.

(ii) The person who applies the bulk sewage sludge shall develop the following information, retain the information in § 503.17 (a)(5)(ii)(A) through (a)(5)(ii)(G) indefinitely, and retain the information in § 503.17 (a)(5)(ii)(H) through (a)(5)(ii)(M) for five years.

(A) The location, by either street address or latitude and longitude, of each site on which bulk sewage sludge is applied.

(B) The number of hectares in each site on which bulk sewage sludge is applied.

(C) The date and time bulk sewage sludge is applied to each site.

(D) The cumulative amount of each pollutant (i.e., kilograms) listed in Table 2 of § 503.13 in the bulk sewage sludge applied to each site, including the amount in § 503.12(e)(2)(iii).

(E) The amount of sewage sludge (i.e., metric tons) applied to each site.

(F) The following certification statement:

"I certify, under penalty of law, that the requirements to obtain information in § 503.12(e)(2) have been met for each site on which bulk sewage sludge is applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the requirements to obtain information have been met. I am aware that there are significant penalties for false certification including fine and imprisonment."

(G) A description of how the requirements to obtain information in § 503.12(e)(2) are met.

(H) The following certification statement:

"I certify, under penalty of law, that the management practices in § 503.14 have been met for each site on which bulk sewage sludge is applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices have been met. I am aware that there are significant penalties for false certification including fine and imprisonment."

(I) A description of how the management practices in § 503.14 are met for each site on which bulk sewage sludge is applied.

(J) The following certification statement when the bulk sewage sludge meets the Class B pathogen requirements in § 503.32(b):

"I certify, under penalty of law, that the site restrictions in § 503.32(b)(5) have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the site restrictions have been met. I am aware that there are significant penalties for false certification including fine and imprisonment."

(K) A description of how the site restrictions in § 503.32(b)(5) are met for each site on which Class B bulk sewage sludge is applied.

(L) The following certification statement when the vector attraction reduction requirement in either § 503.33 (b)(9) or (b)(10) is met:

"I certify, under penalty of law, that the vector attraction reduction requirement in [insert either § 503.33(b)(9) or § 503.33(b)(10)] has been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the vector attraction reduction requirement has been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(M) If the vector attraction reduction requirements in either § 503.33 (b)(9) or (b)(10) are met, a description of how the requirements are met.

(6) If the requirements in § 503.13(a)(4)(ii) are met when sewage sludge is sold or given away in a bag or

other container for application to the land, the person who prepares the sewage sludge that is sold or given away in a bag or other container shall develop the following information and shall retain the information for five years;

(i) The annual whole sludge application rate for the sewage sludge that does not cause the annual pollutant loading rates in Table 4 of § 503.13 to be exceeded.

(ii) The concentration of each pollutant listed in Table 4 of § 503.13 in the sewage sludge.

(iii) The following certification statement:

"I certify, under penalty of law, that the management practice in § 503.14(e), the Class A pathogen requirement in § 503.32(a), and the vector attraction reduction requirement in [insert one of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practice, pathogen requirements, and vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(iv) A description of how the Class A pathogen requirements in § 503.32(a) are met.

(v) A description of how one of the vector attraction requirements in § 503.33 (b)(1) through (b)(8) is met.

(b) *Domestic septage.* When domestic septage is applied to agricultural land, forest, or a reclamation site, the person who applies the domestic septage shall develop the following information and shall retain the information for five years:

(1) The location, by either street address or latitude and longitude, of each site on which domestic septage is applied.

(2) The number of acres in each site on which domestic septage is applied.

(3) The date and time domestic septage is applied to each site.

(4) The nitrogen requirement for the crop or vegetation grown on each site during a 365 day period.

(5) The rate, in gallons per acre per 365 day period, at which domestic septage is applied to each site.

(6) The following certification statement:

"I certify, under penalty of law, that the pathogen requirements in [insert either § 503.32(c)(1) or § 503.32(c)(2)] and the vector attraction reduction requirements in [insert § 503.33(b)(9), § 503.33(b)(10), or § 503.33(b)(12)] have been met. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the pathogen requirements and vector attraction reduction requirements have been met. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

(7) A description of how the pathogen requirements in either § 503.33 (c)(1) or (c)(2) are met.

(8) A description of how the vector attraction reduction requirements in § 503.33 (b)(9), (b)(10), or (b)(12) are met.

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§ 503.18 Reporting.

(a) Class I sludge management facilities, POTWs (as defined in 40 CFR 501.2) with a design flow rate equal to or greater than one million gallons per day, and POTWs that serve 10,000 people or more shall submit the following information to the permitting authority:

(1) The information in § 503.17(a), except the information in § 503.17 (a)(3)(ii), (a)(4)(ii) and in (a)(5)(ii), for the appropriate requirements on February 19 of each year.

(2) The information in § 503.17 (a)(5)(ii)(A) through (a)(5)(ii)(G) on [insert the month and day from the date of publication of this rule] of each year when 90 percent or more of any of the cumulative pollutant loading rates in Table 2 of § 503.13 is reached at a site.

(Approved by the Office of Management and Budget under control number 2040–0157) post-graduate degree in the natural sciences or engineering who has sufficient training and experience in ground-water hydrology and related fields, as may be demonstrated by State registration, professional certification, or completion of accredited university programs, to make sound professional judgments regarding ground-water monitoring, pollutant fate and transport, and corrective action.

(m) *Seismic impact zone* is an area that has a 10 percent or greater probability that the horizontal ground level acceleration of the rock in the area exceeds 0.10 gravity once in 250 years.

(n) *Sewage sludge unit* is land on which only sewage sludge is placed for final disposal. This does not include land on which sewage sludge is either stored or treated. Land does not include waters of the United States, as defined in 40 CFR 122.2.

(o) *Sewage sludge unit boundary* is the outermost perimeter of an active sewage sludge unit.

(p) *Surface disposal site* is an area of land that contains one or more active sewage sludge units.

(q) *Unstable area* is land subject to natural or human-induced forces that may damage the structural components of an active sewage sludge unit. This includes, but is not limited to, land on which the soils are subject to mass movement.

§ 503.22 General requirements.

(a) No person shall place sewage sludge on an active sewage sludge unit unless the requirements in this subpart are met.

(b) An active sewage sludge unit located within 60 meters of a fault that has displacement in Holocene time; located in an unstable area; or located in a wetland, except as provided in a permit issued pursuant to section 402 of the CWA, shall close by [insert date one year after the effective date of this Final rule], unless, in the case of an active sewage sludge unit located within 60 meters of a fault that has displacement in Holocene time, otherwise specified by the permitting authority.

(c) The owner/operator of an active sewage sludge unit shall submit a written closure and post closure plan to the permitting authority 180 days prior to the date that the active sewage sludge unit closes. The plan shall describe how the sewage sludge unit will be closed and, at a minimum, shall include:

(1) A discussion of how the leachate collection system will be operated and maintained for three years after the sewage sludge unit closes if the sewage sludge unit has a liner and leachate collection system.

(2) A description of the system used to monitor for methane gas in the air in any structures within the surface disposal site and in the air at the property line of the surface disposal site, as required in § 503.24(j)(2).

(3) A discussion of how public access to the surface disposal site will be restricted for three years after the last sewage sludge unit in the surface disposal site closes.

(d) The owner of a surface disposal site shall provide written notification to the subsequent owner of the site that sewage sludge was placed on the land.

§ 503.23 Pollutant limits (other than domestic septage).

(a) Active sewage sludge unit without a liner and leachate collection system.

(1) Except as provided in § 503.23 (a)(2) and (b), the concentration of each pollutant listed in Table 1 of § 503.23 in sewage sludge placed on an active sewage sludge unit shall not exceed the concentration for the pollutant in Table 1 of § 503.23.

TABLE 1 OF § 503.23.—POLLUTANT CONCENTRATIONS—ACTIVE SEWAGE SLUDGE UNIT WITHOUT A LINER AND LEACHATE COLLECTION

Pollutant	Concentration (milligrams per kilograms [1])
Arsenic	73
Chromium	600
Nickel	420

[1] Dry weight basis.

(2) Except as provided in § 503.23(b), the concentration of each pollutant listed in Table 1 of § 503.23 in sewage sludge placed on an active sewage sludge unit whose boundary is less than 150 meters from the property line of the surface disposal site shall not exceed the concentration determined using the following procedure.

(*i*) The actual distance from the active sewage sludge unit boundary to the property line of the surface disposal site shall be determined.

(ii) The concentration of each pollutant listed in Table 2 of § 503.23 in the sewage sludge shall not exceed the concentration in Table 2 of § 503.23 that corresponds to the actual distance in § 503.23(a)(2)(i).

TABLE 2 OF § 503.23.—POLLUTANT CONCENTRATIONS—ACTIVE SEWAGE SLUDGE UNIT WITHOUT A LINER AND LEACHATE COLLECTION SYSTEM THAT HAS A UNIT BOUNDARY TO PROPERTY LINE DISTANCE LESS THAN 150 METERS

Unit boundary to property line	Pollutant concentration [1]		
Distance (meters)	Arsenic (mg/kg)	Chromium (mg/kg)	Nickel (mg/kg)
0 to less than 25	30	200	210
25 to less than 50	34	220	240
50 to less than 75	39	260	270
75 to less than 100	46	300	320
100 to less than 125	53	360	390
125 to less than 150	62	450	420

[1] Dry weight basis.

(b) Active sewage sludge unit without a liner and leachate collection system—site-specific limits.

(1) At the time of permit application, the owner/operator of a surface disposal site may request site-specific pollutant limits in accordance with § 503.23(b)(2) for an active sewage sludge unit without a liner and leachate collection system when the existing values for site parameters specified by the permitting authority are different from the values for those parameters used to develop the pollutant limits in Table 1 of § 503.23 and when the permitting authority determines that site-specific pollutant limits are appropriate for the active sewage sludge unit.

(2) The concentration of each pollutant listed in Table 1 of § 503.23 in sewage sludge placed on an active sewage sludge unit without a liner and leachate collection system shall not exceed either the concentration for the pollutant determined during a site-specific assessment, as specified by the permitting authority, or the existing concentration of the pollutant in the sewage sludge, whichever is lower.

§ 503.24 Management practices.

(a) Sewage sludge shall not be placed on an active sewage sludge unit if it is likely to adversely affect a threatened or endangered species listed under section 4 of the Endangered Species Act or its designated critical habitat.

(b) An active sewage sludge unit shall not restrict the flow of a base flood.

(c) When a surface disposal site is located in a seismic impact zone, an active sewage sludge unit shall be designed to withstand the maximum recorded horizontal ground level acceleration.

(d) An active sewage sludge unit shall be located 60 meters or more from a fault that has displacement in Holocene time, unless otherwise specified by the permitting authority.

(e) An active sewage sludge unit shall not be located in an unstable area.

(f) An active sewage sludge unit shall not be located in a wetland, except as provided in a permit issued pursuant to section 402 or 404 of the CWA.

(g)(1) Run-off from an active sewage sludge unit shall be collected and shall be disposed in accordance with National Pollutant Discharge Elimination System permit requirements and any other applicable requirements.

(2) The run-off collection system for an active sewage sludge unit shall have the capacity to handle run-off from a 24-hour, 25-year storm event.

(h) The leachate collection system for an active sewage sludge unit that has a liner and leachate collection system shall be operated and maintained during the period the sewage sludge unit is active and for three years after the sewage sludge unit closes.

(i) Leachate from an active sewage sludge unit that has a liner and leachate collection system shall be collected and shall be disposed in accordance with the applicable requirements during the period the sewage sludge unit is active and for three years after the sewage sludge unit closes.

(j)(1) When a cover is placed on an active sewage sludge unit, the concentration of methane gas in air in any structure within the surface disposal site shall not exceed 25 percent of the lower explosive limit for methane gas during the period that the sewage sludge unit is active and the concentration of methane gas in air at the property line of the surface disposal site shall not exceed the lower explosive limit for methane gas during the period that the sewage sludge unit is active.

(2) When a final cover is placed on a sewage sludge unit at closure, the concentration of methane gas in air in any structure within the surface disposal site shall not exceed 25 percent of the lower explosive limit for methane gas for three years after the sewage sludge unit closes and the concentration of methane gas in air at the property line of the surface disposal site shall not exceed the lower explosive limit for methane gas for three years after the sewage sludge unit closes, unless otherwise specified by the permitting authority.

(k) A food crop, a feed crop, or a fiber crop shall not be grown on an active sewage sludge unit, unless the owner/operator of the surface disposal site demonstrates to the permitting authority that through management practices public health and the environment are protected from any reasonably anticipated adverse effects of pollutants in sewage sludge when crops are grown.

(l) Animals shall not be grazed on an active sewage sludge unit, unless the owner/operator of the surface disposal site demonstrates to the permitting authority that through management practices public health and the environment are protected from any reasonably anticipated adverse effects of pollutants in sewage sludge when animals are grazed.

(m) Public access to a surface disposal site shall be restricted for the period that the surface disposal site contains an active sewage sludge unit and for three years after the last active sewage sludge unit in the surface disposal site closes.

(n)(1) Sewage sludge placed on an active sewage sludge unit shall not contaminate an aquifer.

(2) Results of a ground-water monitoring program developed by a qualified ground-water scientist or a certification by a qualified ground-water scientist shall be used to demonstrate that sewage sludge placed on an active sewage sludge unit does not contaminate an aquifer.

§ 503.25 Operational standards—pathogens and vector attraction reduction.

(a) *Pathogens—sewage sludge (other than domestic septage).* The Class A pathogens requirements in § 503.32(a) or one of the Class B pathogen requirements in § 503.32 (b)(2) through (b)(4) shall be met when sewage sludge is placed on an active sewage sludge unit, unless the vector attraction reduction requirement in § 503.33(b)(11) is met.

(b) *Vector attraction reduction—sewage sludge (other than domestic septage).* One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(11) shall be met when sewage sludge is placed on an active sewage sludge unit.

(c) *Vector attraction reduction—domestic septage.* One of the vector attraction reduction requirement in § 503.33 (b)(9) through (b)(12) shall be met when domestic septage is placed on an active sewage sludge unit.

§ 503.26 Frequency of monitoring.

(a) *Sewage sludge (other than domestic septage).*

(1) The frequency of monitoring for the pollutants in Tables 1 and 2 of § 503.23; the pathogen density requirements in § 503.32(a) and in § 503.32 (b)(2) through (b)(4); and the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) for sewage sludge placed on an active sewage sludge unit shall be the frequency in Table 1 of § 503.26.

TABLE 1 OF § 503.26.—FREQUENCY OF MONITORING—SURFACE DISPOSAL

Amount of sewage sludge[1] (metric tons per 365 day period)	Frequency
Greater than zero but less than 290.	Once per year.
Equal to or greater than 290 but less than 1,500.	Once per quarter (four times per year).
Equal to or greater than 1,500 but less than 15,000.	Once per 60 days (six times per year).
Equal to or greater than 15,000.	Once per month (12 times per year).

[1] Amount of sewage sludge placed on an active sewage sludge unit (dry weight basis).

(2) After the sewage sludge has been monitored for two years at the frequency in Table 1 of § 503.26, the permitting authority may reduce the frequency of monitoring for pollutant concentrations and for the pathogen density requirements in § 503.32 (a)(5)(ii) and (a)(5)(iii), but in no case shall the frequency of monitoring be less than once per year when sewage sludge is placed on an active sewage sludge unit.

(b) *Domestic septage.* If the vector attraction reduction requirements in § 503.33(b)(12) are met when domestic septage is placed on an active sewage sludge unit, each container of domestic septage shall be monitored for compliance with those requirements.

(c) *Air.* Air in structures within a surface disposal site and at the property line of the surface disposal site shall be monitored continuously for methane gas during the period that the surface disposal site contains an active sewage sludge unit on which the sewage sludge is covered and for three years after a sewage sludge unit closes when a final cover is placed on the sewage sludge.

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§ 503.27 Recordkeeping.

(a) When sewage sludge (other than domestic septage) is placed on an active sewage sludge unit:

(1) The person who prepares the sewage sludge shall develop the following information and shall retain the information for five years.

(i) The concentration of each pollutant listed in Table 1 of § 503.23 in the sewage sludge when the pollutant concentrations in Table 1 of § 503.23 are met.

(ii) The following certification statement:

"I certify, under penalty of law, that the pathogen requirements in [insert § 503.32(a), § 503.32(b)(2), § 503.32(b)(3), or § 503.32(b)(4) when one of those requirements is met] and the vector attraction reduction requirements in [insert one of the vector attraction

Subpart D—Pathogens and Vector Attraction Reduction

§ 503.30 Scope.

(a) This subpart contains the requirements for a sewage sludge to be classified either Class A or Class B with respect to pathogens.

(b) This subpart contains the site restrictions for land on which a Class B sewage sludge is applied.

(c) This subpart contains the pathogen requirements for domestic septage applied to agricultural land, forest, or a reclamation site.

(d) This subpart contains alternative vector attraction reduction requirements for sewage sludge that is applied to the land or placed on a surface disposal site.

§ 503.31 Special definitions.

(a) *Aerobic digestion* is the biochemical decomposition of organic matter in sewage sludge into carbon dioxide and water by microorganisms in the presence of air.

(b) *Anaerobic digestion* is the biochemical decomposition of organic matter in sewage sludge into methane gas and carbon dioxide by microorganisms in the absence of air.

(c) *Density of microorganisms* is the number of microorganisms per unit mass of total solids (dry weight) in the sewage sludge.

(d) *Land with a high potential for public exposure* is land that the public uses frequently. This includes, but is not limited to, a public contact site and a reclamation site located in a populated area (e.g, a construction site located in a city).

(e) *Land with a low potential for public exposure* is land that the public uses infrequently. This includes, but is not limited to, agricultural land, forest, and a reclamation site located in an unpopulated area (e.g., a strip mine located in a rural area).

(f) *Pathogenic organisms* are disease-causing organisms. These include, but are not limited to, certain bacteria, protozoa, viruses, and viable helminth ova.

(g) *pH* means the logarithm of the reciprocal of the hydrogen ion concentration.

(h) *Specific oxygen uptake rate (SOUR)* is the mass of oxygen consumed per unit time per unit mass of total solids (dry weight basis) in the sewage sludge.

(i) *Total solids* are the materials in sewage sludge that remain as residue when the sewage sludge is dried at 103 to 105 degrees Celsius.

(j) *Unstabilized solids* are organic materials in sewage sludge that have not been treated in either an aerobic or anaerobic treatment process.

(k) *Vector attraction* is the characteristic of sewage sludge that attracts rodents, flies, mosquitos, or other organisms capable of transporting infectious agents.

(l) *Volatile solids* is the amount of the total solids in sewage sludge lost when the sewage sludge is combusted at 550 degrees Celsius in the presence of excess air.

§ 503.32 Pathogens.

(a) *Sewage sludge—Class A.* (1) The requirement in § 503.32(a)(2) and the requirements in either § 503.32(a)(3), (a)(4), (a)(5), (a)(6), (a)(7), or (a)(8) shall be met for a sewage sludge to be classified Class A with respect to pathogens.

(2) The Class A pathogen requirements in § 503.32 (a)(3) through (a)(8) shall be met either prior to meeting or at the same time the vector attraction reduction requirements in § 503.33, except the vector attraction reduction requirements in § 503.33 (b)(6) through (b)(8), are met.

(3) *Class A—Alternative 1.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella* sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f).

(ii) The temperature of the sewage sludge that is used or disposed shall be maintained at a specific value for a period of time.

(A) When the percent solids of the sewage sludge is seven percent or higher, the temperature of the sewage sludge shall be 50 degrees Celsius or higher; the time period shall be 20 minutes or longer; and the temperature and time period shall be determined using equation (2), except when small particles of sewage sludge are heated by either warmed gases or an immiscible liquid.

$$D=\frac{131{,}700{,}000}{10^{0.1400t}} \quad \text{Eq. (2)}$$

Where,
D=time in days.
t=temperature in degrees Celsius.

(B) When the percent solids of the sewage sludge is seven percent or higher and small particles of sewage sludge are heated by either warmed gases or an immiscible liquid, the temperature of the sewage sludge shall be 50 degrees Celsius or higher; the time period shall be 15 seconds or longer; and the temperature and time period shall be determined using equation (2).

(C) When the percent solids of the sewage sludge is less than seven percent and the time period is at least 15 seconds, but less than 30 minutes, the temperature and time period shall be determined using equation (2).

(D) When the percent solids of the sewage sludge is less than seven percent; the temperature of the sewage sludge is 50 degrees Celsius or higher; and the time period is 30 minutes or longer, the temperature and time period shall be determined using equation (3).

$$D=\frac{50{,}070{,}000}{10^{0.1400t}} \quad \text{Eq. (3)}$$

Where,
D=time in days.
t=temperature in degrees Celsius.

(4) *Class A—Alternative 2.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella* sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f).

(ii) (A) The pH of the sewage sludge that is used or disposed shall be raised to above 12 and shall remain above 12 for 72 hours.

(B) The temperature of the sewage sludge shall be above 52 degrees Celsius for 12 hours or longer during the period that the pH of the sewage sludge is above 12.

(C) At the end of the 72 hour period during which the pH of the sewage sludge is above 12, the sewage sludge shall be air dried to achieve a percent solids in the sewage sludge greater than 50 percent.

(5) *Class A—Alternative 3.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella* sp. bacteria in sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f).

(ii) (A) The sewage sludge shall be analyzed prior to pathogen treatment to determine whether the sewage sludge contains enteric viruses.

(B) When the density of enteric viruses in the sewage sludge prior to pathogen treatment is less than one Plaque-forming Unit per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to enteric viruses until the next monitoring episode for the sewage sludge.

(C) When the density of enteric viruses in the sewage sludge prior to pathogen treatment is equal to or greater than one Plaque-forming Unit per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to enteric viruses when the density of enteric viruses in the sewage sludge after pathogen treatment is less than one Plaque-forming Unit per four grams of total solids (dry weight basis) and when the values or ranges of values for the operating parameters for the pathogen treatment process that produces the sewage sludge that meets the enteric virus density requirement are documented.

(D) After the enteric virus reduction in paragraph (a)(5)(ii)(C) of this section is demonstrated for the pathogen treatment process, the sewage sludge continues to be Class A with respect to enteric viruses when the values for the pathogen treatment process operating parameters are consistent with the values or ranges of values documented in paragraph (a)(5)(ii)(C) of this section.

(iii)(A) The sewage sludge shall be analyzed prior to pathogen treatment to determine whether the sewage sludge contains viable helminth ova.

(B) When the density of viable helminth ova in the sewage sludge prior to pathogen treatment is less than one per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to viable helminth ova until the next monitoring episode for the sewage sludge.

(C) When the density of viable helminth ova in the sewage sludge prior to pathogen treatment is equal to or greater than one per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to viable helminth ova when the density of viable helminth ova in the sewage sludge after pathogen treatment is less than one per four grams of total solids (dry weight basis) and when the values or ranges of values for the operating parameters for the pathogen treatment process that produces the sewage sludge that meets the viable helminth ova density requirement are documented.

(D) After the viable helminth ova reduction in paragraph (a)(5)(iii)(C) of this section is demonstrated for the pathogen treatment process, the sewage sludge continues to be Class A with respect to viable helminth ova when the values for the pathogen treatment process operating parameters are consistent with the values or ranges of values documented in paragraph (a)(5)(iii)(C) of this section.

(6) *Class A—Alternative 4.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella* sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f).

(ii) The density of enteric viruses in the sewage sludge shall be less than one Plaque-forming Unit per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f), unless otherwise specified by the permitting authority.

(iii) The density of viable helminth ova in the sewage sludge shall be less than one per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10 (b), (c), (e), or (f), unless otherwise specified by the permitting authority.

(7) *Class A—Alternative 5.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella*, sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or given away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10(b), (c), (e), or (f).

(ii) Sewage sludge that is used or disposed shall be treated in one of the Processes to Further Reduce Pathogens described in appendix B of this part.

(8) *Class A—Alternative 6.* (i) Either the density of fecal coliform in the sewage sludge shall be less than 1000 Most Probable Number per gram of total solids (dry weight basis), or the density of *Salmonella*, sp. bacteria in the sewage sludge shall be less than three Most Probable Number per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed; at the time the sewage sludge is prepared for sale or given away in a bag or other container for application to the land; or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements in § 503.10(b), (c), (e), or (f).

(ii) Sewage sludge that is used or disposed shall be treated in a process that is equivalent to a Process to Further Reduce Pathogens, as determined by the permitting authority.

(b) *Sewage sludge—Class B.* (1)(i) The requirements in either § 503.32(b)(2), (b)(3), or (b)(4) shall be met for a sewage sludge to be classified Class B with respect to pathogens.

(ii) The site restrictions in § 503.32(b)(5) shall be met when sewage sludge that meets the Class B pathogen requirements in § 503.32(b)(2), (b)(3), or (b)(4) is applied to the land.

(2) *Class B—Alternative 1.*

(i) Seven samples of the sewage sludge shall be collected at the time the sewage sludge is used or disposed.

(ii) The geometric mean of the density of fecal coliform in the samples collected in paragraph (b)(2)(i) of this section shall be less than either 2,000,000 Most Probable Number per gram of total solids (dry weight basis) or 2,000,000 Colony Forming Units per gram of total solids (dry weight basis).

(3) *Class B—Alternative 2.* Sewage sludge that is used or disposed shall be treated in one of the Processes to Significantly Reduce Pathogens described in appendix B of this part.

(4) *Class B—Alternative 3.* Sewage sludge that is used or disposed shall be treated in a process that is equivalent to a Process to Significantly Reduce Pathogens, as determined by the permitting authority.

(5) *Site Restrictions.* (i) Food crops with harvested parts that touch the sewage sludge/soil mixture and are totally above the land surface shall not be harvested for 14 months after application of sewage sludge.

(ii) Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after application of sewage sludge when the sewage sludge remains on the land surface for four months or longer prior to incorporation into the soil.

(iii) Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of sewage sludge when the sewage sludge remains on the land surface for less than four months prior to incorporation into the soil.

(iv) Food crops, feed crops, and fiber crops shall not be harvested for 30 days after application of sewage sludge.

(v) Animals shall not be allowed to graze on the land for 30 days after application of sewage sludge.

(vi) Turf grown on land where sewage sludge is applied shall not be harvested for one year after application of the sewage sludge when the harvested turf is placed on either land with a high potential for public exposure or a lawn, unless otherwise specified by the permitting authority.

(vii) Public access to land with a high potential for public exposure shall be restricted for one year after application of sewage sludge.

(viii) Public access to land with a low potential for public exposure shall be restricted for 30 days after application of sewage sludge.

(c) *Domestic septage.* (1) The site restrictions in § 503.32(b)(5) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site; or

(2) The pH of domestic septage applied to agricultural land, forest, or a reclamation site shall be raised to 12 or higher by alkali addition and, without the addition of more alkali, shall remain at 12 or higher for 30 minutes and the site restrictions in § 503.32 (b)(5)(i) through (b)(5)(iv) shall be met.

§ 503.33 Vector attraction reduction.

(a)(1) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(10) shall be met when bulk sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site.

(2) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) shall be met when bulk sewage sludge is applied to a lawn or a home garden.

(3) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(8) shall be met when sewage sludge is sold or given away in a bag or other container for application to the land.

(4) One of the vector attraction reduction requirements in § 503.33 (b)(1) through (b)(11) shall be met when sewage sludge (other than domestic

septage) is placed on an active sewage sludge unit.

(5) One of the vector attraction reduction requirements in § 503.33 (b)(9), (b)(10), or (b)(12) shall be met when domestic septage is applied to agricultural land, forest, or a reclamation site and one of the vector attraction reduction requirements in § 503.33 (b)(9) through (b)(12) shall be met when domestic septage is placed on an active sewage sludge unit.

(b)(1) The mass of volatile solids in the sewage sludge shall be reduced by a minimum of 38 percent (see calculation procedures in "Environmental Regulations and Technology—Control of Pathogens and Vector Attraction in Sewage Sludge", EPA-625/R-92/013, 1992, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268).

(2) When the 38 percent volatile solids reduction requirement in § 503.33(b)(1) cannot be met for an anaerobically digested sewage sludge, vector attraction reduction can be demonstrated by digesting a portion of the previously digested sewage sludge anaerobically in the laboratory in a bench-scale unit for 40 additional days at a temperature between 30 and 37 degrees Celsius. When at the end of the 40 days, the volatile solids in the sewage sludge at the beginning of that period is reduced by less than 17 percent, vector attraction reduction is achieved.

(3) When the 38 percent volatile solids reduction requirement in § 503.33(b)(1) cannot be met for an aerobically digested sewage sludge, vector attraction reduction can be demonstrated by digesting a portion of the previously digested sewage sludge that has a percent solids of two percent or less aerobically in the laboratory in a bench-scale unit for 30 additional days at 20 degrees Celsius. When at the end of the 30 days, the volatile solids in the sewage sludge at the beginning of that period is reduced by less than 15 percent, vector attraction reduction is achieved.

(4) The specific oxygen uptake rate (SOUR) for sewage sludge treated in an aerobic process shall be equal to or less than 1.5 milligrams of oxygen per hour per gram of total solids (dry weight basis) at a temperature of 20 degrees Celsius.

(5) Sewage sludge shall be treated in an aerobic process for 14 days or longer. During that time, the temperature of the sewage sludge shall be higher than 40 degrees Celsius and the average temperature of the sewage sludge shall be higher then 45 degrees Celsius.

(6) The pH of sewage sludge shall be raised to 12 or higher by alkali addition and, without the addition of more alkali, shall remain at 12 or higher for two hours and then at 11.5 or higher for an additional 22 hours.

(7) The percent solids of sewage sludge that does not contain unstabilized solids generated in a primary wastewater treatment process shall be equal to or greater than 75 percent based on the moisture content and total solids prior to mixing with other materials.

(8) The percent solids of sewage sludge that contains unstabilized solids generated in a primary wastewater treatment process shall be equal to or greater than 90 percent based on the moisture content and total solids prior to mixing with other materials.

(9)(i) Sewage sludge shall be injected below the surface of the land.

(ii) No significant amount of the sewage sludge shall be present on the land surface within one hour after the sewage sludge is injected.

(iii) When the sewage sludge that is injected below the surface of the land is Class A with respect to pathogens, the sewage sludge shall be injected below the land surface within eight hours after being discharged from the pathogen treatment process.

(10)(i) Sewage sludge applied to the land surface or placed on a surface disposal site shall be incorporated into the soil within six hours after application to or placement on the land.

(ii) When sewage sludge that is incorporated into the soil is Class A with respect to pathogens, the sewage sludge shall be applied to or placed on the land within eight hours after being discharged from the pathogen treatment process.

(11) Sewage sludge placed on an active sewage sludge unit shall be covered with soil or other material at the end of each operating day.

(12) The pH of domestic septage shall be raised to 12 or higher by alkali addition and, without the addition of more alkali, shall remain at 12 or higher for 30 minutes.

APPENDIX B

Justification for Deletion of Pollutants from the Final Standards for the Use or Disposal of Sewage Sludge

JUSTIFICATION FOR THE DELETION OF POLLUTANTS FROM THE FINAL STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

CONTENTS

JUSTIFICATION FOR THE DELETION OF POLLUTANTS FROM THE FINAL STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

Office of Science and Technology
U.S. Environmental Protection Agency
401 M Street, S.W.
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SECTION ONE

INTRODUCTION

On February 6, 1989, the U.S. Environmental Protection Agency (EPA) proposed Standards for the Use or Disposal of Sewage Sludge (**40 CFR Part 503**) in the Federal Register (54 FR 5746). Included in those standards were pollutant limits for different sewage sludge use or disposal practices.

Several commenters on the proposed Standards for the Use or Disposal of Sewage Sludge recommended that some of the organic pollutants for which pollutant limits were proposed be deleted from the final standards. The main reason for this recommendation was that the pollutants are either banned or restricted for use in the United States.

Because of the comments received on the proposal, EPA decided to evaluate all of the organic pollutants in the proposed Part 503 standards for land application of sewage sludge and for placement of sewage sludge on a surface disposal site to determine whether to delete any of those pollutants from the final Part 503 standards. This paper discusses the criteria the Agency used to evaluate each organic pollutant; presents the results of the evaluations; and provides the Agency's conclusion about deleting organic pollutants from the final Part 503 standards.

The Agency also evaluated the inorganic pollutants for surface disposal for deletion from the final Part 503 regulation. This paper presents the results of that evaluation and EPA's conclusions about deleting inorganic pollutants from the surface disposal subpart in the final Part 503 regulation.

SECTION TWO

ORGANIC POLLUTANTS - LAND APPLICATION AND SURFACE DISPOSAL

2.1 Criteria for the Deletion of An Organic Pollutant.

The Agency used three criteria to evaluate whether to delete an organic pollutant from the final Part 503 regulation. For an organic pollutant to be deleted from the regulation for a particular use or disposal practice, one of the following three criteria had to be satisfied.

1. The pollutant has been banned for use in the United States; has restricted use in the United States; or is not manufactured for use in the United States.

2. Based on the results of the National Sewage Sludge Survey (NSSS), the pollutant has a low percent detect in sewage sludge.

3. Based on data from the NSSS, the limit for an organic pollutant in the Part 503 exposure assessment by use or disposal practice is not expected to be exceeded in sewage sludge that is used or disposed.

The evaluation for each of the organic pollutants for which pollutant limits were published in the proposed Part 503 standards using the above three criteria is presented below.

2.2 Evaluation

2.2.1 Introduction

The first step in the evaluation of organic pollutants is to identify the organic pollutants for which limits were proposed in the February 6, 1989, proposal (54 FR 5746) for land application of sewage sludge and for placement of sewage sludge on a surface disposal site. These pollutants are presented below in Table 1 by use or disposal practice.

Limits for organic pollutants also were proposed in Part 503 for distribution and marketing of sewage sludge and for sewage sludge placed on a monofill. The requirements for land application and distribution and marketing are combined in the final Part 503 regulation as are the requirements for placement of sewage sludge on a monofill and placement of sewage sludge on a surface disposal site. For this reason, the organic pollutants presented below for land application include the organic pollutants in the proposal for distribution and marketing and the organic pollutants for surface disposal include the organic pollutants in the proposal for a monofill.

TABLE 1 - PART 503 ORGANIC POLLUTANTS BY USE OR DISPOSAL PRACTICE

Pollutant	Use or Disposal Practice LA	SD
Aldrin/dieldrin (total)	x	
Benzene		x
Benzo(a)pyrene	x	x
Bis(2-ethylhexyl)phthalate		x
Chlordane	x	x
DDT/DDE/DDD (total)	x	x
Heptachlor	x	
Hexachlorobenzene	x	
Hexachlorobutadiene	x	
Lindane	x	x
N-Nitrosodimethylamine	x	x
Polychlorinated biphenyls	x	x
Toxaphene	x	x
Trichloroethylene	x	x

LA - land application
SD - surface disposal

The next step is to evaluate each of the organic pollutants using the above three criteria.

2.2.2 Criterion 1

The organic pollutants listed in Table 2 have been banned for use in the United States; have restricted uses in the United States; or are not manufactured for use in the United States.

TABLE 3 - PERCENT DETECT FOR ORGANIC POLLUTANTS

Pollutant	Number of POTWs	Percent Detect*
Aldrin/dieldrin (total)	177	8
Benzene	178	0
Benzo(a)pyrene	178	3
Bis(2-ethylhexyl)phthalate	178	63
Chlordane	177	0
DDT/DDE/DDD (total)	177	3
Heptachlor	177	0
Hexachlorobenzene	178	0
Hexachlorobutadiene	178	0
Lindane	177	0
N-Nitrosodimethylamine	178	0
Polychlorinated biphenyls	177	19
Toxaphene	177	0
Trichloroethylene	178	1

* Estimated percent detect in sewage sludge used or disposed at publicly owned treatment works nationwide. From "Statistical Support Documentation for the 40 CFR Part 503 Final Standards for the Use or Disposal of Sewage Sludge", Volume I, U.S. Environmental Protection Agency, Washington, D.C., November 11, 1992.

A review of the above information indicates that all of the pollutants, except aldrin/dieldrin (total), bis(2-ethylhexyl)phthalate, and polychlorinated biphenyls (PCBs), satisfy Criteria 2 for the deletion of an organic pollutant from the final Part 503 standards because the pollutants have a low percentage of detection (i.e., five percent or less) nationwide. Aldrin/dieldrin (total), bis(2-ethylhexyl)phthalate, and PCBs do not satisfy this criterion because they have a percent detect higher than five percent.

2.2.4 Criterion 3

For the Criterion 3 evaluation, the 99th percentile concentrations (see Table 7-11 in the report referenced in Table 4) from the NSSS were compared to the pollutant limits from the final Part 503 exposure assessment by use or disposal practice. For land application, the comparison was made by comparing annual pollutant loading rates. For surface disposal, pollutant concentrations from the final Part 503 exposure assessment were compared to the 99th percentile pollutant concentrations.

The 99th percentile concentrations from the NSSS were determined using the SM-ML procedure, except for bis(2-ethylhexyl)phthalate. For bis(2-ethylhexyl)phthalate, the MLE procedure was used to determine the 99th percentile concentration because the data for that pollutant appeared to be distributed log normally. The 99th percentile concentrations are presented in Table 4 and the comparisons using those concentrations

TABLE 2 - ORGANIC POLLUTANTS THAT HAVE BEEN BANNED, HAVE RESTRICTED USE, OR ARE NOT MANUFACTURED

Pollutant	Reference
Aldrin/dieldrin (total)	*
Chlordane	*
DDT/DDE/DDD (total)	*
Heptachlor	*
Lindane	*
N-Nitrosodimethylamine	**
Polychlorinated biphenyls	40 CFR Part 761
Toxaphene	*

* See "Suspended, Cancelled, and Restricted Pesticides, 20T-1002, U.S. Environmental Protection Agency, February 1990.

** See "1992 Directory of Chemical Producers", SRI International, Menlo Par, California, 1992.

These eight pollutants satisfy the first criterion for deletion of an organic pollutant from the final Part 503 standards for land application of sewage sludge and for placement of sewage sludge on an active sewage sludge unit.

2.2.3 Criterion 2

The percent detect from the National Sewage Sludge Survey (NSSS) for each of the organic pollutants in the proposed Part 503 standards for land application of sewage sludge and for placement of sewage sludge on an active sewage sludge unit is presented in Table 3.

are presented below.

TABLE 4 - 99TH PERCENTILE CONCENTRATIONS

Pollutant	Units	99th Percentile Concentration*
Aldrin/dieldrin (total)	mg/kg	0.074
Benzene	mg/kg	7.0
Benzo(a)pyrene	mg/kg	43
Bis(2-ethylhexyl) phthalate	mg/kg	1000
Chlordane	mg/kg	1.8
DDT/DDE/DDD (total)	mg/kg	0.14
Heptachlor	mg/kg	0.14
Hexachlorobenzene	mg/kg	43
Hexachlorobutadiene	mg/kg	43
Lindane	mg/kg	0.18
N-Nitrosodimethylamine	mg/kg	210
Polychlorinated biphenyls	mg/kg	9.1
Toxaphene	mg/kg	7.4
Trichloroethylene	mg/kg	7.0

* From "Statistical Support Documentation for the 40 CFR, Part 503 Standards for the Use or Disposal of Sewage", Volume I, U.S. Environmental Protection Agency, Washington, D.C., November 11, 1992. Values are on dry weight basis and are reported in two significant figures.

2.2.4.1 Land Application Comparison

For the purpose of comparing annual pollutant loading rates for land application, the annual whole sludge application rates in Table 5, which are from the NSSS (see Attachment A), were used in equation (1) below with the 99th percentile concentration from the NSSS to determine the calculated annual pollutant loading rates. The comparisons of the calculated annual pollutant loading rates to the annual pollutant loading rates from the Part 503 exposure assessment are presented Tables 6 through 9.

TABLE 5 - ANNUAL WHOLE SLUDGE APPLICATION RATES

Type of Land	Annual Whole Sludge Application Rate*
Agricultural	7
Forest	26
Public contact site	18
Reclamation site	74

* Metric tons per hectare per 365 day period (dry weight basis).

$$APLR = C \times AWSAR \times 0.001 \quad (1)$$

where,

APLR = Annual pollutant loading rate in kilograms per hectare per 365 day period.

C = pollutant concentration in milligrams per kilograms (dry weight basis).

AWSAR = Annual whole sludge application rate in metric tons per hectare per 365 day period (dry weight basis).

0.001 = A conversion factor.

Agricultural land:

TABLE 6 - COMPARISON OF ANNUAL LOADS FOR AGRICULTURAL LAND

Pollutant	APLR (Exposure) kg/ha/365	APLR (NSSS) kg/ha/365
Aldrin/dieldrin (total)	0.027	0.00051
Benzo(a)pyrene	0.15	0.30
Chlordane	0.86	0.012
DDT/DDE/DDD (total)	1.2	0.00098
Heptachlor	0.074	0.00098
Hexachlorobenzene	0.29	0.30
Hexachlorobutadiene	6.0	0.30
Lindane	0.84	0.0012
N-Nitrosodimethylamine	0.021	1.4
Polychlorinated biphenyls	0.046	0.063
Toxaphene	0.10	0.049
Trichloroethylene	100	0.05

The annual pollutant loading rate for benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, and PCBs calculated using the 99th percentile concentration for each pollutant from the NSSS and an annual whole sludge application rate of seven metric tons per hectare per 365 day period is greater than the annual pollutant loading rate for those pollutants from the Part 503 exposure assessment. For this reason, those pollutants do not satisfy Criterion 3 for application of sewage sludge to agricultural land.

Forest:

TABLE 7 - COMPARISON OF ANNUAL LOADS FOR FORESTS

Pollutant	APLR (Exposure) kg/ha/365	APLR (NSSS) kg/ha/365
Aldrin/dieldrin (total)	0.027	0.0019
Benzo(a)pyrene	0.15	1.1
Chlordane	0.86	0.046
DDT/DDE/DDD(total)	1.2	0.0036
Heptachlor	0.074	0.0036
Hexachlorobenzene	0.29	1.1
Hexachlorobutadiene	6.0	1.1
Lindane	0.84	0.0046
N-Nitrosodimethylamine	0.021	5.4
Polychlorinated biphenyls	0.046	0.23
Toxaphene	0.10	0.19
Trichloroethylene	100	0.18

The annual pollutant loading rate for benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene calculated using the 99th percentile concentration from the NSSS and an annual whole sludge application rate of 26 metric tons per hectare per 365 day period is greater than the annual pollutant loading rate for those pollutants from the Part 503 exposure assessment. For this reason, those pollutants do not satisfy Criterion 3 for application of sewage sludge to forests.

Public contact site:

TABLE 8 - COMPARISON OF ANNUAL LOADS FOR PUBLIC CONTACT SITES

Pollutant	APLR (exposure) kg/ha/365	APLR (NSSS) kg/ha/365
Aldrin/dieldrin (total)	0.027	0.0013
Benzo(a)pyrene	0.15	0.77
Chlordane	0.86	0.032
DDT/DDE/DDD(total)	1.2	0.0025
Heptachlor	0.074	0.0025
Hexachlorobenzene	0.29	0.77
Hexachlorobutadiene	6.0	0.77
Lindane	0.84	0.0032
N-Nitrosodimethylamine	0.021	3.7
Polychlorinated biphenyls	0.046	0.16
Toxaphene	0.10	0.12
Trichloroethylene	100	0.13

The annual pollutant loading rate for benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene calculated using the 99th percentile concentration from the NSSS and an annual whole sludge application rate of 18 metric tons per hectare per 365 day period exceeds the annual pollutant loading rate for those pollutants from the Part 503 exposure assessment. For this reason, those pollutants do not satisfy Criterion 3 for application of sewage sludge to a public contact site.

Reclamation site:

TABLE 9 - COMPARISON OF ANNUAL LOADS FOR RECLAMATION SITES

Pollutant	APLR (Exposure) kg/ha/365	APLR (NSSS) kg/ha/365
Aldrin/dieldrin (total)	0.027	0.0054
Benzo(a)pyrene	0.15	3.1
Chlordane	0.86	0.13
DDT/DDE/DDD(total)	1.2	0.010
Heptachlor	0.074	0.010
Hexachlorobenzene	0.29	3.1
Hexachlorobutadiene	6.0	3.1
Lindane	0.84	0.013
N-Nitrosodimethylamine	0.021	15
Polychlorinated biphenyls	0.046	0.67
Toxaphene	0.10	0.54
Trichloroethylene	100	0.51

The annual pollutant loading rates for benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene calculated using the 99th percentile concentration for each pollutant from the NSSS and an annual whole sludge application rate of 74 metric tons per hectare per 365 day period exceed the annual pollutant loading rates for those pollutants from the Part 503 exposure assessment. For this reason, those pollutants do not satisfy Criterion 3 for application of sewage sludge to a reclamation site.

Annual pollutant loading rates for organic pollutants are included in the final Part 503 exposure assessment only for land application of sewage sludge. Those rates are the same for all types of land on which sewage sludge is applied. For this reason, results of the above evaluation were combined to determine which pollutants satisfy Criterion 3 for land application of sewage sludge. When this is done, the pollutants that do not satisfy Criterion 3 for land application of sewage sludge are benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene.

Sewage sludge sold or given-away in a bag or other container for application to the land (formerly distribution and marketing):

The Part 503 exposure assessment contains limits for organic pollutants for sewage sludge sold or given-away in a bag or other container for application to the land. These limits are annual pollutant loading rates.

Sewage sludge sold or given-away in a bag or other container for application to the land may be applied to all types of land. For this reason, the annual whole sludge application rates used to calculate the annual pollutant loading rates for the above land application comparison also were used to calculate the annual pollutant loading rates for sewage sludge sold or given-away in a bag or other container for application to the land.

For the purpose of comparing annual pollutant loading rates for sewage sludge sold or given-away in a bag or other container for application to the land, the highest annual whole sludge application rate (i.e., 74 metric tons per hectare per 365 day period) from the land application comparison was used in equation (2) below along with the 99th percentile concentrations from the NSSS to calculate annual pollutant loading rates. Results of the comparison of the calculated annual pollutant loading rates to the annual pollutant loading rates for sewage sludge sold or given-away in a bag or other container for application to the land from the Part 503 exposure assessment are presented in Table 10.

$$APLR = C \times AWSAR \times 0.001 \qquad (2)$$

where,

APLR = annual pollutant loading rate in kilograms per hectare per 365 day period.

C = pollutant concentration in milligrams per kilogram of sewage sludge (dry weight basis).

AWSAR = annual whole sludge application rate in metric tons per hectare per 365 day period (dry weight basis).

0.001 = a conversion factor.

TABLE 10 - COMPARISON OF ANNUAL LOADS FOR SEWAGE SLUDGE SOLD OR GIVEN AWAY IN A BAG OR OTHER CONTAINER FOR APPLICATION TO THE LAND

Pollutant	APLR (Exposure) kg/hectare/365	APLR (NSSS) kg/hectare/365
Aldrin/dieldrin (total)	0.027	0.0054
Benzo(a)pyrene	0.15	3.1
Chlordane	0.86	0.13
DDT/DDE/DDD (total)	1.2	0.010
Heptachlor	0.074	0.010
Hexachlorobenzene	0.29	3.1
Hexachlorobutadiene	6.0	3.1
Lindane	0.84	0.013
Polychlorinated biphenyls	0.046	0.67
Toxaphene	0.10	0.54

The annual pollutant loading rate calculated using the 99th percentile concentration for benzo(a)pyrene, hexachlorobenzene, PCBs, and toxaphene from the NSSS and an annual whole application rate of 74 metric tons per hectare per 365 day period exceeds the annual pollutant loading rate for those pollutants from the Part 503 exposure assessment. For this reason, those pollutants do not satisfy Criterion 3 for sewage sludge sold or given away in a bag or other container for application to the land.

2.2.4.2 Surface Disposal

For this disposal practice, the 99th percentile concentrations from the NSSS were compared to the Part 503 pollutant concentrations from the exposure assessment for an active sewage sludge unit without a liner and leachate collection system. This comparison is presented in Table 11.

TABLE 11 - COMPARISON OF ORGANIC POLLUTANT CONCENTRATIONS FOR SURFACE DISPOSAL

Pollutant	Concentration* Exposure - mg/kg	Concentration NSSS - mg/kg
Benzene	140	7.0
Benzo(a)pyrene	>100,000	43
Bis(2-ethylhexyl)phthalate	>100,000	1000
Chlordane	>100,000	1.8
DDT/DDE/DDD (total)	>100,000	0.14
Lindane	28,000	0.18
N-Nitrosodimethylamine	0.088	210
Polychlorinated biphenyls	110	9.1
Toxaphene	26,000	7.4
Trichloroethylene	9,500	7.0

* Active sewage sludge unit without a liner and leachate collection system.

N-Nitrosodimethylamine does not satisfy Criterion 3 for placement of sewage sludge on an active sewage sludge unit because the 99th percentile concentration for that pollutant from the NSSS exceeds the concentration for that pollutant from the Part 503 exposure assessment. All of the other organic pollutants for this practice satisfy Criterion 3.

2.3 Evaluation results

Following are the results of the evaluation of the organic pollutants for which pollutant limits were published in the proposed Part 503 standards to determine which of those pollutants, if any, to delete from the final Part 503 standards:

- o Eight of the organic pollutants for which pollutant limits were published in the proposed Part 503 regulation for land application of sewage sludge and placement of sewage sludge on a surface disposal site have been banned for use in the United States; have been restricted for use in the United States; or are not manufactured in the United States. They are: aldrin/dieldrin (total), chlordane, DDT/DDE/DDD (total), heptachlor, lindane, N-Nitrosodimethylamine, polychlorinated biphenyls, and toxaphene. These pollutants satisfy Criterion 1.

- o The percent detect from the NSSS for the organic pollutants for which limits were proposed for land application of sewage sludge and placement of sewage sludge on a surface disposal site are low (i.e., five percent or less), except for aldrin/dieldrin (total), bis(2-ethylhexyl)phthalate, and polychlorinated biphenyls. All of the other organic pollutants for which limits were proposed satisfy Criterion 2.

o With the exception of benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene, the annual pollutant loading rate for the organic pollutants calculated using the 99th percentile concentration for each pollutant from the NSSS and an annual whole application rate from the NSSS is below the Part 503 exposure assessment annual pollutant loading rate for each organic pollutant for sewage sludge applied to agricultural land, forest, a public contact site, or a reclamation site. For land application of sewage sludge, benzo(a)pyrene, hexachlorobenzene, N-Nitrosodimethylamine, PCBs, and toxaphene do not satisfy Criterion 3.

o With the exception of benzo(a)pyrene, hexachlorobenzene, PCBs, and toxaphene, the annual pollutant loading rate for the organic pollutants calculated using the 99th percentile concentration for each pollutant from the NSSS and an annual whole sludge application rate from the NSSS is below the final Part 503 exposure assessment annual pollutant loading rate for each organic pollutant for sewage sludge sold or given-away in a bag c other container for application to the land (formerly distribution and marketing). For sewage sludge sold or given away in a bag or other container, benzo(a)pyrene, hexachlorobenzene, PCBs, and toxaphene do not satisfy Criterion 3.

o With the exception of N-Nitrosodimethylamine, the 99th percentile pollutant concentration from the NSSS is below the Part 50ˀ exposure assessment concentration for each organic polluta..t in sewage sludge placed on an active sewage sludge unit without a liner and leachate collection system. For this practic N-Nitrosodimethylamine does not satisfy Criterion 3.

2.4 Conclusions

Based on the results of the above evaluations, the Agency is deleting organic pollutants from the final Part 503 regulation, as indicated below, for the appropriate use or disposal practice. EPA concluded that because those organic pollutants satisfy one of the three criteria discussed above, public health and the environment are protected from the reasonably anticipated adverse effects of the organic pollutants in sewage sludge without establishing limits for the pollutants in the final Part 503 regulation.

2.4.1 Application to agricultural land, forest, a public contact site, or a reclamation site - pollutants deleted:

Pollutant	Criteria Met
Aldrin/dieldrin (total)	1 and 3
Benzo(a)pyrene	2
Chlordane	1, 2, and 3
DDT/DDE/DDD(total)	1, 2, and 3
Heptachlor	1, 2, and 3
Hexachlorobenzene	2
Hexachlorobutadiene	2 and 3
Lindane	1, 2, and 3
N-Nitrosodimethylamine	1 and 2
Polychlorinated biphenyls	1
Toxaphene	1 and 2
Trichloroethylene	2 and 3

Organic pollutant remaining: none.

Sewage sludge sold or given-away in a bag or other container for application to the land (formerly distribution and marketing) - pollutants deleted:

Pollutant	Criteria Met
Aldrin/dieldrin (total)	1 and 3
Benzo(a)pyrene	2
Chlordane	1, 2, and 3
DDT/DDE/DDE (total)	1, 2, and 3
Heptachlor	1, 2, and 3
Hexachlorobenzene	2
Hexchlorobutadiene	2 and 3
Lindane	1, 2, and 3
Polychlorinated biphenyls	1
Toxaphene	1 and 2

Organic pollutants remaining: none

As indicated above, PCBs were deleted from the final Part 503 regulation for land application because Criterion 1 is satisfied. PCBs are restricted for use in the United States. They can be used only in closed systems and the disposal of PCBs is closely regulated under the Toxic Substances Control Act (**40 CFR Part 761**).

Based on the results of the National Sewage Sludge Survey (NSSS), PCBs did not satisfy Criterion 2. PCBs are estimated to be detected in sewage sludge that is used or disposed at 19 percent of the publicly owned treatment works nationwide. To satisfy Criterion 2, the percent detect had to be five percent or less.

PCBs also did not satisfy Criterion 3. If PCBs had been regulated, the pollutant limit for PCBs based on results of the exposure assessment would be 0.046 kilograms per hectare per 365 day period. The annual pollutant loading rate (APLR) delivered to each hectare of land assuming a concentration of PCBs in the sewage sludge equal to the 99th percentile concentration from the NSSS (i.e., 9.1 milligrams per kilogram) and an annual whole sludge application rate of 7, 18, 26, and 74 metric tons per hectare for agricultural land, forest, a public contact site, and a reclamation site, respectively, would be 0.063, 0.16, 0.23, and 0.67 kilograms per hectare, respectively.

For application to agricultural land, which is by far the most widely used land for application of sewage sludge, the above APLR calculated using the 99th percentile PCB concentration is higher than the pollutant limit for PCBs that would have been in the final Part 503 regulation by only 37 percent. The APLRs for the other types of land are higher than the potential Part 503 APLR by larger factors. However, this is mitigated by the fact that sewage sludge only is applied to forest, a public contact site, or a reclamation site at most every three to five years. In the case of a reclamation site, sewage sludge is applied to the site at most three times during the period that the land is a reclamation site.

Another factor that mitigates the calculated APLRs is the use of the 99th percentile concentration for PCBs from the NSSS to calculate the APLRs. This concentration represents, to a large extent, outlier values for PCBs and, therefore, is conservative. If the more reasonable worst case 90th percentile concentration for PCBs (i.e., 1.9 milligrams per kilogram) is used to calculate the APLRs, the annual amounts delivered to a hectare of land are 0.013, 0.034, 0.049, and 0.14 kilograms for agricultural land, forest, a public contact site, and reclamation site, respectively. In this case,the calculated APLRs for agricultural land and forest satisfy Criterion 3, the APLR for a public contact site is only slightly higher than the exposure assessment value for PCBs (i.e., 0.046 kilograms per hectare per 365 day period), and the APLR for a reclamation site does not satisfy Criterion 3.

EPA is committed to re-evaluate the decision not to regulate PCBs in the final Part 503 regulation during the next review of the regulation (i.e., Round II). EPA expects the concentration of PCBs in sewage sludge to continue to decrease. In addition, EPA will re-evaluate the toxicity of PCB congeners through use of a toxicity equivalent factor system. Both of these factors will be considered in Round II.

2.4.2 Surface disposal - pollutant deleted:

Pollutant	Criteria Met
Benzene	2 and 3
Benzo(a)pyrene	2 and 3
Bis(2-ethylhexyl)phthalate	3
Chlordane	1, 2, and 3
DDT/DDE/DDD (total)	1, 2, and 3
Lindane	1, 2, and 3
N-Nitrosodimethylamine	1 and 2
Polychlorinated biphenyls	1 and 3
Toxaphene	1, 2, and 3
Trichloroethylene	2 and 3

Organic pollutants remaining: none

SECTION THREE

INORGANIC POLLUTANTS - SURFACE DISPOSAL

3.1 Introduction

After reviewing results of the exposure assessment for surface disposal, the Agency decided to evaluate the inorganic pollutants to determine whether to include limits in the final Part 503 regulation for all of the inorganic pollutants for which limits were included in the proposed Part 503 regulation. This evaluation was done for both sewage sludge and domestic septage. Results the evaluations and the Agency's conclusions based on those results are presented below.

3.2 Evaluation - Sewage Sludge

The evaluation to determine whether to include limits for inorganic pollutants in sewage sludge placed on an active sewage sludge unit in the final Part 503 regulation consisted of comparing the limits from the Part 503 exposure assessment to the 99th percentile concentration for a pollutant from the NSSS. Results of this comparison are present in Table 12.

TABLE 12 - COMPARISON OF INORGANIC POLLUTANT CONCENTRATIONS FOR SEWAGE SLUDGE

Pollutant	Concentration (mg/kg)[1]	Concentration (mg/kg)[2]	Concentration (mg/kg)[3]
Arsenic	75	73	>100,000
Cadmium	85	>100,000	>100,000
Chromium	1200	600	>100,000
Copper	4300	46,000	>100,000
Lead	840	>100,000	>100,000
Mercury	58	>100,000	>100,000
Nickel	420	690	>100,000

1 - From "Statistical Support Documentation for the 40 CFR, Part 503 Final Standards for the Use or Disposal of Sewage Sludge, Volume I, U.S. Environmental Protection Agency, Washington, D.C., November 11,1992. Pollutant concentrations are dry weight 99th percentile concentrations.

2 - From P .t 503 exposure assessment for an active sewage sludge unit without a liner and leachate collection system (dry weight basis) - see technical support document for the Part 503 surface disposal requirements.

3 - From Part 503 exposure assessment for an active sewage sludge unit with a liner and leachate collection system (dry weight basis) - see technical support document for the Part 503 surface disposal requirements.

Results of the above comparison indicate that the 99th percentile pollutant concentrations are much lower than the Part 503 exposure assessment concentrations for an active sewage sludge unit without a liner and leachate collection system, except for arsenic, chromium, and nickel. In the case of arsenic, chromium, and nickel, the 99th percentile concentration is either higher than or very close to the exposure assessment concentrations for those pollutants.

The above results also indicate that the 99th percentile pollutant concentrations are much lower than the Part 503 exposure assessment concentrations for an active sewage sludge unit with a liner and leachate collection system. In this case, all of the 99th percentile concentrations are at least an order of magnitude lower than the exposure assessment concentrations.

3.3 Evaluation - Domestic Septage

The evaluation to determine whether to include limits in the final Part 503 regulation for inorganic pollutants in domestic septage placed on an active sewage sludge unit consisted of comparing the limit from the Part 503 exposure assessment for sewage sludge placed on an active sewage sludge unit to the 98th percentile concentration for a pollutant in domestic septage (see

Attachment B). Results of this comparison are presented in Table 13.

TABLE 13 - COMPARISON OF INORGANIC POLLUTANT CONCENTRATIONS FOR DOMESTIC SEPTAGE

Pollutant	Concentration (mg/kg)[1]	Concentration (mg/kg)[2]	Concentration (mg/kg)[3]
Arsenic	30[4]	73	>100,000
Cadmium	25	>100,000	>100,000
Chromium	110	600	>100,000
Copper	2600	46,000	>100,000
Lead	100	>100,000	>100,000
Mercury	0.91	>100,000	>100,000
Nickel	50	690	>100,000

1 - Concentration on a dry weight basis (see page 26 in Attachment B).

2 - From Part 503 exposure assessment for an active sewage sludge unit without a liner and leachate collection system (dry weight basis) - see the technical support document for the Part 503 surface disposal requirements.

3 - From Part 503 exposure assessment for an active sewage sludge unit with a liner and leachate collection system (dry weight basis) - see the technical support document for the Part 503 surface disposal requirements.

4 - Concentration is the minimum level value (i.e., highest detection limit value) because arsenic was not detected in any of the collected domestic septage samples.

Results of the above comparison indicate that the 98th percentile pollutant concentrations are lower than the Part 503 exposure assessment concentrations for sewage sludge placed on an active sewage sludge unit both with and without a liner and leachate collection system. The 98th percentile concentration that is the closest to the Part 503 concentration is the value for arsenic when compared to the Part 503 exposure assessment concentration for an active sewage sludge unit without a liner and leachate collection system. As indicated in a footnote above, arsenic was not detected in any of the domestic septage samples collected and analyzed. The concentration for arsenic in the table is the minimum level value (i.e., the highest detection limit) for arsenic in the domestic septage samples collected and analyzed.

3.4 Conclusions

3.4.1 Sewage Sludge

After comparing the 99th percentile concentrations to the Part 503 exposure assessment concentrations for an active sewage sludge unit without a liner and leachate collection system, the Agency concluded that limits only should be included in the final Part 503 regulation for arsenic, chromium, and nickel. Limits are not needed in the final regulation to protect public health and the environment from cadmium, copper, lead, and mercury in the sewage sludge because the 99th percentile concentration is much lower than the exposure assessment concentration for each of those pollutants. In this case, the concentration of cadmium, copper, lead, and mercury in the sewage sludge is not expected to exceed the exposure assessment concentration for those pollutants. Consequently, there are no pollutant limits for cadmium, copper, lead, and mercury in the final Part 503 regulation for an active sewage sludge without a liner and leachate collection system.

The Agency also concluded that no limits are needed in the final Part 503 regulation for inorganic pollutants in sewage sludge placed on an active sewage sludge unit with a liner and leachate collection system to protect public health and the environment because the 99th percentile concentrations are much lower than the exposure assessment concentrations for the inorganic pollutants. The concentration of each of the inorganic pollutants in sewage sludge is not expected to exceed the exposure assessment concentration for the pollutant. Consequently, there are no pollutant limits in the final Part 503 regulation for sewage sludge placed on an active sewage sludge unit with a liner and leachate collection system.

3.4.2 Domestic Septage

After comparing the 98th percentile domestic septage concentrations to the Part 503 exposure assessment concentrations for an active sewage sludge unit both with and without a liner and leachate collection, the Agency concluded that limits are not needed in the final Part 503 regulation to protect public health and the environment from the reasonably anticipated of arsenic, cadmium, chromium, copper, lead, mercury, and nickel in domestic septage placed on an active sewage sludge unit because the 98th percentile concentrations are lower than the Part 503 exposure assessment concentrations for those pollutants. In this case, the concentration of each of those pollutants is not expected to exceed the exposure assessment concentration for each pollutant. Consequently, there are no limits for inorganic pollutants in the final Part 503 regulation for domestic septage placed on either an active sewage sludge without a liner and leachate collection system or an active sewage sludge unit with a liner and leachate collection system.

MEMORANDUM

Date: November 10, 1992

To: Bob Southworth, EPA

From: Anne Jones and Matt Murphy, ERG

Re: Revised Mean Application Rates for Land Application

==

We have calculated weighted mean application rates for agricultural land application, land application to forest sites and public contact sites, and land reclamation. The following methodology was used to derive these numbers.

First, we used the analytical survey rather than the larger questionnaire survey for the following reason. A question on numbers of applications was critical to the calculation of application rates. However, respondents frequently, and fairly consistently, misinterpreted this question. We made corrections (based on call backs) to the question on number of applications, as well as to other questions that affected application rates, to many of the analytical survey observations. Thus a larger proportion of the analytical survey had application rates based on corrected data than the questionnaire survey. Because we had more confidence in a greater proportion of data in the analytical questionnaire, we preferred to use this questionnaire.

Second, because of some remaining problems with the question on number of applications we limited the number of applications to 10, that is, we allowed this number to range up to 10, but where any number exceeded 10, it was set to 10. This was felt to be a very conservatively high estimate of numbers of applications. We feel that, if anything, this assumption would tend to somewhat overstate actual application rates in most cases.

Finally, we deleted one observation, which was a POTW practicing land reclamation. This POTW was applying sewage sludge at over 1,600 dmt/ha. The sewage sludge fails ceiling concentrations, but even if it passed, it is highly unlikely that this application rate would be allowed under Subpart B. The mean application rate shown in the following tables reflects the deletion of this observation.

Attachment A

We then ran the Univariate Procedure in SAS to obtain the weighted means discussed below and presented in the attached tables.

The results of this analysis are as follows: agricultural rates average about 7 dmt/ha; rates at forest sites average 26 dmt/ha; rates at public contact sites average 19 dmt/ha; and rates at reclamation sites average 74 dmt/ha, as shown in the attached tables.

The SAS System   11:50 Tuesday, November 10, 1992 1

------------------------------ NEWUSE=AG ------------------------------

Univariate Procedure

Variable=MTHAYR
Weight= ANAL_WT

Moments

N	87	Sum Wgts	3691
Mean	6.768121	Sum	24981.14
Std Dev	104.9951	Variance	11023.97
Skewness	.	Kurtosis	.
USS	1117136	CSS	948061.1
CV	1551.318	Std Mean	11.25665
T:Mean=0	0.601255	Pr>|T|	0.5493
Num ^= 0	87	Num > 0	87
M(Sign)	43.5	Pr>=|M|	0.0001
Sgn Rank	1914	Pr>=|S|	0.0001

Quantiles(Def=5)

100% Max	290	99%	290
75% Q3	16.3666	95%	53.4717
50% Med	7.53312	90%	43.719
25% Q1	1.61424	10%	0.13452
0% Min	0.026904	5%	0.035872
		1%	0.026904

Range	289.9731
Q3-Q1	14.75236
Mode	0.026904

Extremes

Lowest	Obs	Highest	Obs
0.026904(	40)	53.4717(	19)
0.026904(	39)	58.5162(	51)
0.026904(	73)	61.2066(	9)
0.035872(	72)	75.3312(	50)
0.035872(	71)	290(	25)

Missing Value	.
Count	2
% Count/Nobs	2.25

The SAS System   11:50 Tuesday, November 10, 1992 3

------------------------------ NEWUSE=FOR ------------------------------

Univariate Procedure

Variable=MTHAYR
Weight= ANAL_WT

Moments

N	2	Sum Wgts	12
Mean	26.06325	Sum	312.759
Std Dev	26.21199	Variance	687.0685
Skewness	.	Kurtosis	.
USS	8838.584	CSS	687.0685
CV	100.5707	Std Mean	18.53468
T:Mean=0	1.406189	Pr>|T|	0.3935
Num ^= 0	2	Num > 0	2
M(Sign)	1	Pr>=|M|	0.5000
Sgn Rank	1.5	Pr>=|S|	0.5000

Quantiles(Def=5)

100% Max	33.63	99%	33.63
75% Q3	33.63	95%	33.63
50% Med	26.06325	90%	33.63
25% Q1	18.4965	10%	18.4965
0% Min	18.4965	5%	18.4965
		1%	18.4965

Range	15.1335
Q3-Q1	15.1335
Mode	18.4965

Extremes

Lowest	Obs	Highest	Obs
18.4965(	2)	.(	)
33.63(	1)	.(	)
.(	)	.(	)
.(	)	18.4965(	2)
.(	)	33.63(	1)

NEWUSE=PUBC

Univariate Procedure

Variable=MTHAYR
Weight= ANAL_WT

Moments

N	11	Sum Wg^s	74
Mean	18.67404	Sum	1381.879
Std Dev	121.8776	Variance	14854.16
Skewness	.	Kurtosis	.
USS	174346.9	CSS	148541.6
CV	652.6581	Std Mean	36.74749
T:Mean=0	0.508172	Pr>|T|	0.6224
Num ^= 0	11	Num > 0	11
M(Sign)	5.5	Pr>=|M|	0.0010
Sgn Rank	33	Pr>=|S|	0.0010

Quantiles(Def=5)

100% Max	6.194	99%	246.194
75% Q3	1..4.6552	95%	246.194
50% Med	55.1532	90%	230.2534
25% Q1	44.7279	10%	4.0356
0% Min	0.38114	5%	0.38114
		1%	0.38114
Range	245.8129		
Q3-Q1	79.9273		
Mode	55.1532		

Extremes

Lowest	Obs	Highest	Obs
0.38114(	11)	1C2.011(	7)
4.0356(	10)	116.584(	6)
44.7279(	9)	124.6552(	2)
51.0055(	8)	230.2534(	5)
55.1532(	4)	246.194(	1)

Missing Value	.
Count	2
% Count/Nobs	15.38

NEWUSE=RECL

Univariate Procedure

Variable=MTHAYR
Weight= ANAL_WT

Moments

N	7	Sum Wgts	17
Mean	74.07916	Sum	1259.346
Std Dev	147.885	Variance	21869.97
Skewness	.	Kurtosis	.
USS	224511.1	CSS	131219.8
CV	199.631	Std Mean	55.89527
T:Mean=0	1.325321	Pr>|T|	0.2333
Num ^= 0	7	Num > 0	7
M(Sign)	3.5	Pr>=|M|	0.0156
Sgn Rank	14	Pr>=|S|	0.0156

Quantiles(Def=5)

100% Max	420.7113	99%	420.7113
75% Q3	100.89	95%	420.7113
50% Med	65.9148	90%	420.7113
25% Q1	45	10%	45
0% Min	45	5%	45
		1%	45
Range	375.7113		
Q3-Q1	55.89		
Mode	65.9148		

Extremes

Lowest	Obs	Highest	Obs
45(	7)	65.9148(	3)
45(	6)	65.9148(	4)
65.9148(	5)	65.9148(	5)
65.9148(	4)	100.89(	2)
65.9148(	3)	420.7113(	1)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

NOV 6 1992

OFFICE OF WATER

MEMORANDUM

Subject: Summary Statistics for EPA's Study on the Quality of Domestic Septage

From: Charles E. White, Statistician
Statistical Analysis Section

To: Alan Rubin, Chief
Sludge Risk Assessment Branch

Through: Henry D. Kahn, Chief
Statistical Analysis Section

At your request, I will present and document summary statistics based on EPA's Study on the Quality of Domestic Septage. These summary statistics will include basic statistics on pollutants of concern, other requested pollutants, and the estimated relationship between Total Kjeldahl Nitrogen and Ammonia. EPA's Study on the Quality of Domestic Septage (1991) was conducted in order to support the development of hydraulic loading rates for the land application of domestic septage under the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal. This loading rate is intended to be a protective and affordable method for regulating the beneficial reuse of septage. Development of the loading rate itself will not be discussed in this memo.

Results

There are two basic results from these analyses. First, truckloads of domestic septage are not expected to contain pollutant concentrations as high as could be found in sewage sludge used or disposed from Publicly Owned Treatment Works that practice secondary or better wastewater treatment. Second, Total Kjeldahl Nitrogen is found to be approximately 43% Ammonia in wet domestic septage.

Data

Nine trucks delivering domestic septage to the Madison Metropolitan Sewerage District (MMSD) in Madison, Wisconsin were each sampled once. As septage was being discharged, a grab sample was collected and delivered to the MMSD lab for splitting, labeling, icing, and shipping to appropriate labs under contract to the EPA. Each independent sample was physically analyzed for 324 pollutants. Only data regarding pollutants of concern and some data for pollutants that are also micro-nutrients will be considered in this report.

Physical Analytical Procedures

Physical analytical methods used here are the same as those used for the National Sewage Sludge Survey (NSSS), though some pollutants are reported differently. Individual PCB aroclors were reported in the NSSS; total PCB aroclors are reported here. Aldrin and Dieldrin were reported separately in the NSSS; the totals for Aldrin and Dieldrin are reported here. Total Chlordane is reported in the NSSS; the alpha and gamma portions of chlordane are reported here. DDT, DDS, and DDD are reported separately in the NSSS; totals for DDT, DDS, and DDD are reported here. Lindane is reported in the NSSS; Lindane (Gamma-BHC) is reported here.

Some pollutant concentrations were not measured above the Minimum Level for the particular pollutant. Minimum Levels are a form of "detection limit" used in physical analytical methods developed for the Office of Science and Technology. Under contract, each contractor lab must demonstrate that it is able to achieve the Minimum Levels stated for the particular EPA method to be used. In general, a Minimum Level is defined as the lowest concentration at which the physical analytical process can be reliably calibrated. Pollutant concentrations not measured above the Minimum Level for a particular pollutant are not reported; the Minimum Level is reported instead.

Statistical Methods for Basic Summary Statistics

Statistical analysis methods were primarily selected to estimate a concentration level for each pollutant such that, under certain assumptions, "most" septage concentrations for a particular pollutant will be below it's respective level, i.e., we are primarily estimating percentiles. These methods will also be used to characterize both wet and dry weight pollutant concentration measurements, mixed with "detection limits." Substitution and Maximum Likelihood Methods will be used to estimate summary statistics. One overall assumption of this study is that residential septage samples across the country follow approximately the same probability distributions for pollutant concentrations as those distributions found in the area around Madison, Wisconsin. Additional statistical assumptions are discussed in the section on the Substitution Method, in the section on the Maximum Likelihood Method for estimating summary statistics in the presence of censored, or "non-detect," data and in the section on estimating the relationship between Ammonia and Total Kjeldahl Nitrogen.

Dry Weight Conversion

Physical analyses were conducted on liquid septage samples. However, both because pollutants are assumed to be concentrated in the solid phase of the septage sample and because pollutants were reported this way in the NSSS, a dry weight conversion is also used in presentation of these data. More detailed discussion of the reasons for dry weight conversion and analyses in support of this practice are presented in the *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal.* Conversion of a concentration reported in ug/l is illustrated below:

Let: Pollutant Concentration for Sample $i = x_i$ µg/l
Solids Concentration for Sample $i = y_i$ mg/l

$$\text{Dry Weight Pollutant Concentration in } \mu g/kg = \frac{x_i \mu g/l}{y_i mg/l}\left(\frac{1{,}000{,}000 \text{ mg}}{\text{kg}}\right) = \left(\frac{1{,}000{,}000 x_i}{y_i}\right) \mu g/kg$$

Substitution Methods

The substitution methods used here make no assumptions about the probability distributions of the pollutant concentration data, but they do make assumptions about the concentration of pollutants in samples where pollutants could not be measured above their "detection limit." The first of two substitution methods used assumes that pollutant concentrations, in samples where pollutants could not be measured, are at the "detection limit." The second substitution method assumes that pollutant concentrations, in samples where pollutants could not be measured, are zero. Together, these two substitution methods give a kind of upper and lower bound on non-parametric summary statistics for pollutant concentrations in septage. More detailed discussion of these methods and the reasons for their selection are presented in the *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal.*

Tables of wet weight summary statistics developed using these substitution methods are presented on pages 13 through 23 and tables of dry weight summary statistics developed using these substitution methods are presented on pages 27 through 36.

Maximum Likelihood Estimation

The maximum likelihood estimation (MLE) procedure used here assumes pollutant concentrations are approximately lognormal in probability distribution. When this assumption is true, estimates produced using this procedure will be more efficient than those produced without assumptions about probability distributions. The procedure uses sample size, measured pollutant concentrations, and the range of possible values for "detection limit" data in order to pick optimum estimates for the log mean and log variance of a two parameter lognormal distribution. If the assumption of a lognormal distribution is not closely approximated, this procedure is expected to produce good estimates for upper percentiles while the mean and variance estimates may not be optimal.

The two parameter lognormal distribution is fully described by the log mean and log variance, or the mean and standard deviation. Any desired summary statistic can be calculated using an appropriate pair of sufficient statistics. More detailed discussion of this method and the reasons why it was selected are presented in *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal* (1992).

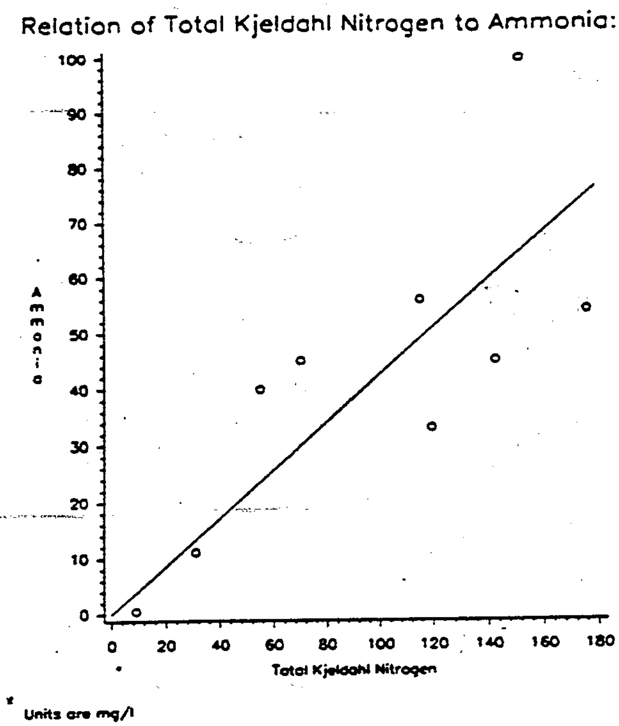
In order to assess the quality of the MLEs, cumulative probability distributions were plotted for both the wet and dry weight distributions. Each plot shows the estimated cumulative distribution for all three estimation methods. The substitution methods are illustrated with points for each observation. The probability plotting position for each point is determined by a ranking procedure developed by Blom. The line indicating the estimated lognormal distribution is a plot of the 10th through 90th percentiles. These plots do not indicate any obvious deviations from the assumption that the pollutant concentration data are approximately lognormal in distribution. These plots are presented in the appendix.

Tables for wet weight summary statistics are presented on pages 10 through 12 and tables for dry weight summary statistics are presented on pages 24 through 26. Pollutants measured above their sample specific Minimum Level, or "detection limit," one time or less are not included in these tables as it is not possible to obtain MLEs under those conditions.

Note that truckloads of domestic septage are not expected to contain pollutant concentrations as high as could be found in sewage sludge used or disposed from Publicly Owned Treatment Works that practice secondary or better wastewater treatment. This statement is based on the previously mentioned distributional assumptions of the MLE estimation procedure and the additional assumption that domestic septage trucks across the country have approximately the same probability distribution for pollutant concentrations as domestic septage in trucks found in the area around Madison, Wisconsin. This result is found by comparing the 98th percentile estimates from the National Sewage Sludge Survey, presented in *Statistical Support Documentation for the 40 CFR, Part 503 Final Standards for the Use or Disposal of Sewage Sludge* (1992), to 98th percentile estimates developed here for dry weight concentrations of septage.

Statistical Methods for Estimating the Relationship Between Ammonia & TKN

Ammonia is the constituent of Total Kjeldahl Nitrogen (TKN) that is immediately available for plant uptake. Over time, Total Kjeldahl Nitrogen is expected to completely break down into Ammonia. The purpose of this analysis is to assist in determining an appropriate hydraulic loading rate for domestic septage that allows sufficient nitrogen for crop growth while not allowing for so much nitrogen that crop growth would be adversely affected. The loading rate itself will be estimated in another document.



The observed relationship between the Ammonia and the Total Kjeldahl Nitrogen data indicates, as expected, that both pollutants increase together. A statistical model was fit to these data that assumes the concentration of Ammonia is zero when the concentration of TKN is zero, that the Ammonia concentration will increase in a linear fashion as TKN increases, that the Ammonia concentrations about that line are approximately normal in distribution, and that the deviations from that line are independent and identically distributed. Under these assumptions, Total Kjeldahl Nitrogen is approximately 43% Ammonia in wet domestic septage.

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	3785.12042	3785.12042	9.806	0.0166
Error	7	2702.12438	386.01777		
C Total	8	6487.24480			

Root MSE	19.64733	R-square	0.5835
Dep Mean	42.72000	Adj R-sq	0.5240
C.V.	45.99095		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.292426	13.34986889	0.471	0.6517
TKN	1	0.377705	0.12061931	3.131	0.0166

Variable	DF	Variable Label
INTERCEP	1	Intercept
TKN	1	Total Kjeldahl Nitrogen

Evaluation of Assumptions

For the assumption that the concentration of Ammonia is zero when the concentration of TKN is zero, a model was fit that estimated a non-zero constant when TKN is zero and a hypothesis test was conducted that failed to reject the hypothesis that the constant was statistically different than zero. The

Analysis of Variance table for this model indicates that the intercept term is not statistically significant at the 0.05 level. The significance test used is robust to many departures from assumptions.

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	20124.34510	20124.34510	57.748	0.0001
Error	8	2787.88530	348.48566		
U Total	9	22912.23040			

Root MSE	18.66777	R-square	0.8783
Dep Mean	42.72000	Adj R-sq	0.8631
C.V.	43.69797		

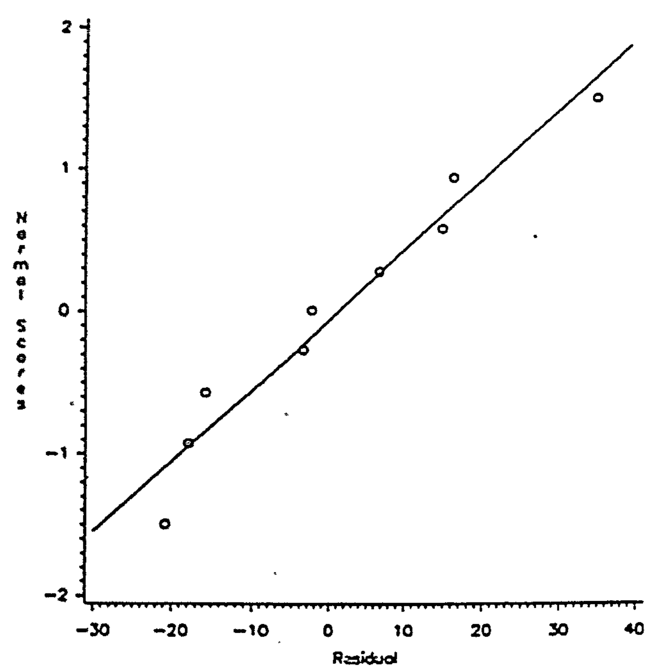
Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
TKN	1	0.427247	0.05622261	7.599	0.0001

Variable	DF	Variable Label
TKN	1	Total Kjeldahl Nitrogen

For the assumption of linearity, both the Analysis of Variance table for the model with an intercept term and for the model without an intercept term indicate that a statistically significant linear relationship exists between Ammonia and TKN. Again, the significance test used is robust to many departures from assumptions.

Relation of Total Kjeldahl Nitrogen to Ammonia:
Normal Score Plot of Residuals from Regression



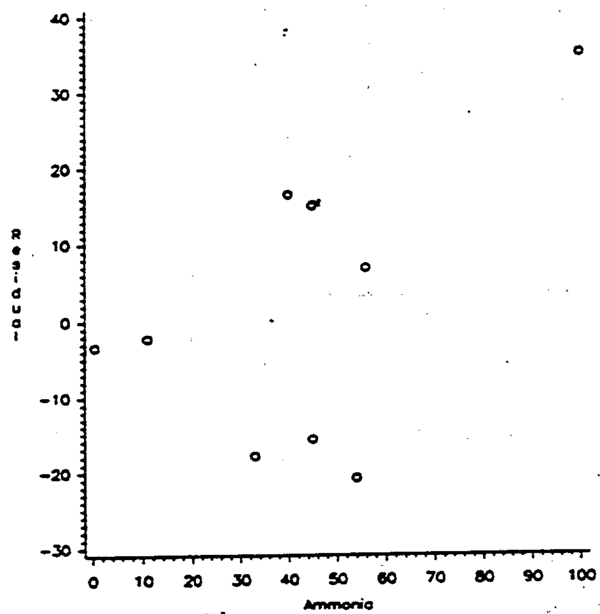
Units are mg/l

For the assumption that Ammonia concentrations about that line are approximately normal in distribution, the Shapiro-Wilk test for the normal distribution fails to reject the hypothesis that the residuals from the fitted line come from a normal distribution. Residuals are the arithmetic difference between the observed concentration of Ammonia at a particular TKN concentration and the Ammonia concentration predicted by the statistical model. Further evidence is that the plot of the residuals versus their expected position in a normal distribution, a normal scores plot, is approximately linear.

For the assumption that deviations from the line are independent, the physical process of sampling from different truck loads of septage would tend to make the sample results independent.

For the assumption that deviations from the line are identically distributed, the plot of residuals versus observed Ammonia values does not appear to indicate strong deviation from this assumption.

Relation of Total Kjeldahl Nitrogen to Ammonia:
Residuals Versus Observed Values



Units are mg/l

References

Blom, G. (1958), *Statistical Estimates and Transformed Beta Variables,* New York: John Wiley & Sons, Inc.

USEPA (1992), *Statistical Support Documentation for the 40 CFR, Part 503 Final Standards for the Use or Disposal of Sewage Sludge*

Appendix A

Summary Statistics

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Sample Size	Non-Detect	Log Mean	Log Variance
ALDRIN/DIELDRIN(TOTAL)	UG/L	9	7	-4.872	15.2471
AMMONIA (AS N)	MG/L	9	0	3.231	2.5560
CADMIUM	UG/L	9	6	1.207	1.1385
CHROMIUM	UG/L	9	1	3.494	0.8888
COPPER	UG/L	9	0	5.373	1.8551
DDT,DDE,DDD(TOTAL)	UG/L	9	7	-2.783	6.1436
LEAD	UG/L	9	6	3.642	0.5873
LINDANE(GAMMA-BHC)	UG/L	9	7	-2.360	0.2981
MERCURY	UG/L	9	4	-1.348	2.7855
NICKEL	UG/L	9	4	3.747	0.3319
NITRATE+NITRITE (AS N)	MG/L	9	2	-1.345	1.0699
PERCENT SOLIDS	%	9	0	-0.488	2.8024
SELENIUM	UG/L	9	7	0.442	5.4810
TOTAL KJELDAHL NITROGEN	MG/L	9	0	4.284	0.9236
TOTAL PHOSPHOROUS	MG/L	9	0	2.960	1.2521
ZINC	UG/L	9	0	7.806	2.1128

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation
ALDRIN/DIELDRIN(TOTAL)	UG/L	15.7000	10700.000	32100.000	2050.0000
AMMONIA (AS N)	MG/L	90.8000	104.0000	313.0000	3.4500
CADMIUM	UG/L	5.9100	2.8700	8.6100	1.4600
CHROMIUM	UG/L	51.3000	20.5000	61.4000	1.2000
COPPER	UG/L	545.0000	422.0000	1270.0000	2.3200
DDT,DDE,DDD(TOTAL)	UG/L	1.3300	9.5900	28.8000	21.6000
LEAD	UG/L	51.2000	15.3000	45.8000	0.8940
LINDANE(GAMMA-BHC)	UG/L	0.1100	0.0215	0.0646	0.5890
MERCURY	UG/L	1.0500	1.3600	4.0800	3.9000
NICKEL	UG/L	50.0000	10.5000	31.4000	0.6270
NITRATE+NITRITE (AS N)	MG/L	0.4450	0.2050	0.6160	1.3800
PERCENT SOLIDS	%	2.4900	3.2700	9.8100	3.9300
SELENIUM	UG/L	24.1000	124.0000	373.0000	15.5000
TOTAL KJELDAHL NITROGEN	MG/L	115.0000	47.3000	142.0000	1.2300
TOTAL PHOSPHOROUS	MG/L	36.1000	19.0000	57.0000	1.5800
ZINC	UG/L	7060.0000	6350.0000	19000.000	2.7000

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Median	90th Percentile	95th Percentile	98th Percentile
ALDRIN/DIELDRIN(TOTAL)	UG/L	0.0077	1.1600	4.7200	23.4000
AMMONIA (AS N)	MG/L	25.3000	197.0000	351.0000	676.0000
CADMIUM	UG/L	3.[illegible]400	13.2000	19.3000	30.0000
CHROMIUM	UG/L	32.9000	111.0000	155.0000	228.0000
COPPER	UG/L	216.0000	1240.0000	2030.0000	3540.0000
DDT,DDE,DDD(TOTAL)	UG/L	0.0619	1.4900	3.6500	10.1000
LEAD	UG/L	38.2000	102.0000	135.0000	184.0000
LINDANE(GAMMA-BHC)	UG/L	0.0944	0.1900	0.2320	0.2900
MERCURY	UG/L	0.2600	2.2200	4.0400	8.0200
NICKEL	UG/L	42.4000	88.9000	109.0000	138.0000
NITRATE+NITRITE (AS N)	MG/L	0.2610	0.9840	1.4300	2.1800
PERCENT SOLIDS	%	0.6140	5.2800	9.6400	19.1000
SELENIUM	UG/L	1.5600	31.5000	73.2000	191.0000
TOTAL KJELDAHL NITROGEN	MG/L	72.5000	249.0000	352.0000	523.0000
TOTAL PHOSPHOROUS	MG/L	19.3000	81.3000	122.0000	192.0000
ZINC	UG/L	2460.0000	15900.000	26800.000	48700.000

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

------------ Pollutant=ALDRIN/DIELDRIN(TOTAL) -- Sample Size=9 -- Units=UG/L ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.4480	0.2660	0.7980	178.0	0.1000	0.1000	2.500
SM-0	0.3610	0.2800	0.8400	232.0	0.0000	0.0000	2.500

---------------- Pollutant=ALPHA-CHLORDANE -- Sample Size=9 -- Units=UG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.1090	0.0093	0.0280	25.6	0.1000	0.1000	0.184
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

---------------- Pollutant=AMMONIA (AS N) -- Sample Size=9 -- Units=MG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	42.7000	9.4900	28.5000	66.7	0.4800	45.0000	100.000
SM-0	42.7000	9.4900	28.5000	66.7	0.4800	45.0000	100.000

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------------------- Pollutant=ARSENIC -- Sample Size=9 -- Units=UG/L ----------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	20.0000	0.0000	0.0000	0.0	20.0000	20.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

---------------------- Pollutant=BENZENE -- Sample Size=7 -- Units=UG/L ----------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.4000	1.4300	3.7800	33.1	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

----------------- Pollutant=BENZO(A)PYRENE -- Sample Size=9 -- Units=UG/L -----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.1000	1.1100	3.3300	30.0	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

Pollutant=BERYLLIUM -- Sample Size=9 -- Units=UG/L

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	5.0000	0.0000	0.0000	0.0	5.0000	5.0000	5.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE -- Sample Size=9 -- Units=UG/L

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.1000	1.1100	3.3300	30.0	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Pollutant=CADMIUM -- Sample Size=9 -- Units=UG/L

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	7.1300	1.4900	4.4700	62.7	5.0000	5.0000	18.400
SM-0	3.8000	2.1700	6.5000	171.0	0.0000	0.0000	18.400

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------------- Pollutant=CHROMIUM -- Sample Size=9 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	46.7000	12.7000	38.1000	81.6	10.0000	33.5000	128.000
SM-0	45.6000	13.1000	39.4000	86.5	0.0000	33.5000	128.000

-------------------- Pollutant=COPPER -- Sample Size=9 -- Units=UG/L --------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	503.0000	223.0000	669.0000	133.0	62.0000	115.0000	1850.000
SM-0	503.0000	223.0000	669.0000	133.0	62.0000	115.0000	1850.000

-------------- Pollutant=DDT,DDE,DDD(TOTAL) -- Sample Size=9 -- Units=UG/L --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.6850	0.2810	0.8440	123.0	0.3380	0.3380	2.880
SM-0	0.4220	0.3230	0.9690	230.0	0.0000	0.0000	2.880

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------------- Pollutant=GAMMA-CHLORDANE -- Sample Size=9 -- Units=UG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.1230	0.0104	0.0313	25.4	0.1130	0.1130	0.207
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

------------------ Pollutant=HEPTACHLOR -- Sample Size=9 -- Units=UG/L ------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.0896	0.0209	0.0626	69.9	0.0630	0.0630	0.250
SM-0	0.0278	0.0278	0.0833	300.0	0.0000	0.0000	0.250

--------------- Pollutant=HEXACHLOROBENZENE -- Sample Size=9 -- Units=UG/L --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.1000	1.1100	3.3300	30.0	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------------- Pollutant=HEXACHLOROBUTADIENE -- Sample Size=9 -- Units=UG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.1000	1.1100	3.3300	30.0	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

---------------------- Pollutant=LEAD -- Sample Size=9 -- Units=UG/L ----------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	63.4000	8.0800	24.2000	38.2	50.0000	50.0000	121.000
SM-0	30.1000	15.7000	47.1000	157.0	0.0000	0.0000	121.000

---------------- Pollutant=LINDANE(GAMMA-BHC) -- Sample Size=9 -- Units=UG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.1620	0.0170	0.0511	31.6	0.1250	0.1380	0.253
SM-0	0.0417	0.0295	0.0884	212.0	0.0000	0.0000	0.250

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------------- Pollutant=MERCURY -- Sample Size=9 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.8220	0.4200	1.2600	153.0	0.2000	0.3000	4.050
SM-0	0.7330	0.4380	1.3100	179.0	0.0000	0.3000	4.050

------------------ Pollutant=MOLYBDENUM -- Sample Size=9 -- Units=UG/L ------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	10.5000	0.4890	1.4700	14.0	10.0000	10.0000	14.400
SM-0	1.6000	1.6000	4.8000	300.0	0.0000	0.0000	14.400

------------ Pollutant=N-NITROSODIMETHYLAMINE -- Sample Size=9 -- Units=UG/L ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	55.6000	5.5600	16.7000	30.0	50.0000	50.0000	100.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

--------------------- Pollutant=NICKEL -- Sample Size=9 -- Units=UG/L ---------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	54.5000	7.8300	23.5000	43.1	40.0000	41.6000	105.000
SM-0	36.7000	13.2000	39.7000	108.0	0.0000	41.6000	105.000

------------ Pollutant=NITRATE+NITRITE (AS N) -- Sample Size=9 -- Units=MG/L ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.3890	0.0964	0.2890	74.4	0.1000	0.2000	0.900
SM-0	0.3670	0.1050	0.3160	86.2	0.0000	0.2000	0.900

------------------ Pollutant=PCB(TOTAL) -- Sample Size=9 -- Units=UG/L ------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	1.9100	0.1630	0.4890	25.6	1.7500	1.7500	3.220
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

Pollutant=PERCENT SOLIDS -- Sample Size=9 -- Units=' %'

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	2.2100	1.5100	4.5400	205.0	0.0653	0.6580	14.200
SM-0	2.2100	1.5100	4.5400	205.0	0.0653	0.6580	14.200

Pollutant=SELENIUM -- Sample Size=9 -- Units=UG/L

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	20.8000	6.6400	19.9000	95.6	5.0000	5.0000	50.000
SM-0	6.9400	4.6000	13.8000	199.0	0.0000	0.0000	32.000

Pollutant=TOTAL KJELDAHL NITROGEN -- Sample Size=9 -- Units=MG/L

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	96.4000	19.2000	57.6000	59.7	9.0000	115.0000	175.000
SM-0	96.4000	19.2000	57.6000	59.7	9.0000	115.0000	175.000

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------------- Pollutant=TOTAL PHOSPHOROUS -- Sample Size=9 -- Units=MG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	27.6000	5.7400	17.2000	62.3	1.7000	32.0000	48.000
SM-0	27.6000	5.7400	17.2000	62.3	1.7000	32.0000	48.000

------------------- Pollutant=TOXAPHENE -- Sample Size=9 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.3000	1.6700	5.0100	44.3	0.9100	11.4000	20.900
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

---------------- Pollutant=TRICHLOROETHENE -- Sample Size=7 -- Units=UG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.4000	1.4300	3.7800	33.1	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------------------- Pollutant=ZINC -- Sample Size=9 -- Units=UG/L ----------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	5300.0000	2420.0000	7270.0000	137.0	182.0000	3190.0000	23800.000
SM-O	5300.0000	2420.0000	7270.0000	137.0	182.0000	3190.0000	23800.000

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Sample Size	Non-Detect	Log Mean	Log Variance
ALDRIN/DIELDRIN(TOTAL)	UG/KG	9	7	0.741	8.92238
AMMONIA (AS N)	MG/KG	9	0	8.325	3.90825
CADMIUM	MG/K'	9	6	-1.766	5.86238
CHROMIUM	MG/KG	9	1	1.542	2.39400
COPPER	MG/KG	9	0	3.559	4.39988
DDT,DDE,DDD(TOTAL)	UG/KG	9	7	1.665	7.27425
LEAD	MG/KG	9	6	0.561	3.87225
LINDANE(GAMMA-BHC)	UG/KG	9	7	0.967	2.14650
MERCURY	MG/KG	9	4	-3.571	2.86875
NICKEL	MG/KG	9	4	1.330	1.57612
NITRATE+NITRITE (AS N)	MG/KG	9	2	3.522	0.82463
PERCENT SOLIDS	%	9	0	-0.488	2.80237
SELENIUM	MG/KG	9	7	-2.098	6.97725
TOTAL KJELDAHL NITROGEN	MG/KG	9	0	9.378	2.81813
TOTAL PHOSPHOROUS	MG/KG	9	0	8.054	1.42312
ZINC	MG/KG	9	0	5.992	1.05525

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation
ALDRIN/DIELDRIN(TOTAL)	UG/KG	182.0000	5240.0000	15700.000	86.6000
AMMONIA (AS N)	MG/KG	29100.000	67800.000	203000.00	6.9900
CADMIUM	MG/KG	3.2100	20.0000	60.0000	18.7000
CHROMIUM	MG/KG	15.5000	16.3000	48.8000	3.1600
COPPER	MG/KG	317.0000	948.0000	2840.0000	8.9700
DDT,DDE,DDD(TOTAL)	UG/KG	201.0000	2540.0000	7620.0000	38.0000
LEAD	MG/KG	12.1000	27.8000	83.3000	6.8600
LINDANE(GAMMA-BHC)	UG/KG	7.6900	7.0500	21.1000	2.7500
MERCURY	MG/KG	0.1180	0.1600	0.4810	4.0800
NICKEL	MG/KG	8.3200	5.4300	16.3000	1.9600
NITRATE+NITRITE (AS N)	MG/KG	51.1000	19.3000	57.9000	1.1300
PERCENT SOLIDS	%	2.4900	3.2700	9.8100	3.9300
SELENIUM	MG/KG	4.0200	43.8000	131.0000	32.7000
TOTAL KJELDAHL NITROGEN	MG/KG	48400.000	64000.000	192000.00	3.9700
TOTAL PHOSPHOROUS	MG/KG	6410.0000	3790.0000	11400.000	1.7700
ZINC	MG/KG	678.0000	309.0000	928.0000	1.3700

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Median	90th Percentile	95th Percentile	98th Percentile
ALDRIN/DIELDRIN(TOTAL)	UG/KG	2.1000	97.4000	286.0000	972.0000
AMMONIA (AS N)	MG/KG	4130.0000	52300.000	107000.00	240000.00
CADMIUM	MG/KG	0.1710	3.8400	9.1800	24.8000
CHROMIUM	MG/KG	4.6700	34.1000	59.6000	112.0000
COPPER	MG/KG	35.1000	520.0000	1110.0000	2620.0000
DDT,DDE,DDD(TOTAL)	UG/KG	5.2900	169.0000	447.0000	1350.0000
LEAD	MG/KG	1.7500	22.0000	44.6000	100.0000
LINDANE(GAMMA-BHC)	UG/KG	2.6300	17.3000	29.3000	53.4000
MERCURY	MG/KG	0.0281	0.2480	0.4560	0.9140
NICKEL	MG/KG	3.7800	19.0000	29.8000	49.9000
NITRATE+NITRITE (AS N)	MG/KG	33.9000	109.0000	151.0000	219.0000
PERCENT SOLIDS	%	0.6140	5.2800	9.6400	19.1000
SELENIUM	MG/KG	0.1230	3.6600	9.4600	27.9000
TOTAL KJELDAHL NITROGEN	MG/KG	11800.000	102000.00	187000.00	372000.00
TOTAL PHOSPHOROUS	MG/KG	3150.0000	14600.000	22400.000	36500.000
ZINC	MG/KG	400.0000	1500.0000	2170.0000	3300.0000

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------ Pollutant=ALDRIN/DIELDRIN(TOTAL) -- Sample Size=9 -- Units=UG/KG ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	77.200	36.300	109.000	141.0	8.55000	17.6000	325.00
SM-0	38.000	35.900	108.000	283.0	0.00000	0.0000	325.00

--------------- Pollutant=ALPHA-CHLORDANE -- Sample Size=9 -- Units=UG/KG ---------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	44.100	19.500	58.500	133.0	0.70400	15.2000	153.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

---------------- Pollutant=AMMONIA (AS N) -- Sample Size=9 -- Units=MG/KG ---------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	12700.000	6390.000	19200.000	151.0	77.50000	8210.0000	61300.00
SM-0	12700.000	6390.000	19200.000	151.0	77.50000	8210.0000	61300.00

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

------------------- Pollutant=ARSENIC -- Sample Size=9 -- Units=MG/KG -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	8.710	3.920	11.800	135.0	0.14100	3.0400	30.60
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

------------------- Pollutant=BENZENE -- Sample Size=7 -- Units=UG/KG -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	1540.000	519.000	1370.000	89.1	70.40000	1080.0000	4330.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

---------------- Pollutant=BENZO(A)PYRENE -- Sample Size=9 -- Units=UG/KG ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4420.000	1950.000	5840.000	132.0	70.40000	1520.0000	15300.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------------ Pollutant=BERYLLIUM -- Sample Size=9 -- Units=MG/KG ------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	2.180	0.981	2.940	135.0	0.03520	0.7600	7.66
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

--------- Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE -- Sample Size=9 -- Units=UG/KG ----------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4420.000	1950.000	5840.000	132.0	70.40000	1520.0000	15300.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

------------------ Pollutant=CADMIUM -- Sample Size=9 -- Units=MG/KG ------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	2.430	0.954	2.860	118.0	0.03520	0.9950	7.66
SM-0	0.632	0.349	1.050	166.0	0.00000	0.0000	2.77

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

------------------- Pollutant=CHROMIUM -- Sample Size=9 -- Units=MG/KG -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	10.900	3.640	10.900	100.0	0.22600	7.6300	35.30
SM-0	9.360	3.800	11.400	122.0	0.00000	6.9200	35.30

-------------------- Pollutant=COPPER -- Sample Size=9 -- Units=MG/KG --------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	113.000	40.900	123.000	108.0	0.81000	105.0000	328.00
SM-0	113.000	40.900	123.000	108.0	0.81000	105.0000	328.00

-------------- Pollutant=DDT,DDE,DDD(TOTAL) -- Sample Size=9 -- Units=UG/KG --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	176.000	64.500	194.000	110.0	2.38000	69.3000	518.00
SM-0	33.800	28.100	84.400	250.0	0.00000	0.0000	254.00

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------------- Pollutant=GAMMA-CHLORDANE -- Sample Size=9 -- Units=UG/KG ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	49.800	22.000	66.100	133.0	0.79600	17.2000	173.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

------------------ Pollutant=HEPTACHLOR -- Sample Size=9 -- Units=UG/KG ------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	32.000	12.400	37.100	116.0	0.44400	9.5700	96.50
SM-0	5.690	5.690	17.100	300.0	0.00000	0.0000	51.20

-------------- Pollutant=HEXACHLOROBENZENE -- Sample Size=9 -- Units=UG/KG --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4420.000	1950.000	5840.000	132.0	70.40000	1520.0000	15300.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

-------------- Pollutant=HEXACHLOROBUTADIENE -- Sample Size=9 -- Units=UG/KG --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4420.000	1950.000	5840.000	132.0	70.40000	1520.0000	15300.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

--------------------- Pollutant=LEAD -- Sample Size=9 -- Units=MG/KG ---------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	23.800	9.600	28.800	121.0	0.35200	7.6000	76.60
SM-0	3.960	2.730	8.200	207.0	0.00000	0.0000	24.80

-------------- Pollutant=LINDANE(GAMMA-BHC) -- Sample Size=9 -- Units=UG/KG --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	61.900	26.700	80.000	129.0	0.88000	22.1000	211.00
SM-0	2.560	2.450	7.340	287.0	0.00000	0.0000	22.10

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------------------- Pollutant=MERCURY -- Sample Size=9 -- Units=MG/KG ----------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.138	0.044	0.132	95.4	0.00211	0.0760	0.35
SM-O	0.059	0.037	0.112	189.0	0.00000	0.0021	0.35

---------------------- Pollutant=MOLYBDENUM -- Sample Size=9 -- Units=MG/KG ----------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4.460	1.950	5.850	131.0	0.07040	1.5200	15.30
SM-O	0.328	0.328	0.984	300.0	0.00000	0.0000	2.95

------------- Pollutant=N-NITROSODIMETHYLAMINE -- Sample Size=9 -- Units=UG/KG -------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	22100.000	9740.000	29200.000	132.0	352.00000	7600.0000	76600.00
SM-O	0.000	0.000	0.000	.	0.00000	0.0000	0.00

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

-------------------- Pollutant=NICKEL -- Sample Size=9 -- Units=MG/KG --------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	18.900	7.800	23.400	124.0	0.56200	6.0800	61.30
SM-0	4.470	2.870	8.620	193.0	0.00000	0.5620	26.80

------------ Pollutant=NITRATE+NITRITE (AS N) -- Sample Size=9 -- Units=MG/KG ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	68.600	17.200	51.700	75.4	6.34000	53.1000	153.00
SM-0	36.400	11.600	34.900	95.9	0.00000	32.4000	91.20

----------------- Pollutant=PCB(TOTAL) -- Sample Size=9 -- Units=UG/KG -----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	771.000	341.000	1020.000	133.0	12.30000	266.0000	2680.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

------------------- Pollutant=SELENIUM -- Sample Size=9 -- Units=MG/KG -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4.370	1.240	3.720	85.2	0.03520	2.7400	10.20
SM-0	0.487	0.335	1.000	206.0	0.00000	0.0000	2.74

----------- Pollutant=TOTAL KJELDAHL NITROGEN -- Sample Size=9 -- Units=MG/KG -----------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	23600.000	8350.000	25100.000	106.0	218.00000	13000.0000	84200.00
SM-0	23600.000	8350.000	25100.000	106.0	218.00000	13000.0000	84200.00

-------------- Pollutant=TOTAL PHOSPHOROUS -- Sample Size=9 -- Units=MG/KG --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4580.000	1050.000	3150.000	68.7	176.00000	3500.0000	10700.00
SM-0	4580.000	1050.000	3150.000	68.7	176.00000	3500.0000	10700.00

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------------ Pollutant=TOXAPHENE -- Sample Size=9 -- Units=UG/KG ------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	3240.000	1600.000	4800.000	148.0	80.10000	1390.0000	15500.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

--------------- Pollutant=TRICHLOROETHENE -- Sample Size=7 -- Units=UG/KG ---------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	1540.000	519.000	1370.000	89.1	70.40000	1080.0000	4330.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

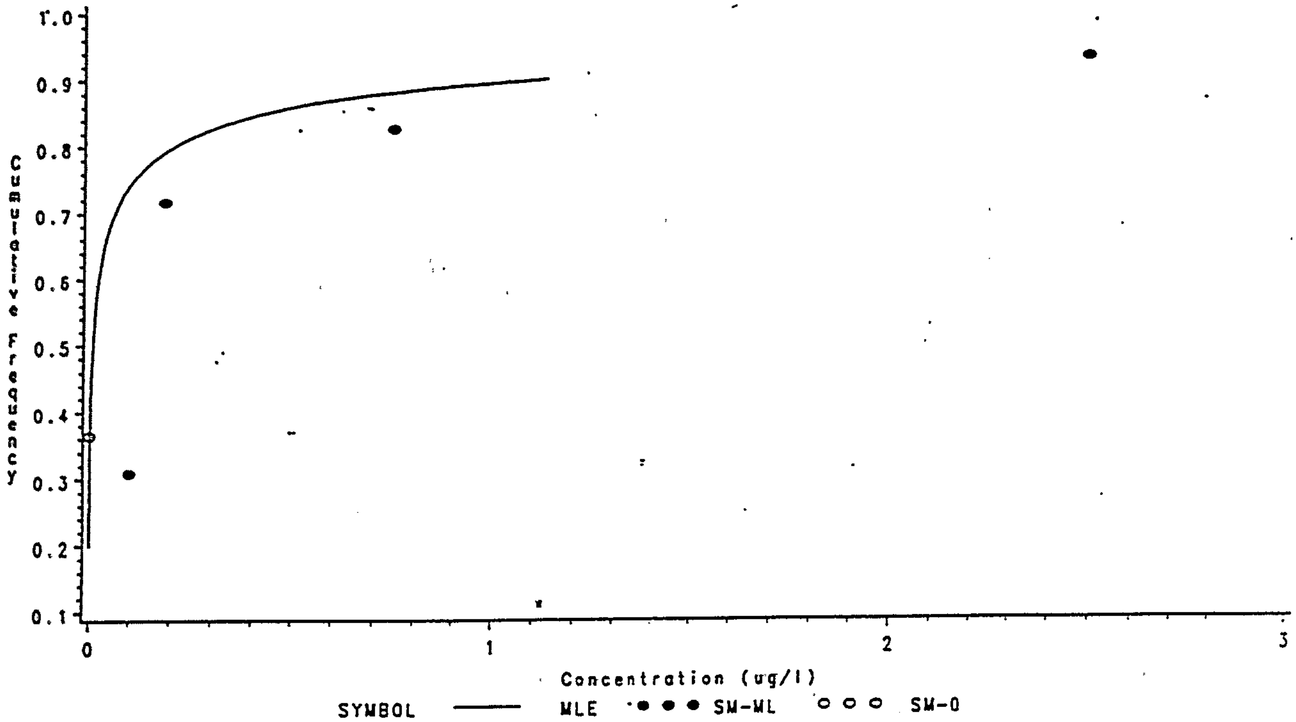
-------------------- Pollutant=ZINC -- Sample Size=9 -- Units=MG/KG --------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	570.000	146.000	439.000	77.1	43.70000	433.0000	1290.00
SM-0	570.000	146.000	439.000	77.1	43.70000	433.0000	1290.00

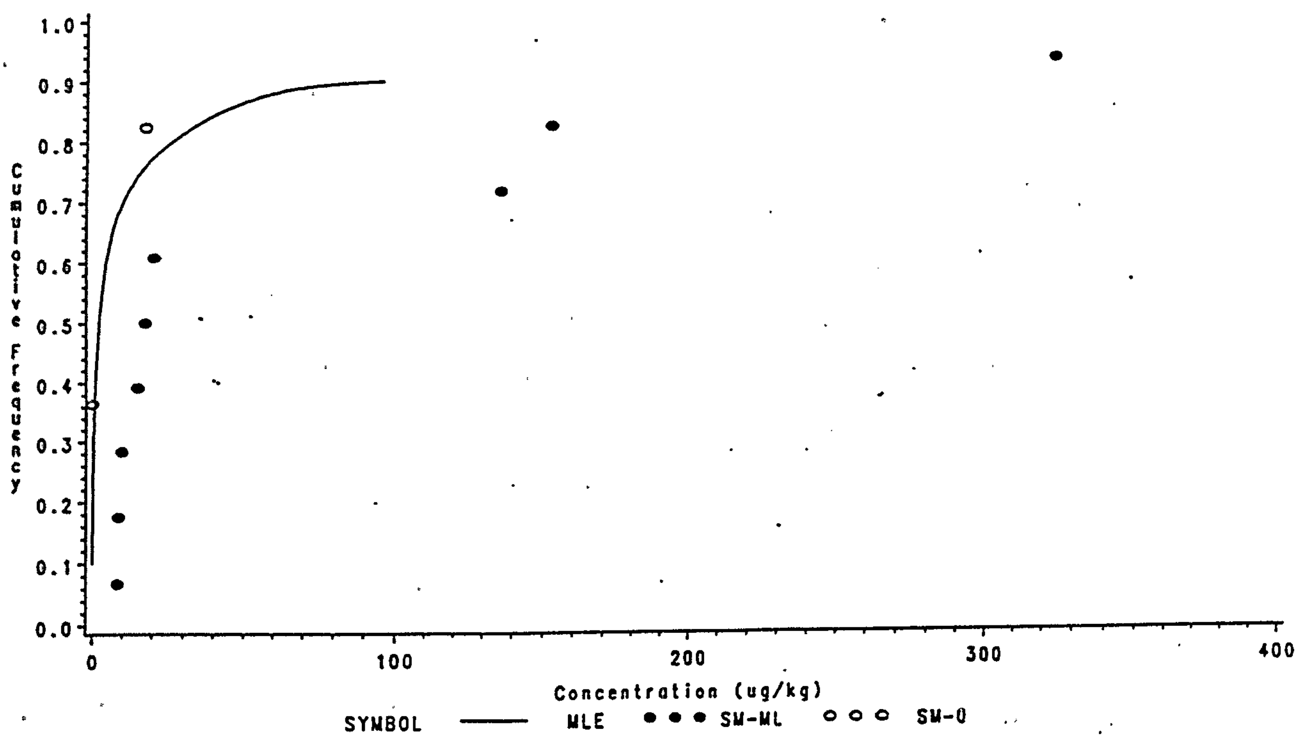
Appendix B

Graphics

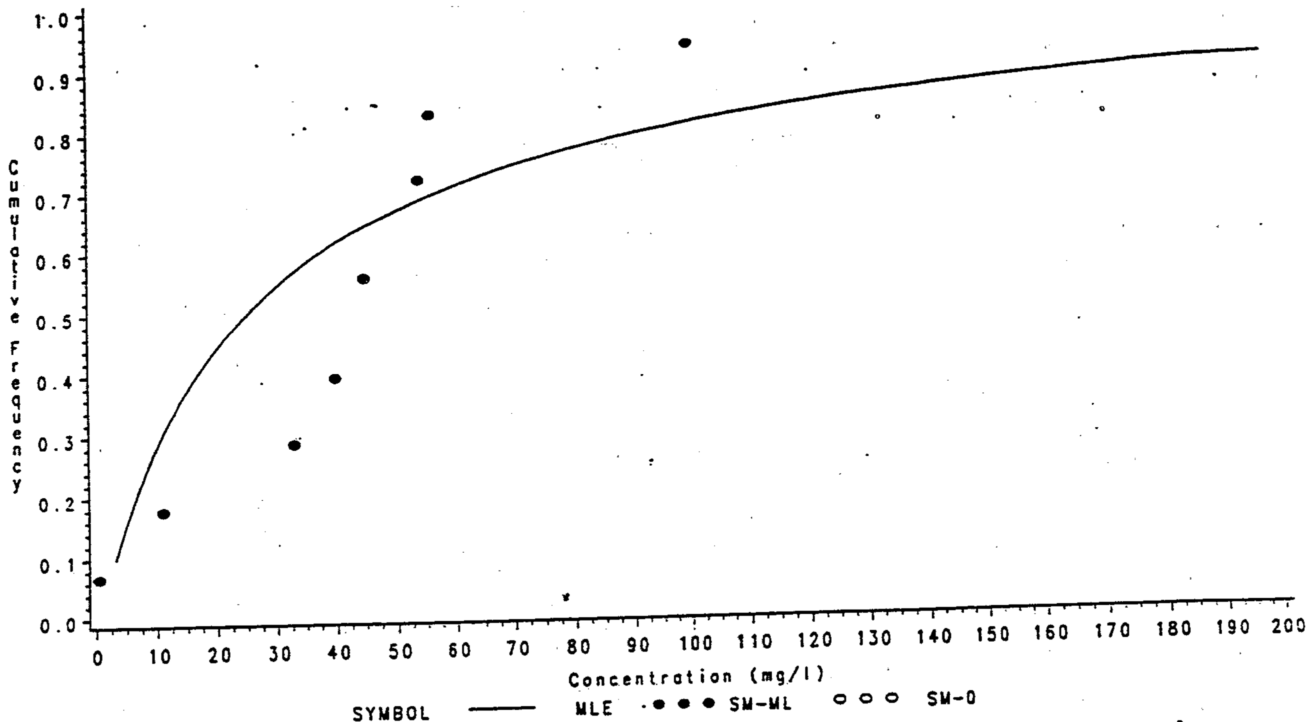
Cumulative Frequency for Total Aldrin/Dieldrin (ug/l)



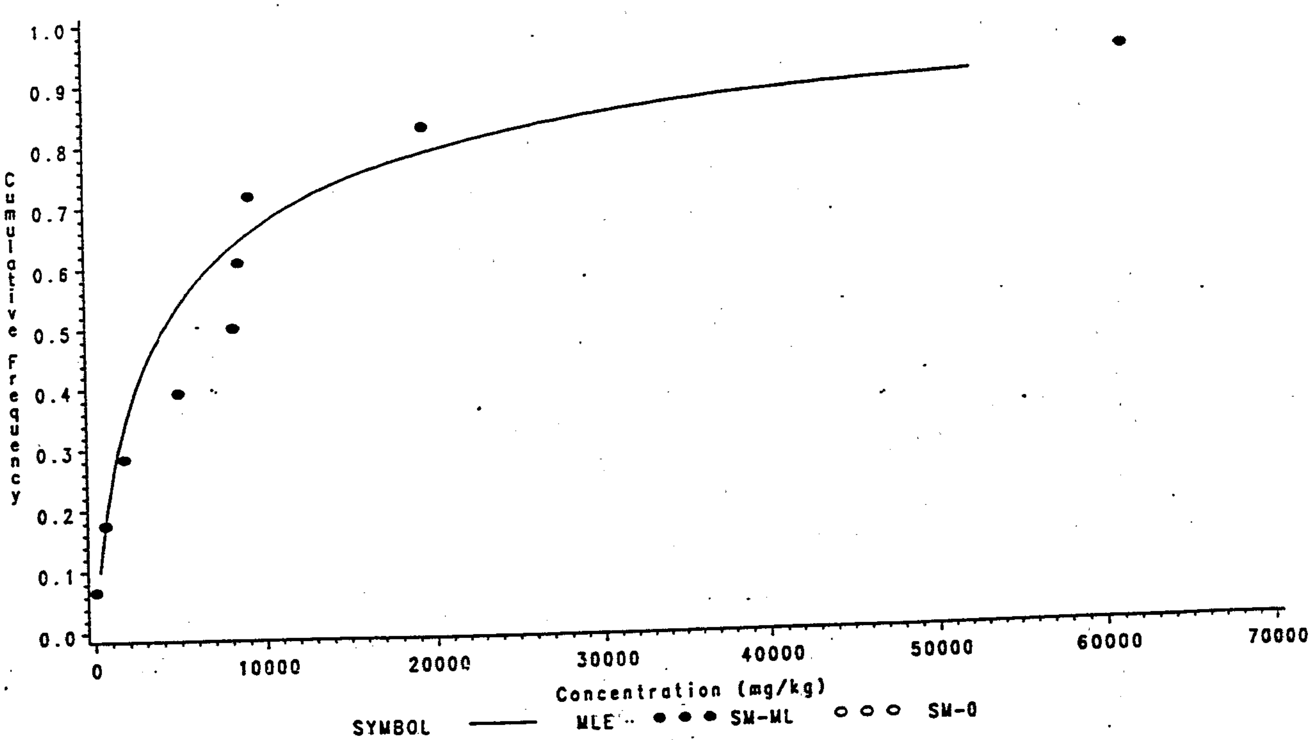
Cumulative Frequency for Total Aldrin/Dieldrin (ug/kg)



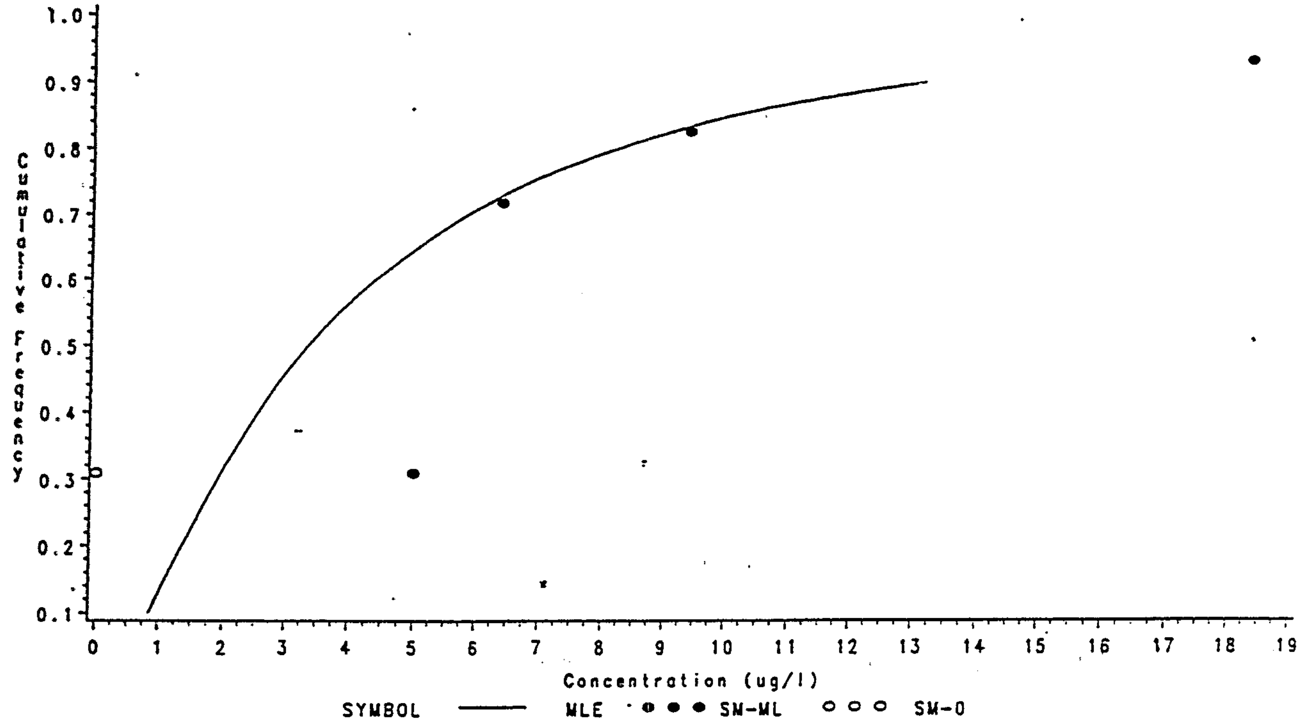
Cumulative Frequency for Ammonia (AS N) (mg/l)



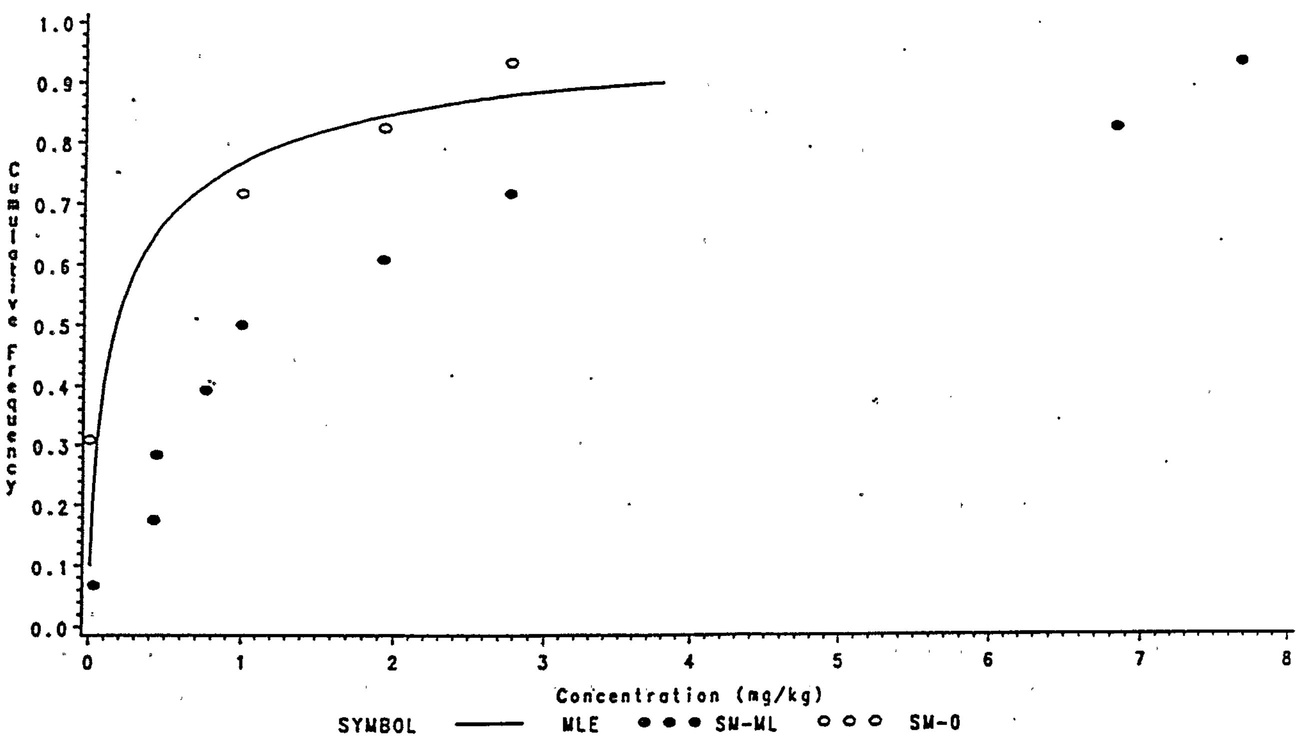
Cumulative Frequency for Ammonia (AS N) (mg/kg)



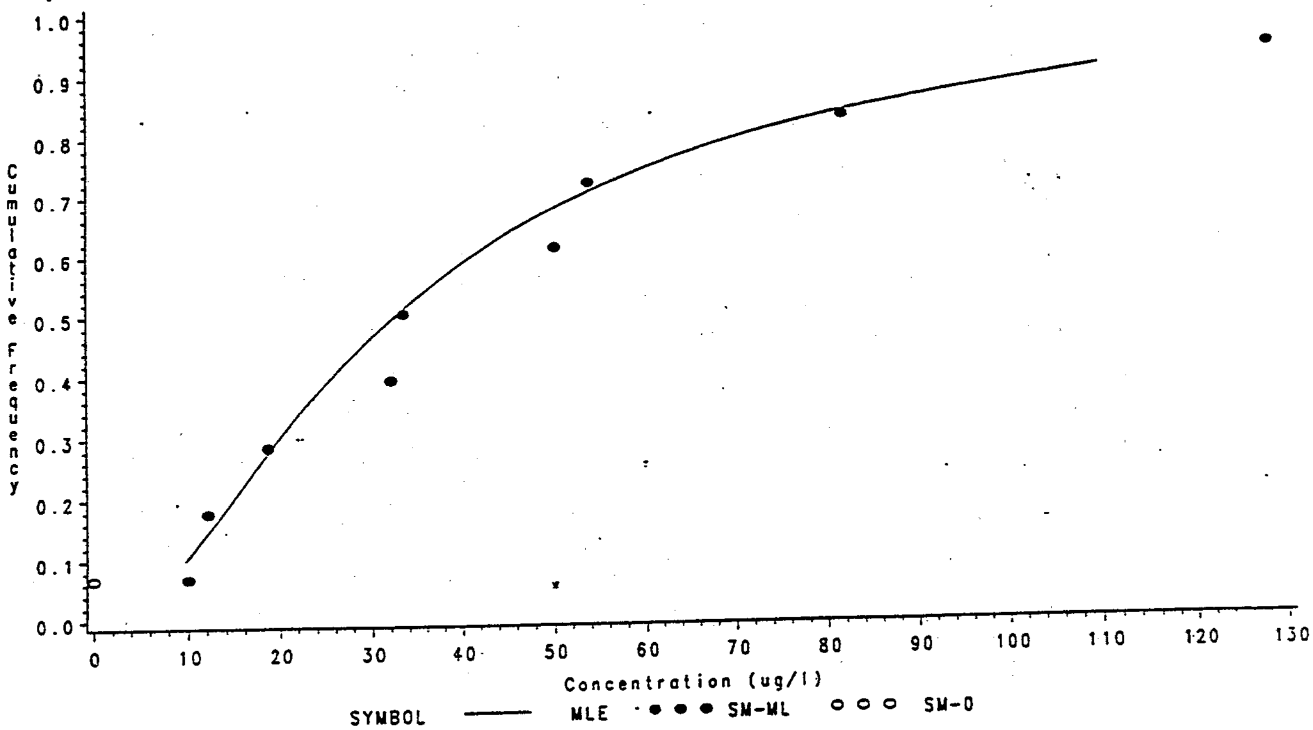
Cumulative Frequency for Cadmium (ug/l)



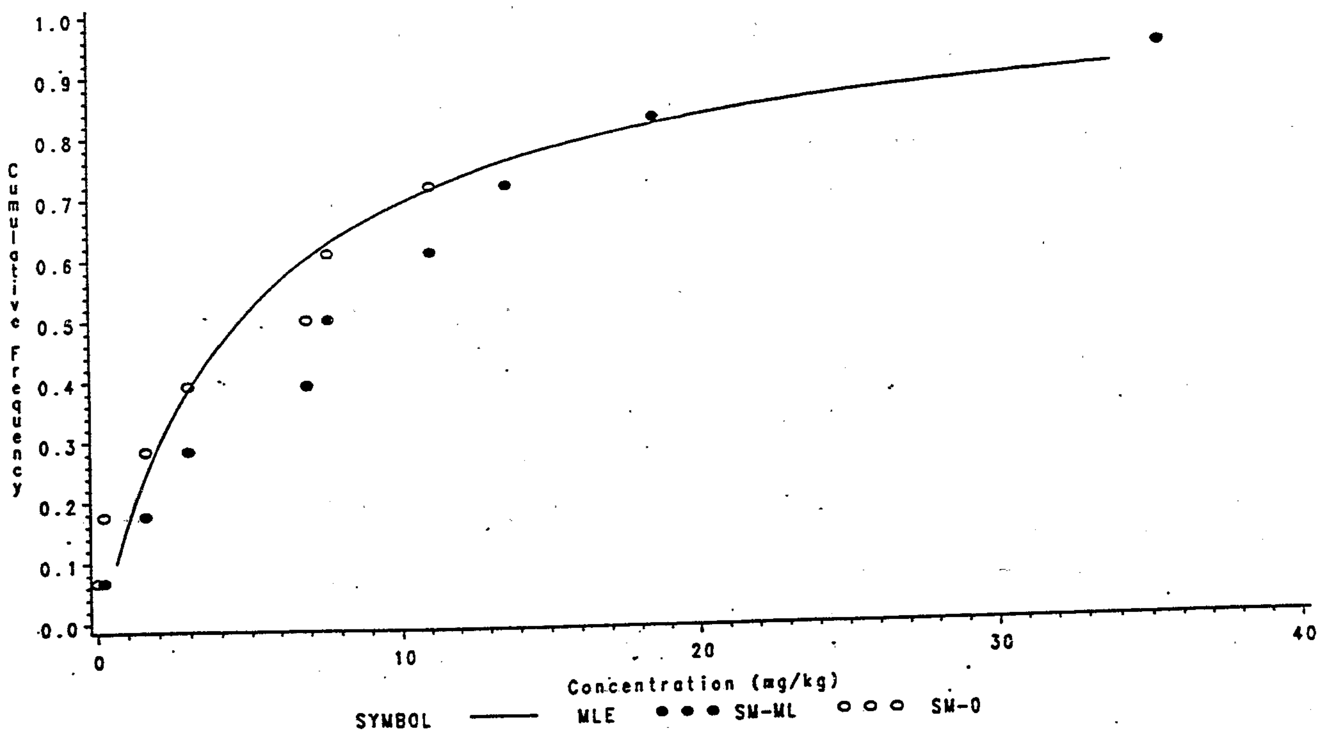
Cumulative Frequency for Cadmium (mg/kg)



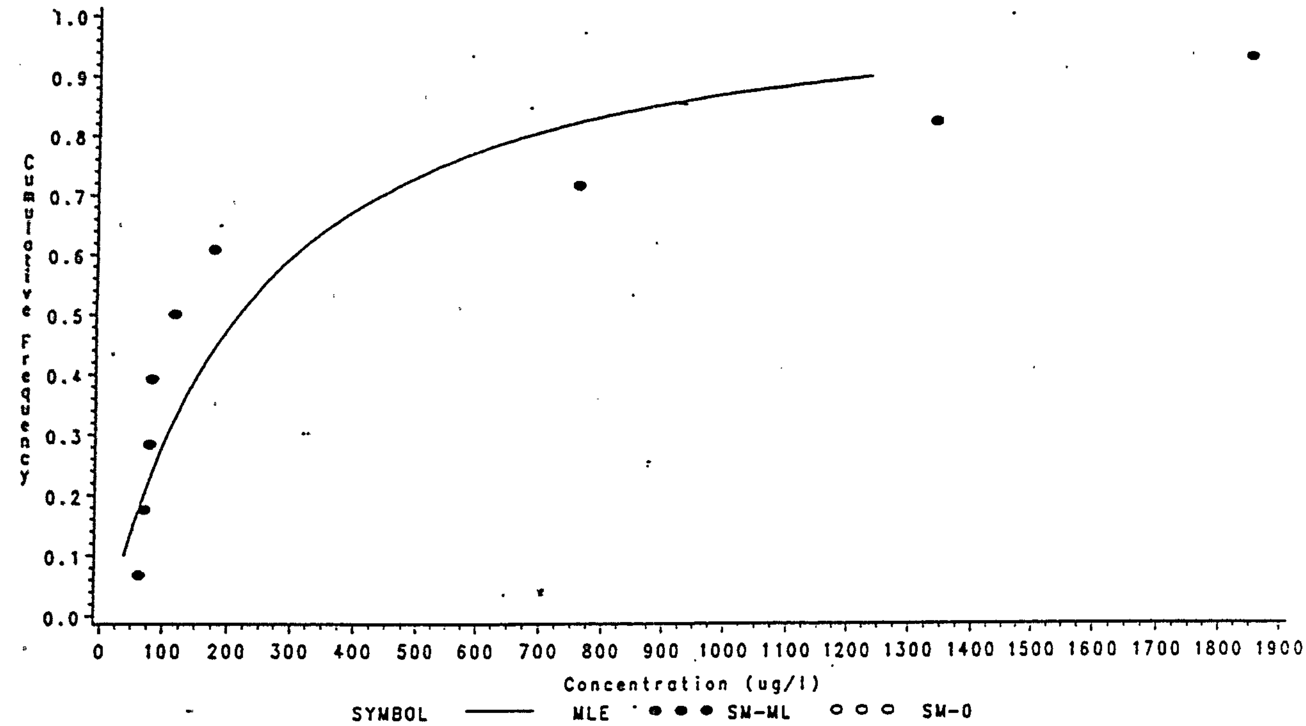
Cumulative Frequency for Chromium (ug/l)



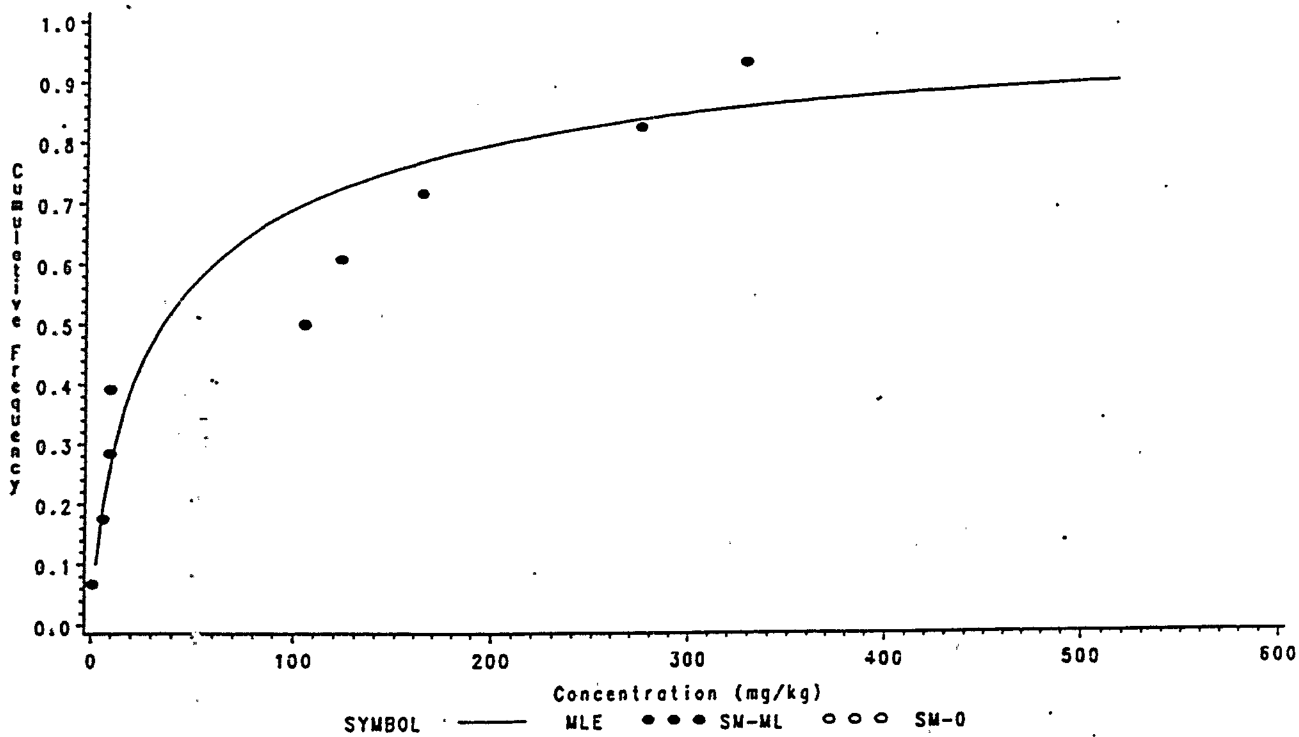
Cumulative Frequency for Chromium (mg/kg)



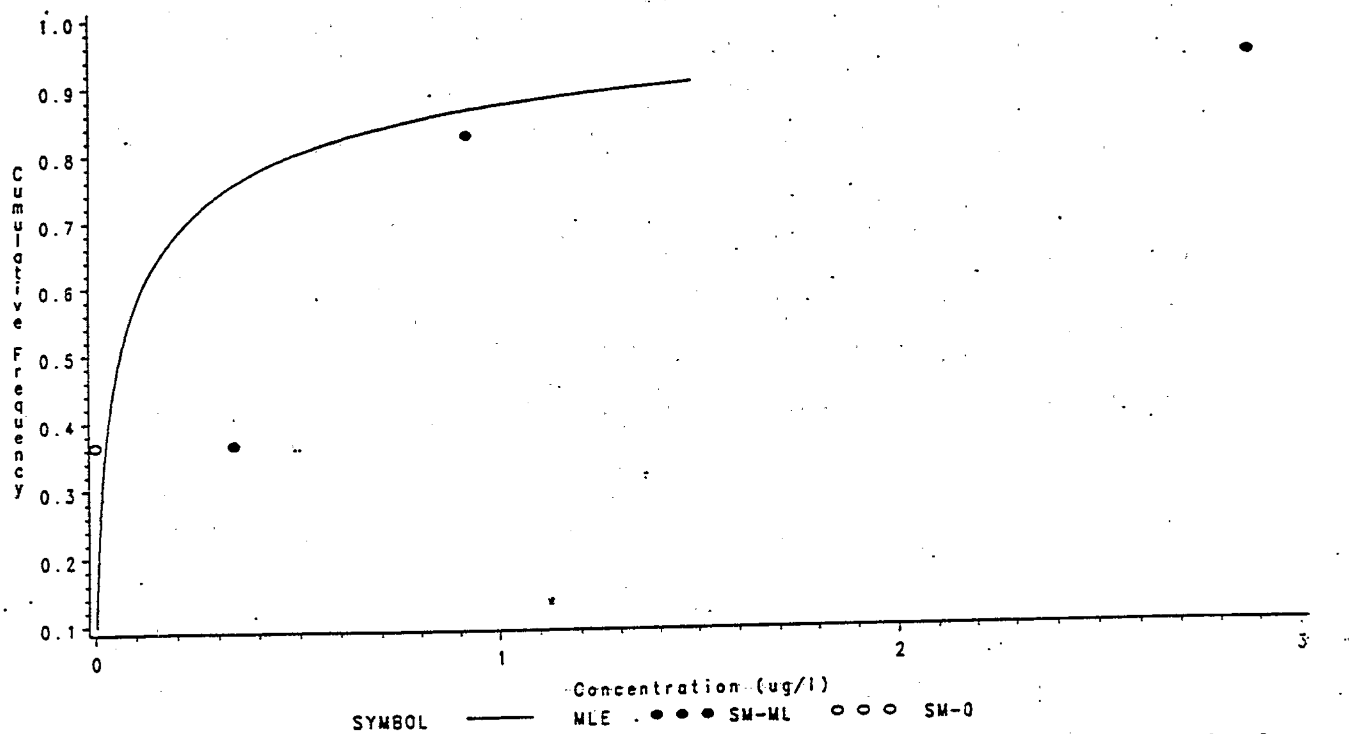
Cumulative Frequency for Copper (ug/l)



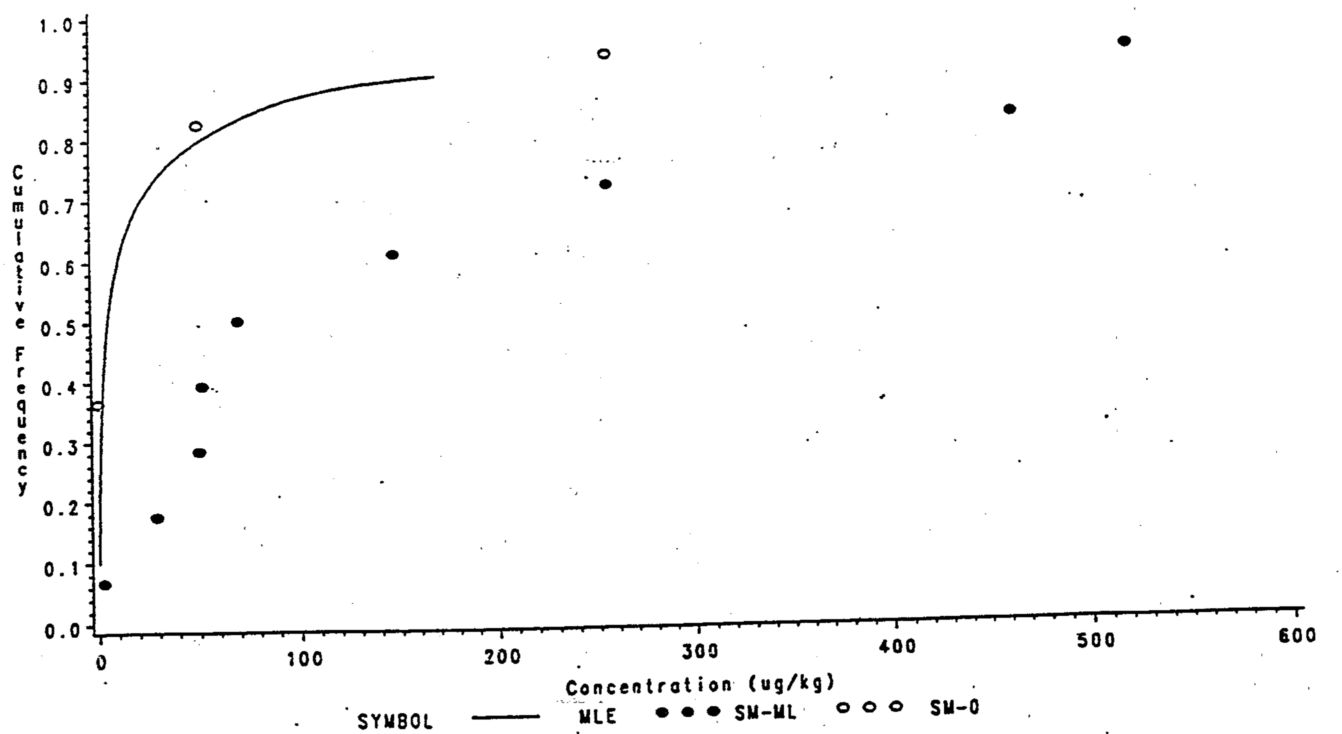
Cumulative Frequency for Copper (mg/kg)

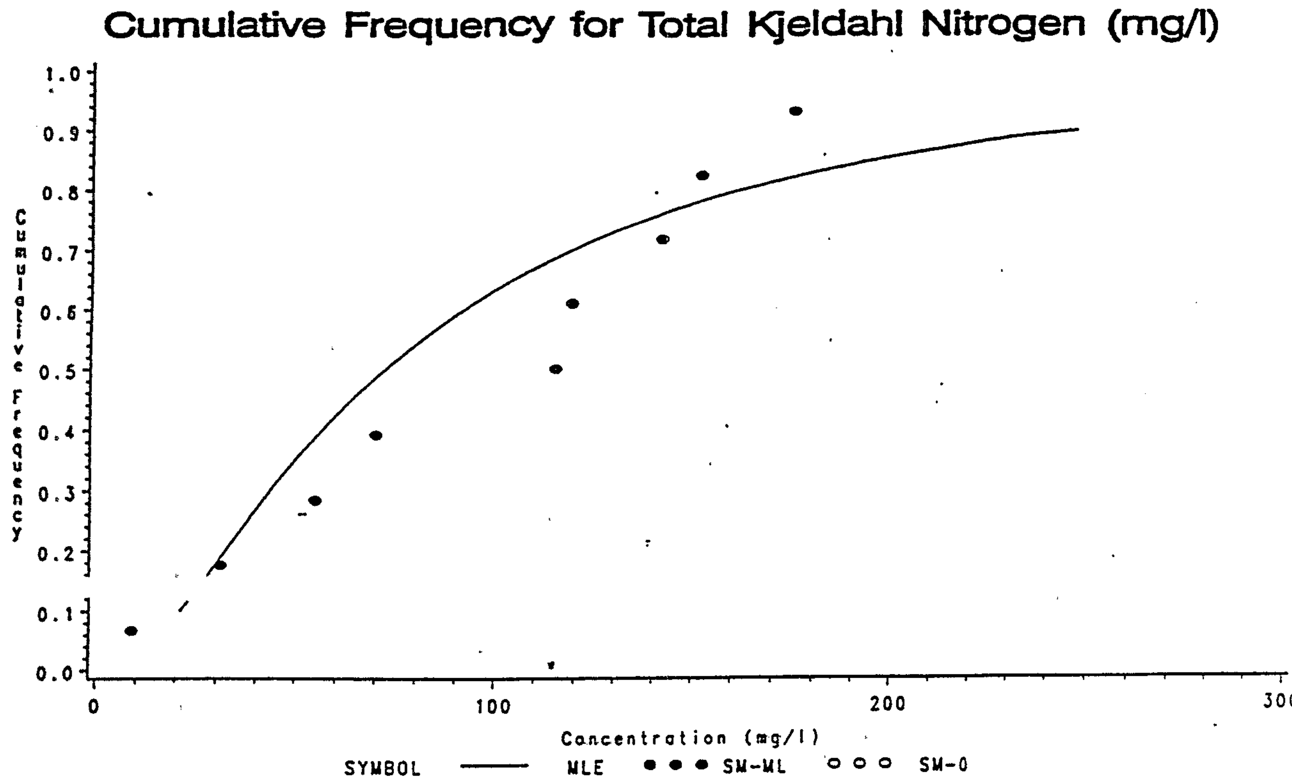


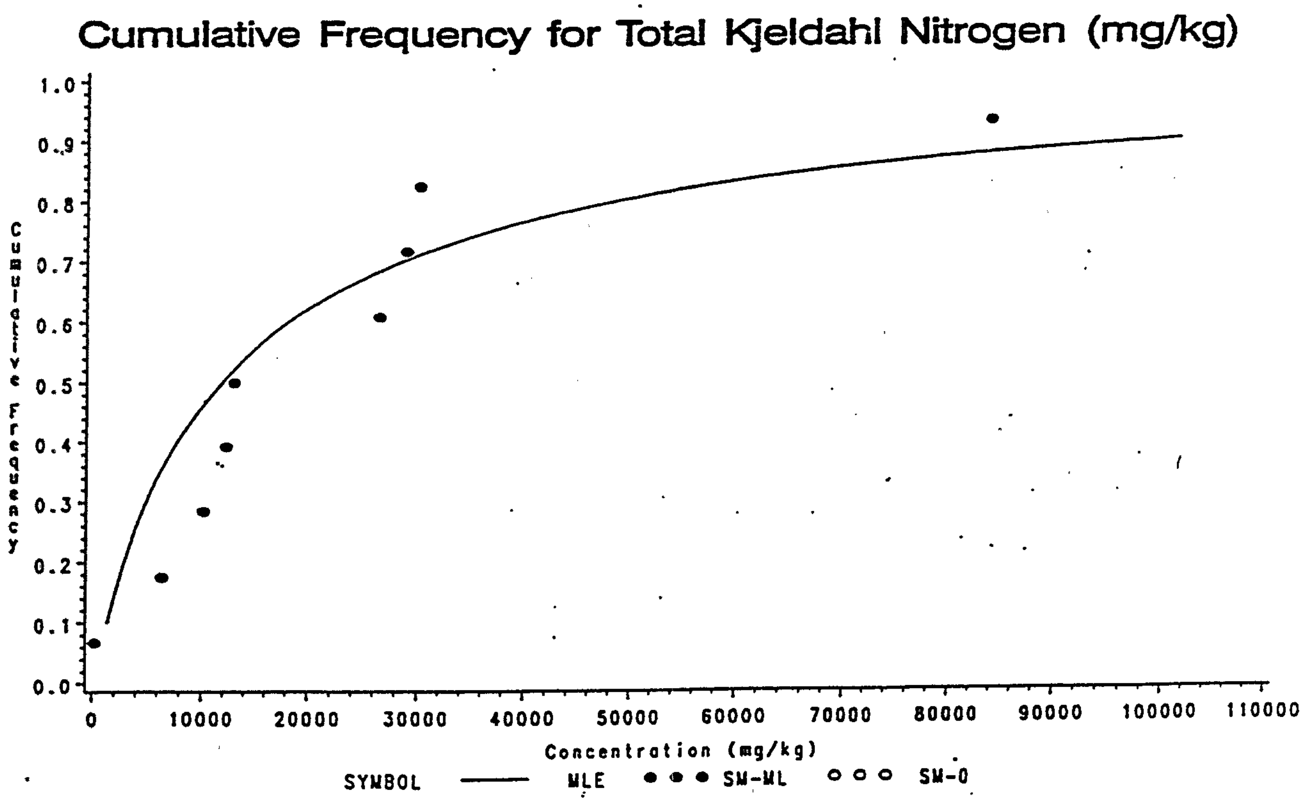
Cumulative Frequency for Total DDT, DDE, and DDD (ug/l)



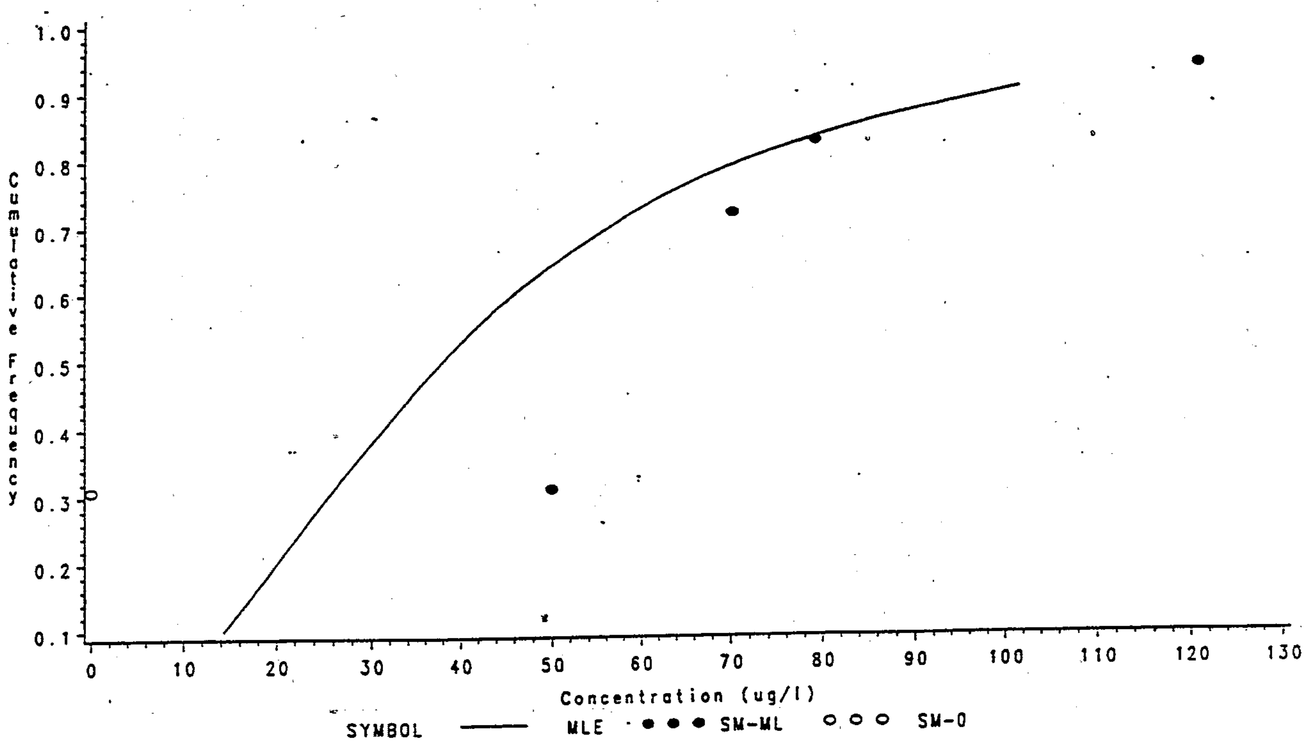
Cumulative Frequency for Total DDT, DDE, and DDD (ug/kg)



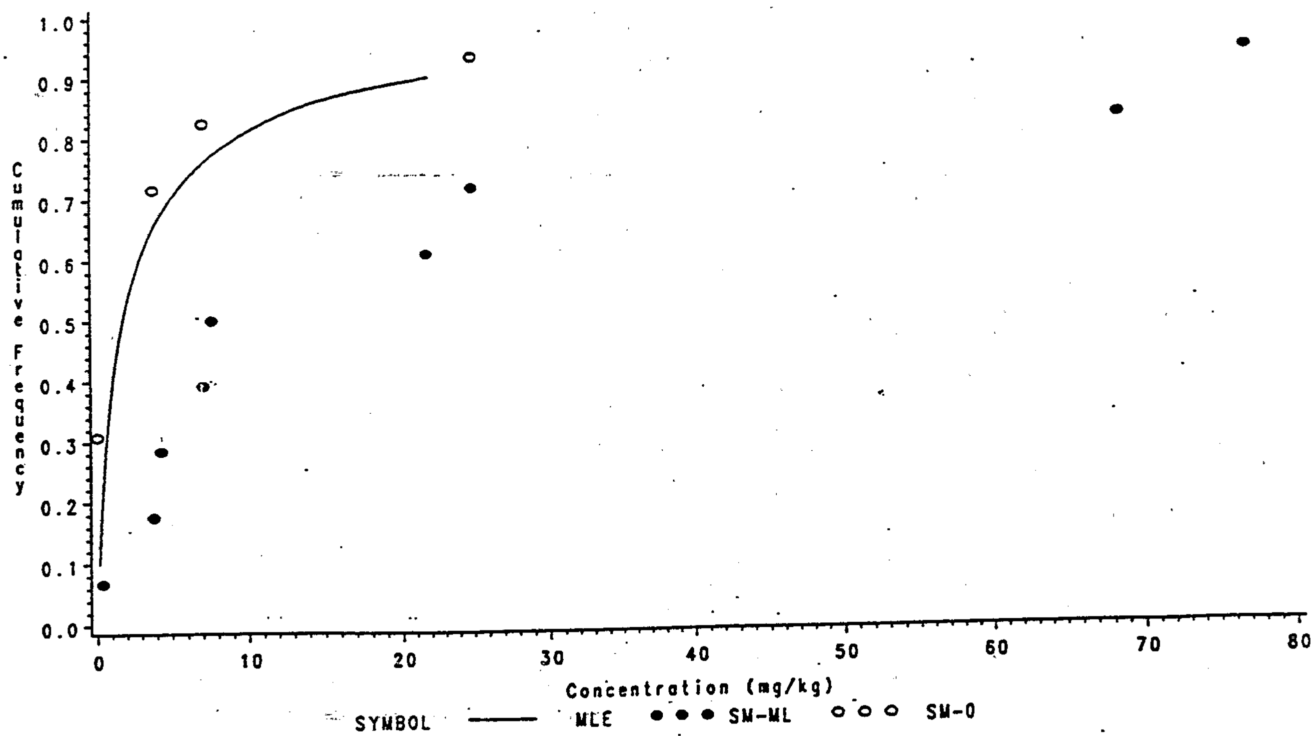

Cumulative Frequency for Total Kjeldahl Nitrogen (mg/l)
Cumulative Frequency
Concentration (mg/l)
SYMBOL MLE SM-ML SM-0

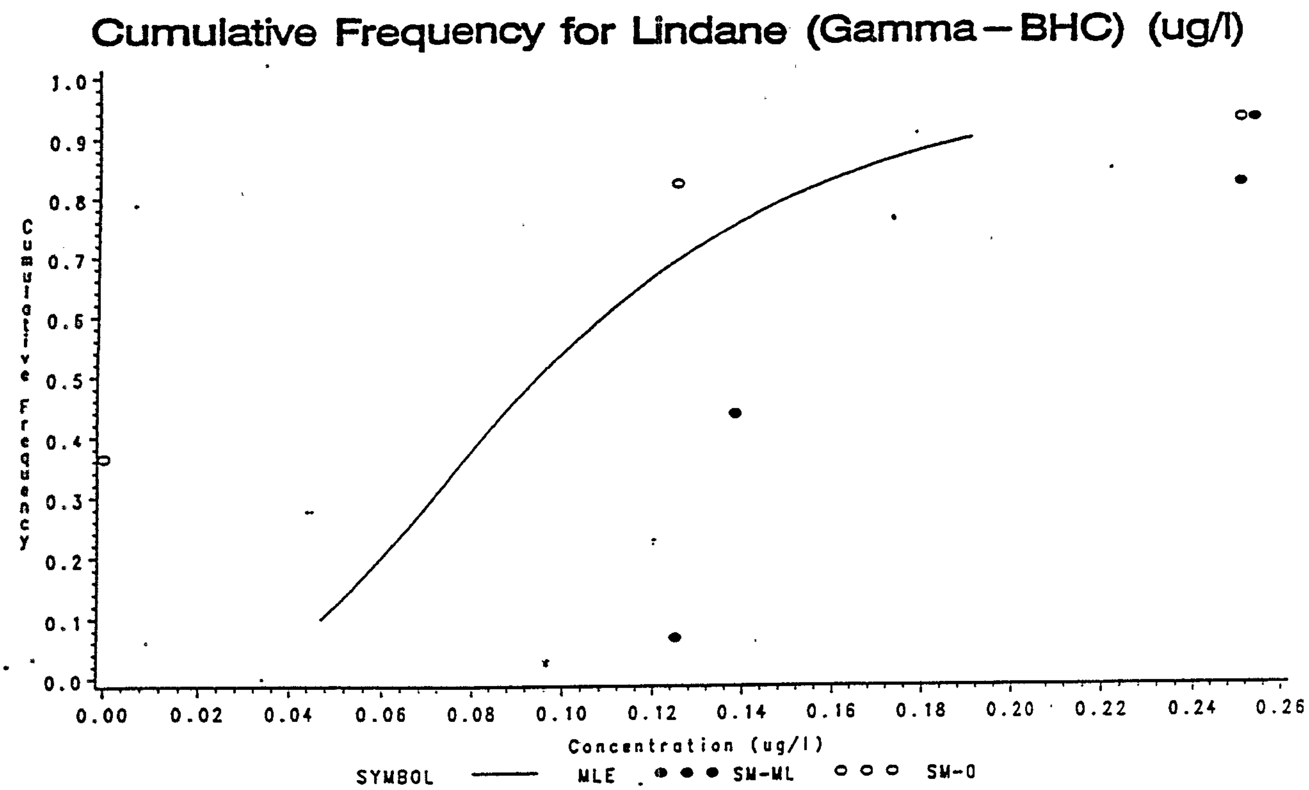

Cumulative Frequency for Total Kjeldahl Nitrogen (mg/kg)
Cumulative Frequency
Concentration (mg/kg)
SYMBOL MLE SM-ML SM-0

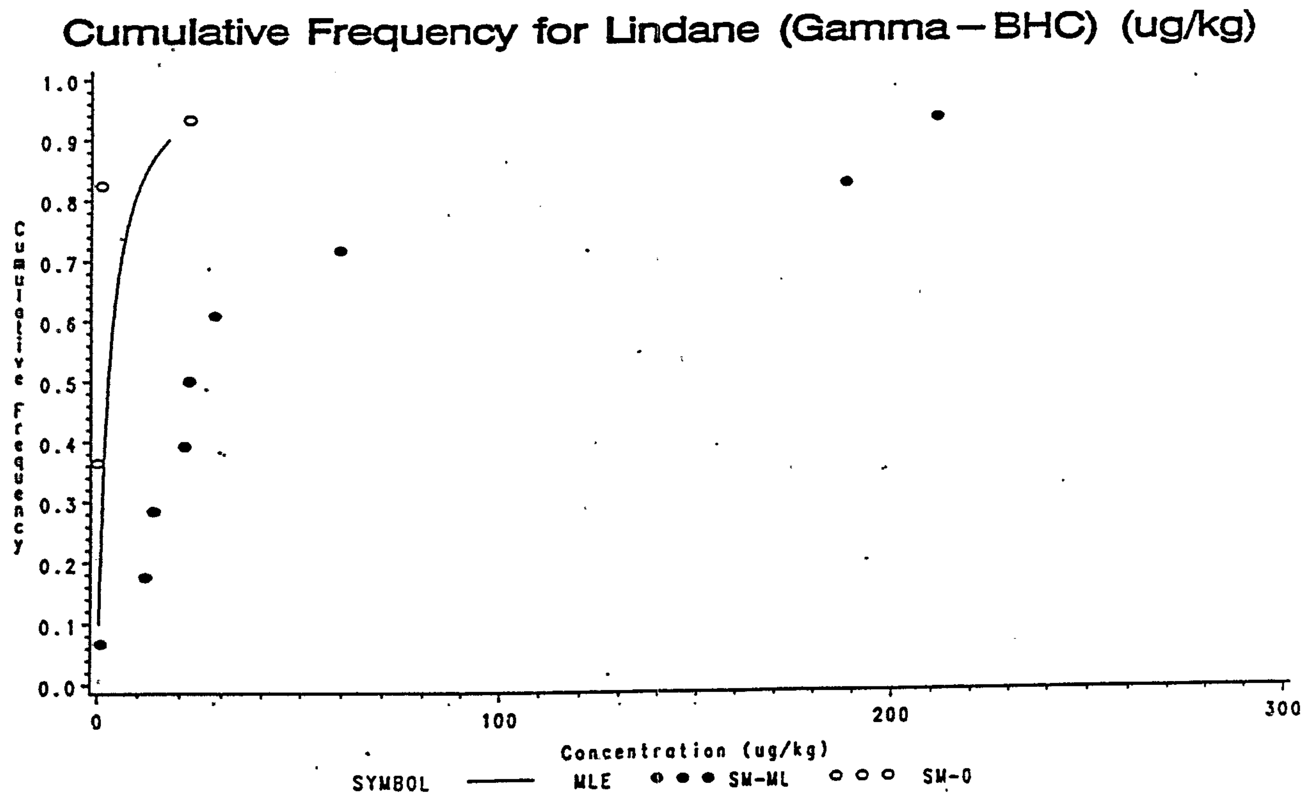
Cumulative Frequency for Lead (ug/l)

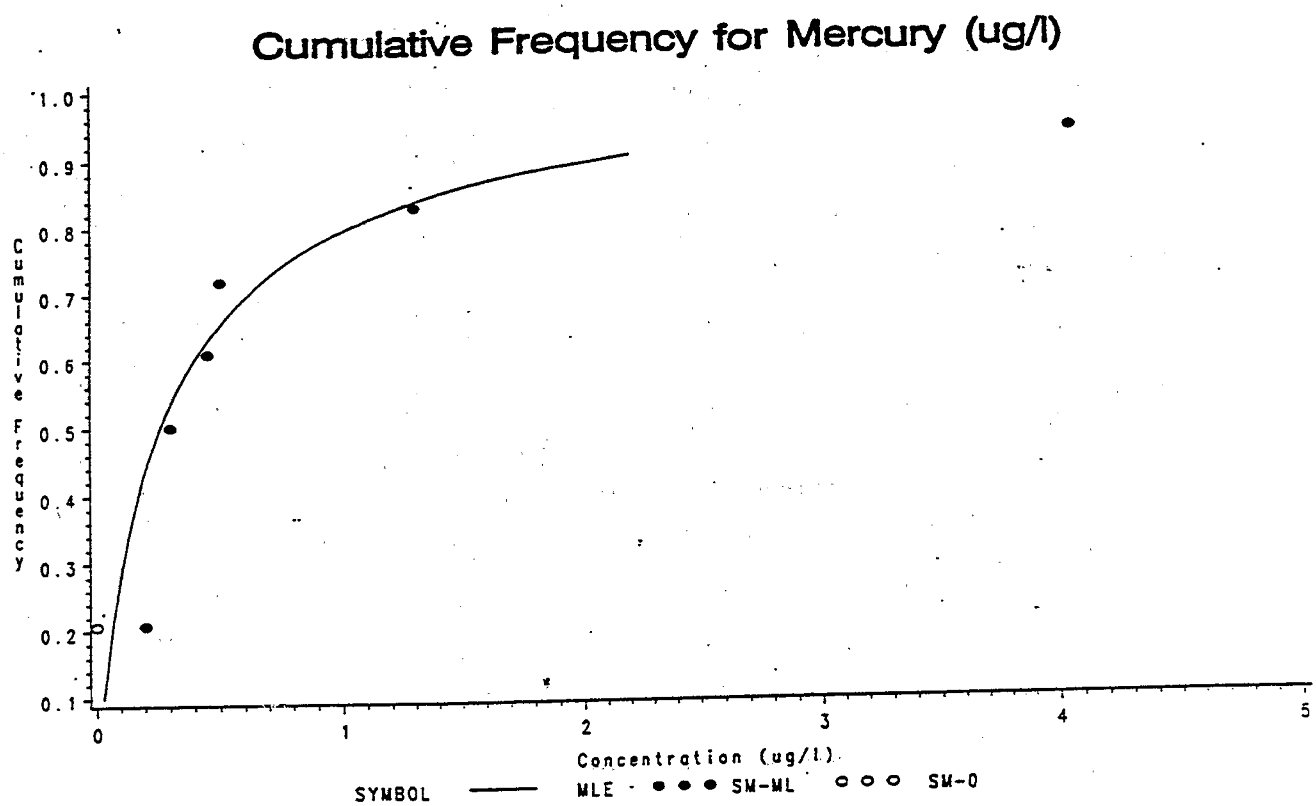


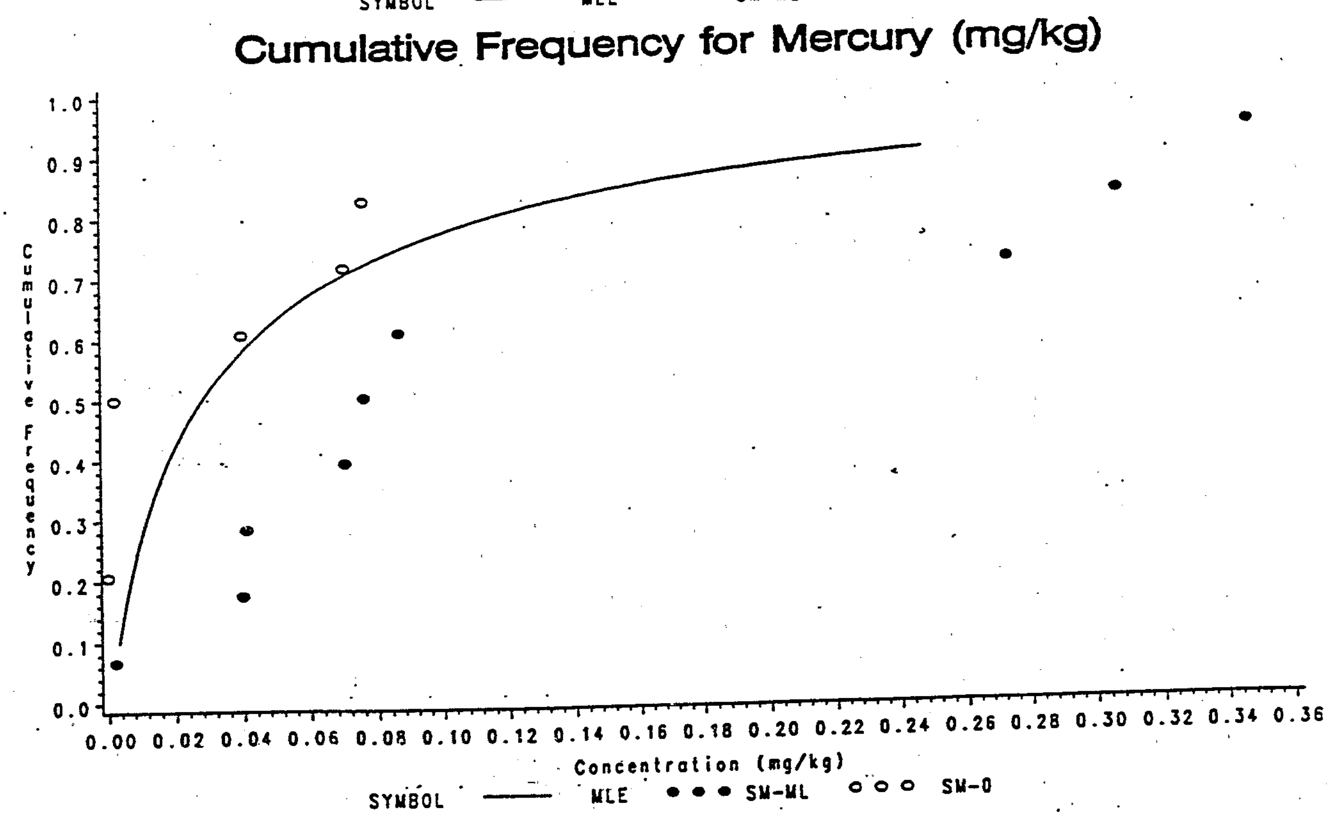
Cumulative Frequency for Lead (mg/kg)

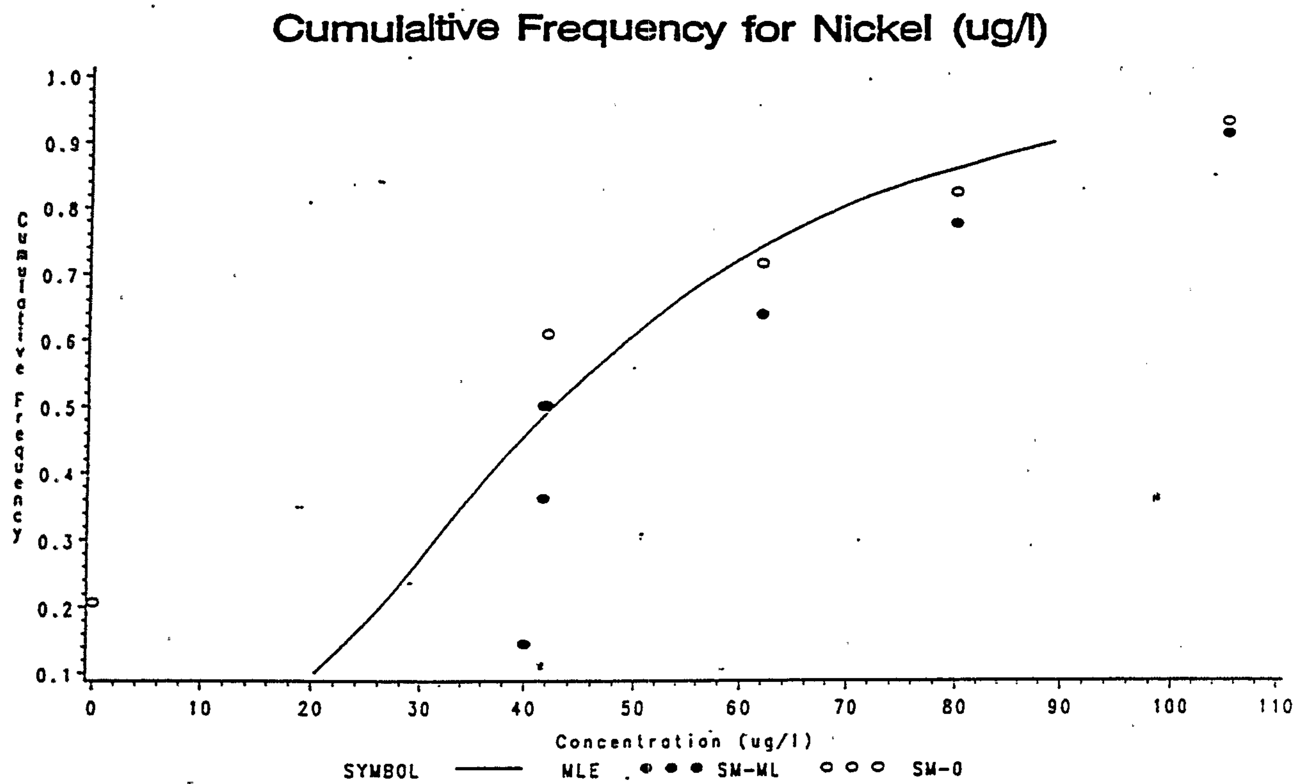


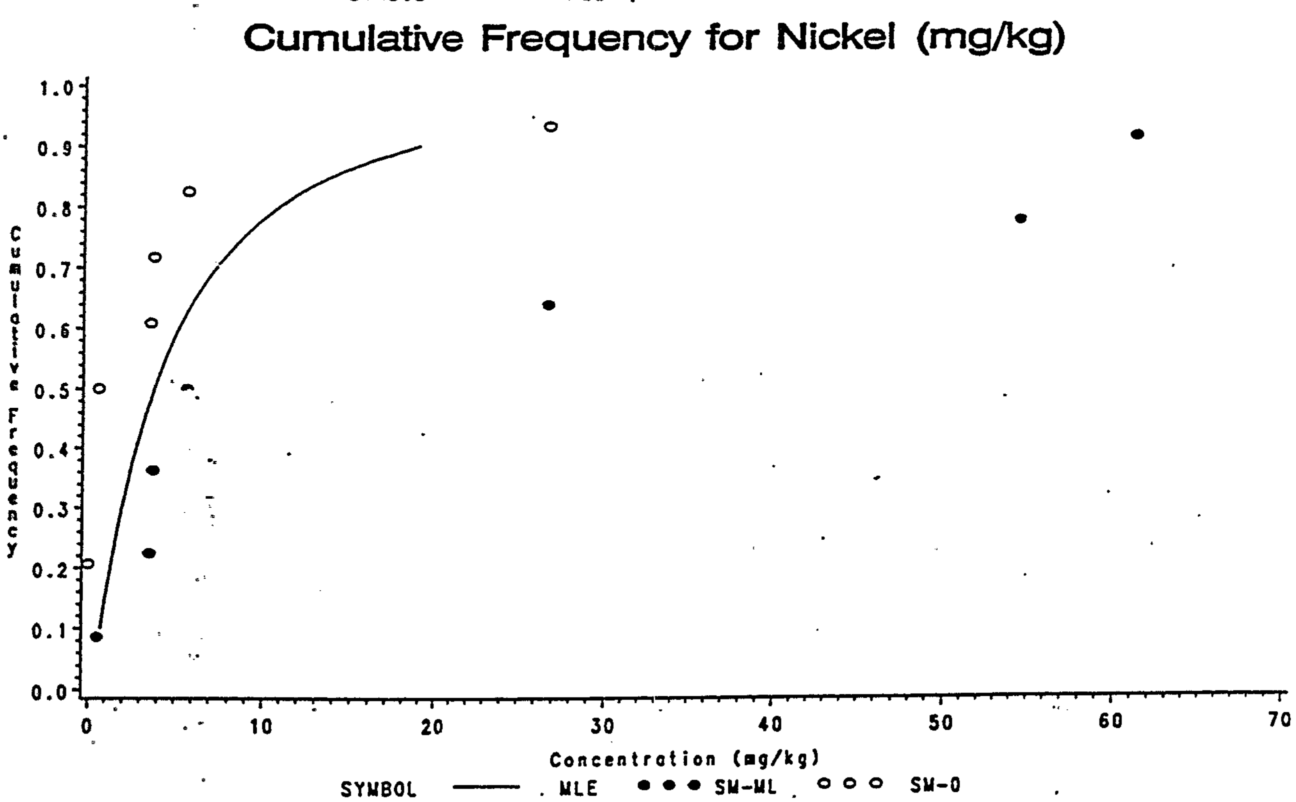

Cumulative Frequency for Lindane (Gamma-BHC) (ug/l)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20
0.22
0.24
0.26
Concentration (ug/l)
SYMBOL
MLE
SM-ML
SM-0


Cumulative Frequency for Lindane (Gamma-BHC) (ug/kg)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
100
200
300
Concentration (ug/kg)
SYMBOL
MLE
SM-ML
SM-0

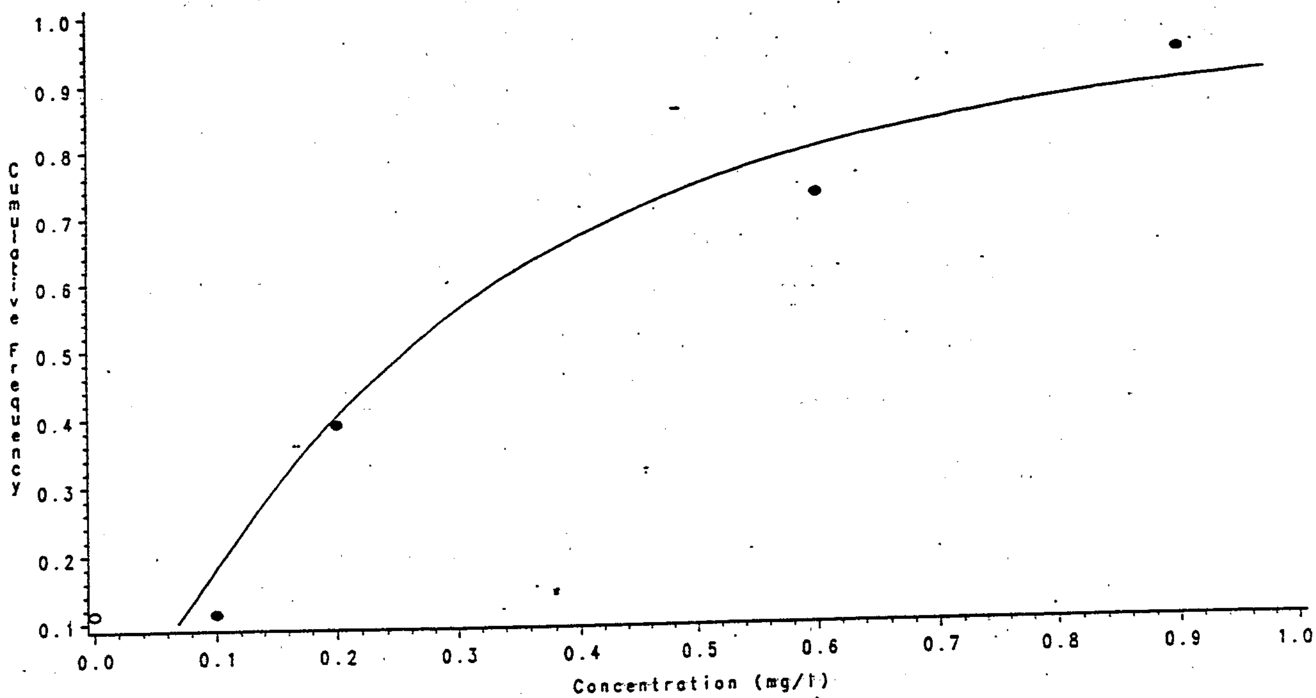

Cumulative Frequency for Mercury (ug/l)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
2
3
4
5
Concentration (ug/l)
SYMBOL
MLE
SM-ML
SM-0


Cumulative Frequency for Mercury (mg/kg)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.00 0.02 0.04 0.06 0.08 0.10 0.12 0.14 0.16 0.18 0.20 0.22 0.24 0.26 0.28 0.30 0.32 0.34 0.36
Concentration (mg/kg)
SYMBOL
MLE
SM-ML
SM-0


Cumulaltive Frequency for Nickel (ug/l)
Cumulative Frequency
Concentration (ug/l)
SYMBOL MLE SM-ML SM-0

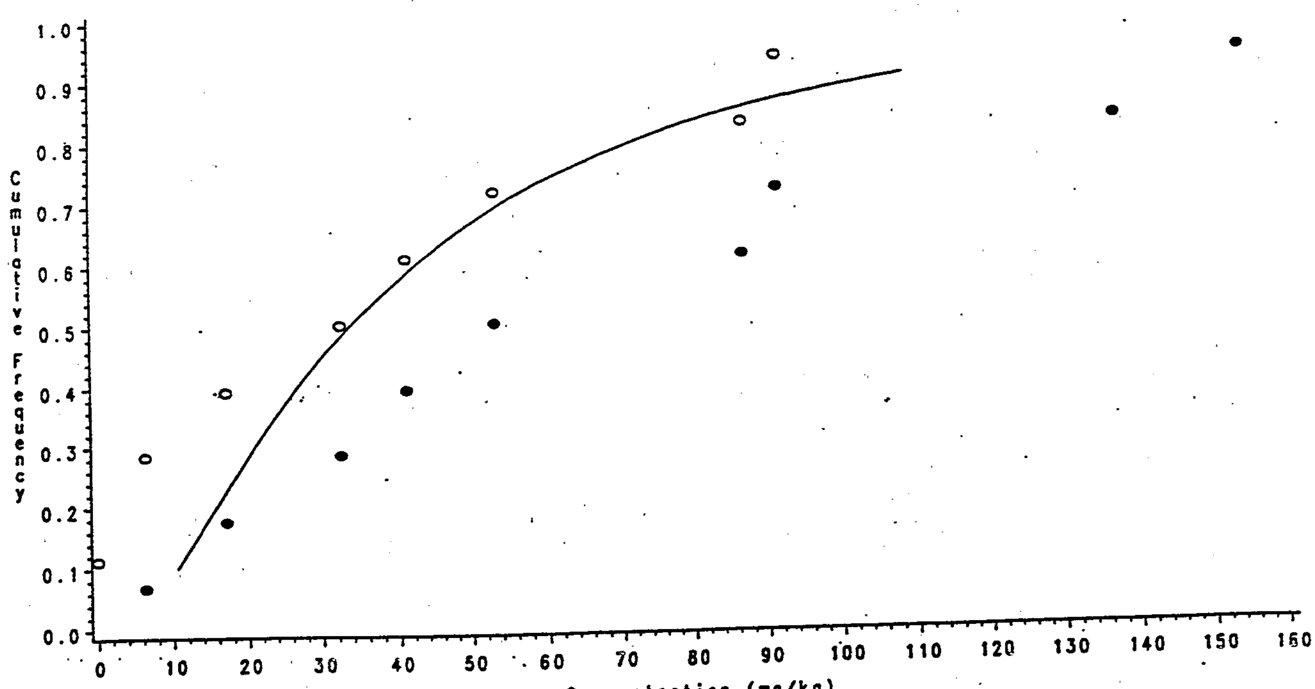

Cumulative Frequency for Nickel (mg/kg)
Cumulative Frequency
Concentration (mg/kg)
SYMBOL MLE SM-ML SM-0

Cumulative Frequency for Nitrate + Nitrite (mg/l)

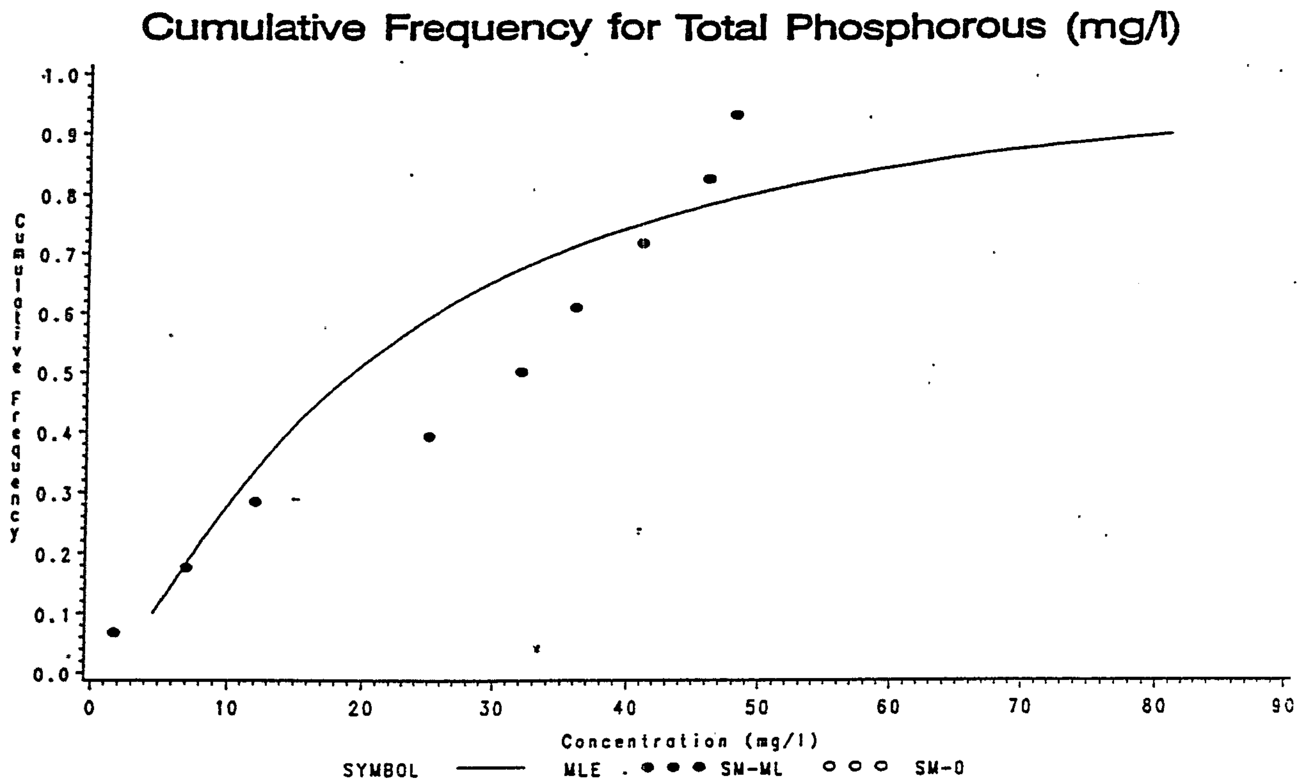


SYMBOL —— MLE ● ● ● SM-ML ○ ○ ○ SM-0

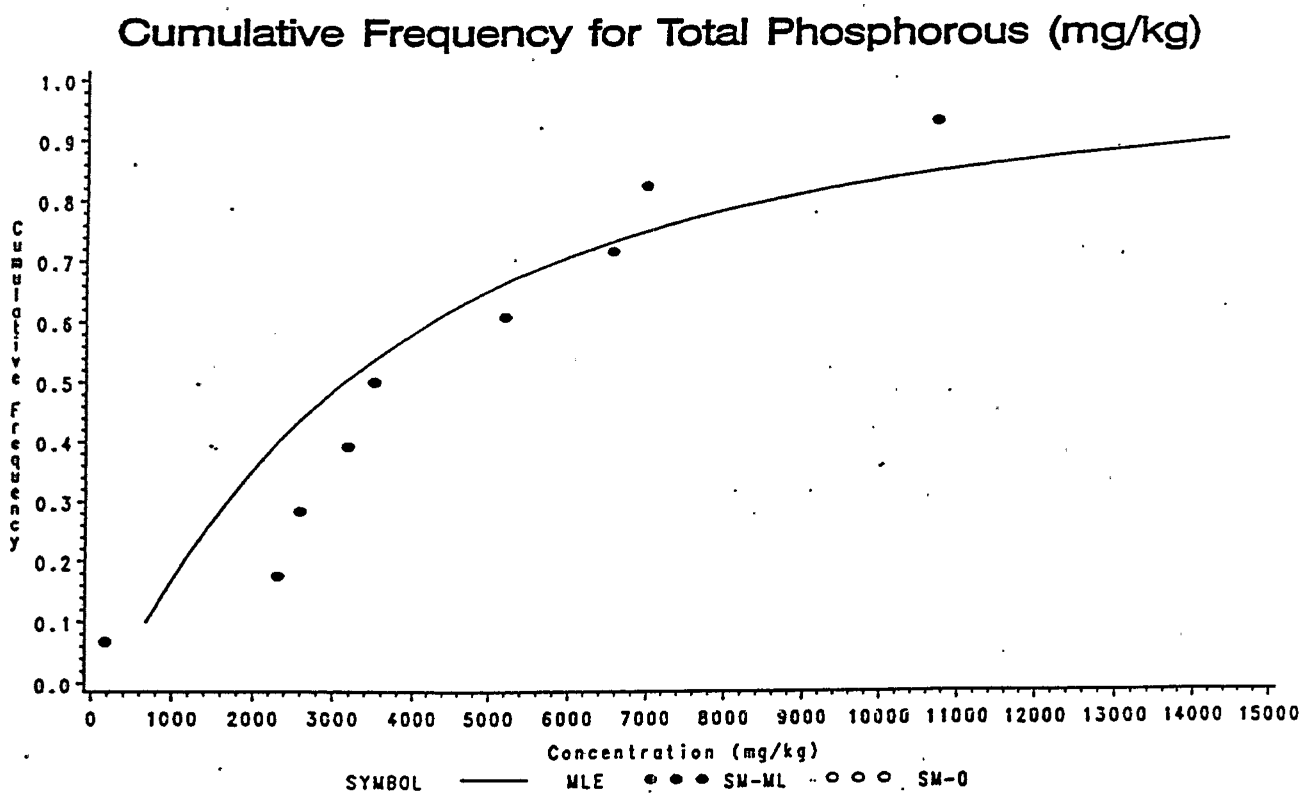
Cumulative Frequency for Nitrate + Nitrite (mg/kg)



SYMBOL —— MLE ● ● ● SM-ML ○ ○ ○ SM-0

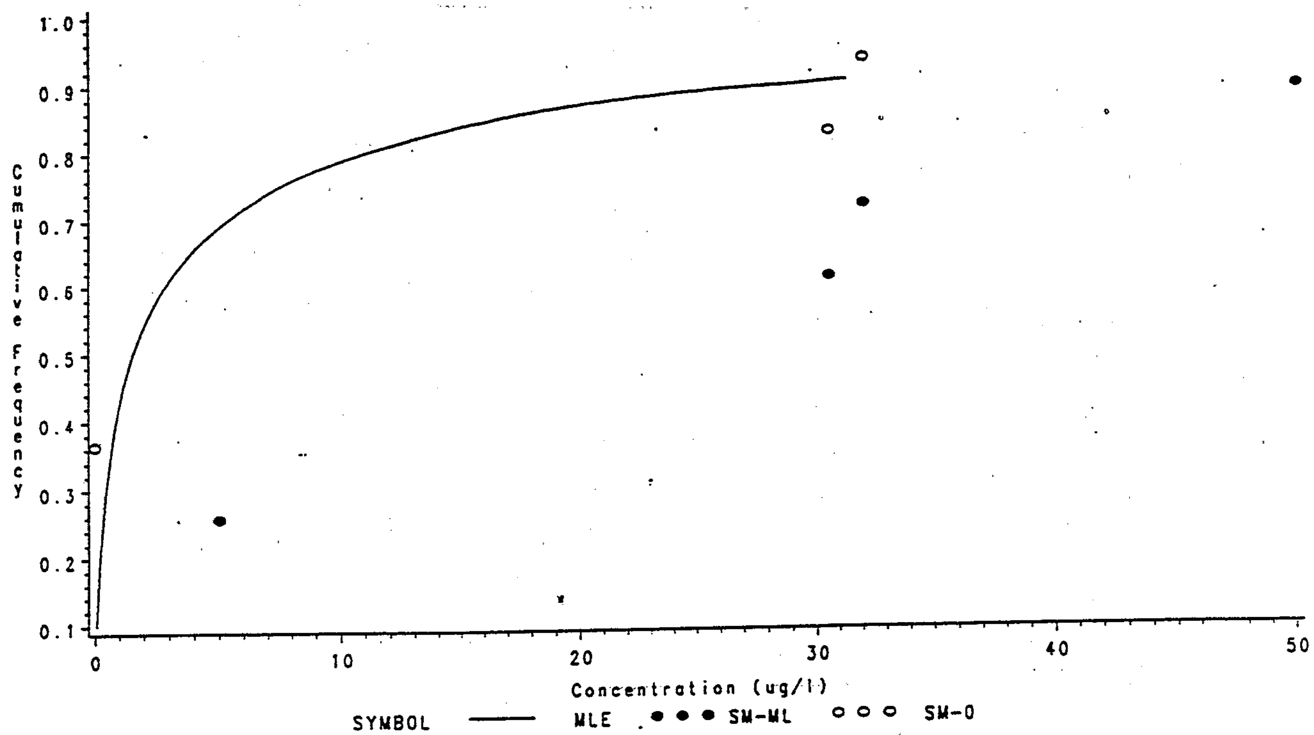


Cumulative Frequency for Total Phosphorous (mg/l)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
10
20
30
40
50
60
70
80
90
Concentration (mg/l)
SYMBOL
MLE
SM-ML
SM-0

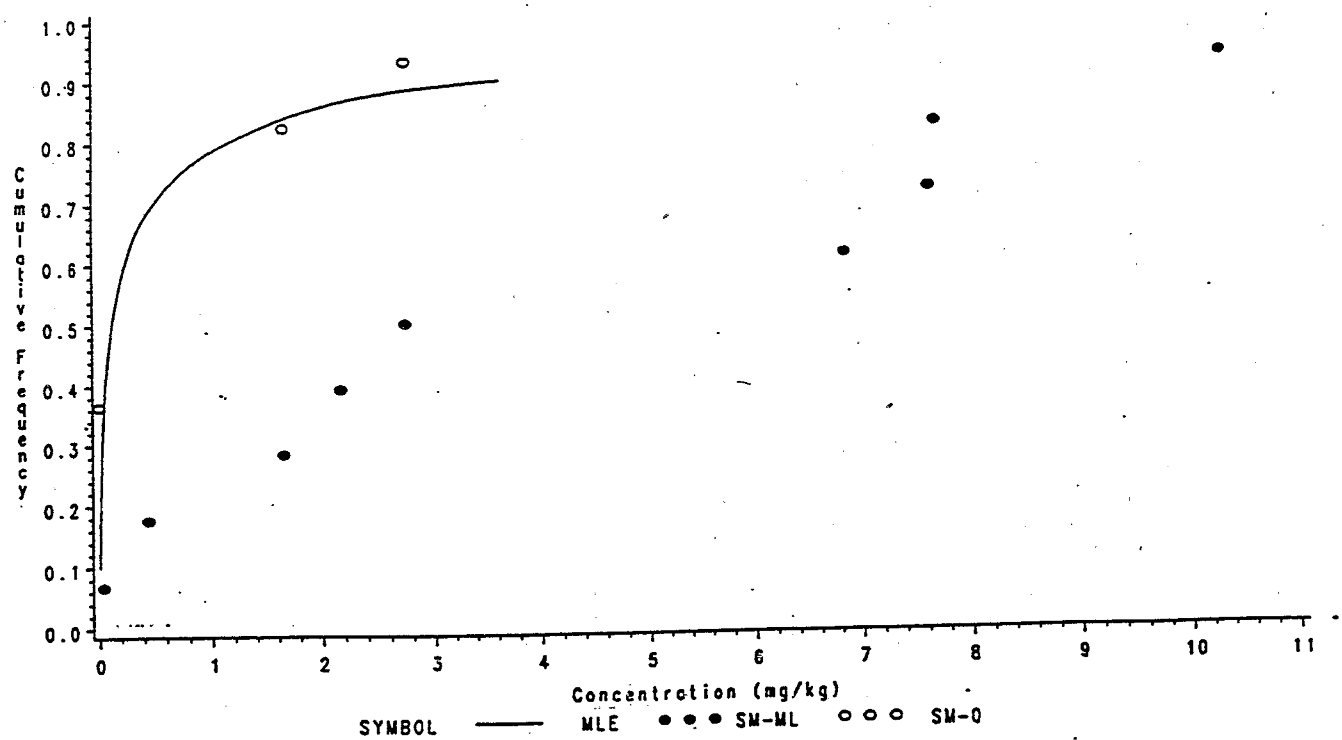


Cumulative Frequency for Total Phosphorous (mg/kg)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
15000
Concentration (mg/kg)
SYMBOL
MLE
SM-ML
SM-0

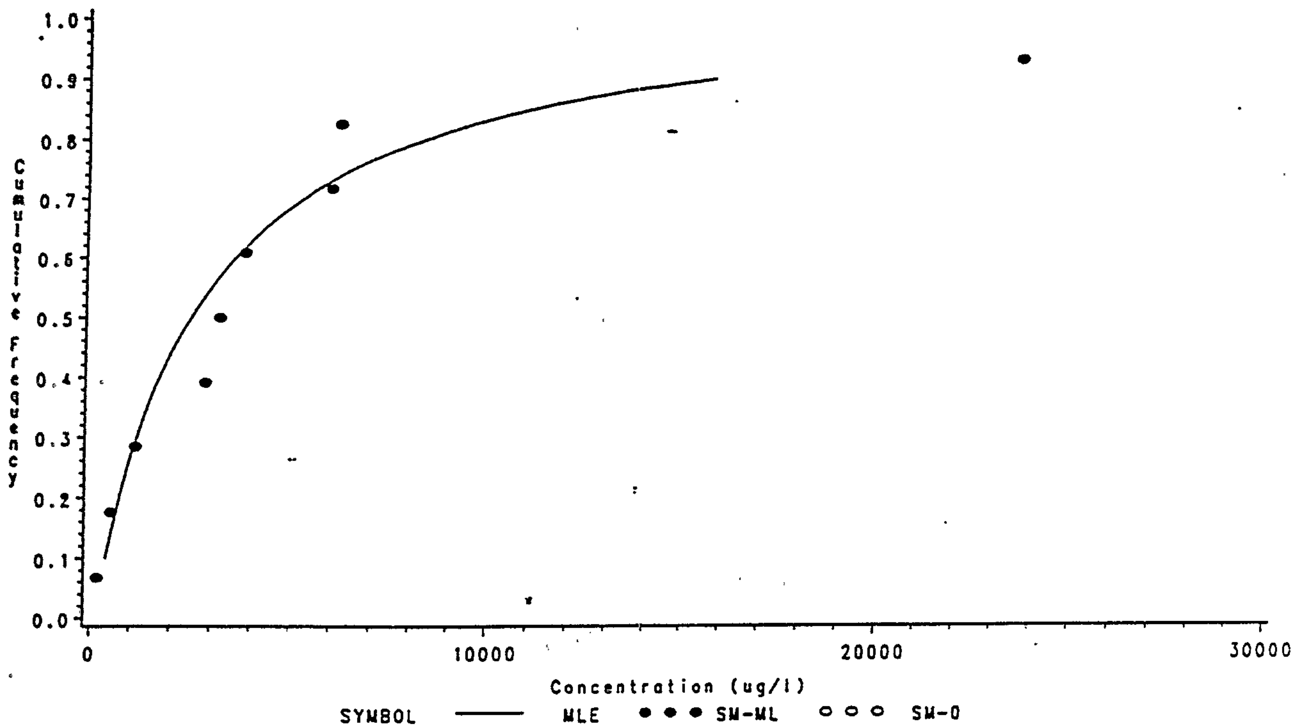
Cumulative Frequency for Selenium (ug/l)



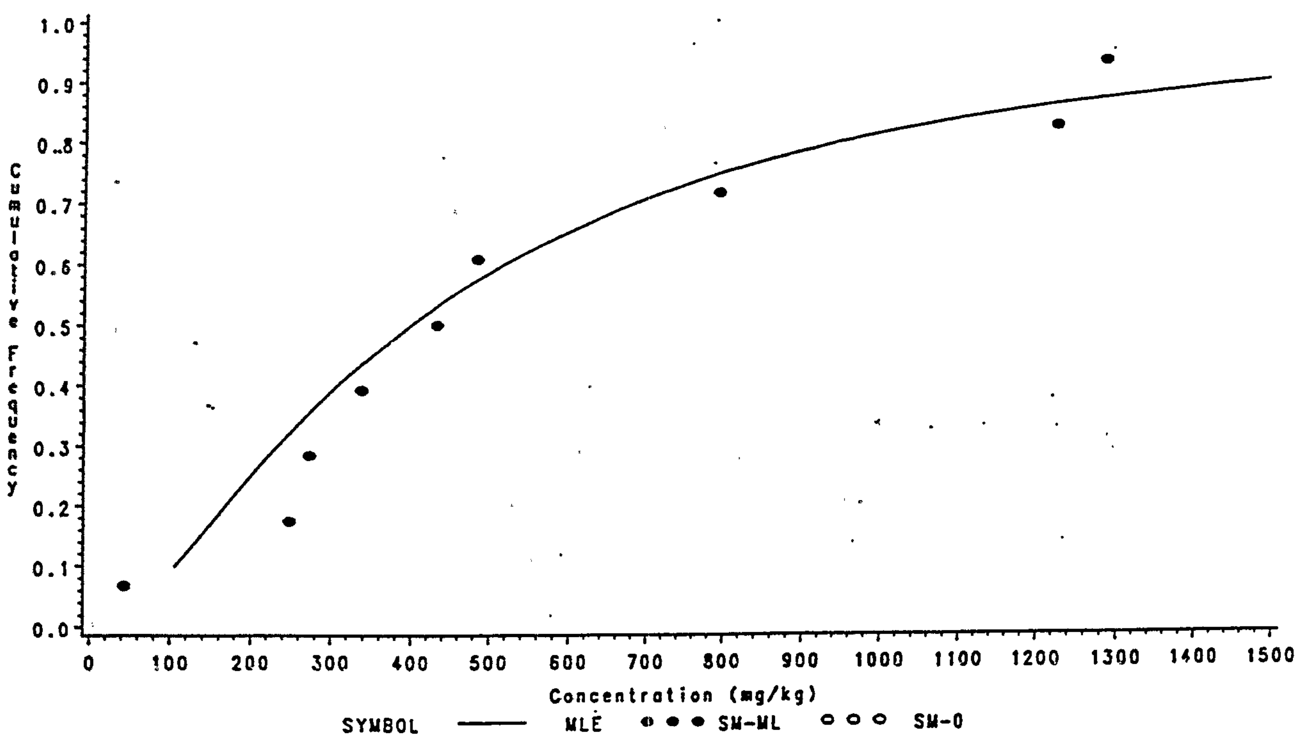
Cumulative Frequency for Selenium (mg/kg)



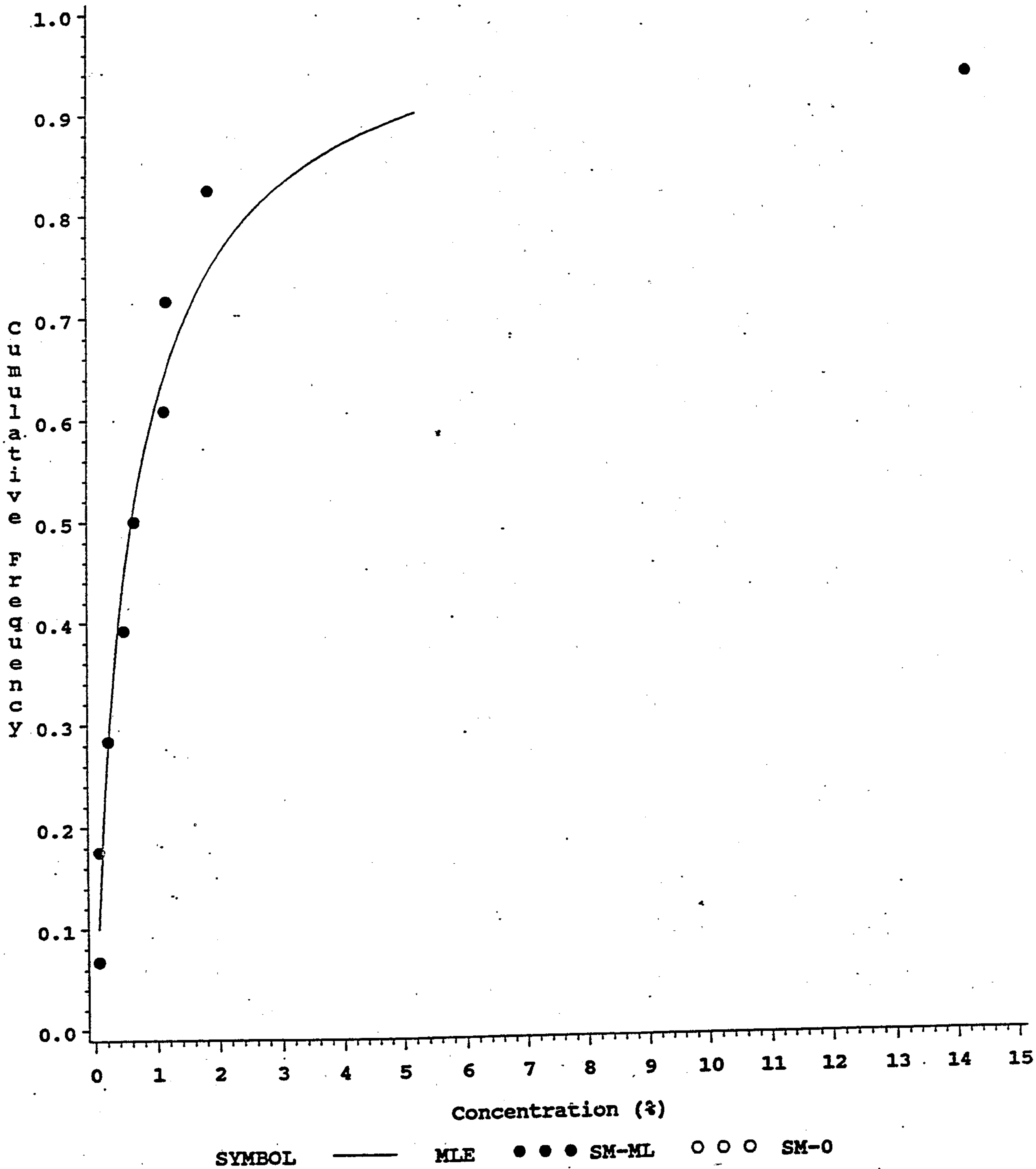
Cumulative Frequency for Zinc (ug/l)



Cumulative Frequency for Zinc (mg/kg)



Cumulative Frequency for Percent Solids (%)



Appendix C

Data Listing

Wet Weight Concentrations of Pollutants in Septage

---------------- Pollutant=ALDRIN/DIELDRIN(TOTAL) ----------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.100	UG/L
19975	.	0.100	UG/L
19976	.	0.100	UG/L
19977	2.50	.	UG/L
19978	0.75	.	UG/L
19979	.	0.184	UG/L
19980	.	0.100	UG/L
19981	.	0.100	UG/L
19982	.	0.100	UG/L

------------------- Pollutant=ALPHA-CHLORDANE -------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.100	UG/L
19975	.	0.100	UG/L
19976	.	0.100	UG/L
19977	.	0.100	UG/L
19978	.	0.100	UG/L
19979	.	0.184	UG/L
19980	.	0.100	UG/L
19981	.	0.100	UG/L
19982	.	0.100	UG/L

------------------- Pollutant=AMMONIA (AS N) -------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	45.00	.	MG/L
19975	0.48	.	MG/L
19976	40.00	.	MG/L
19977	11.00	.	MG/L
19978	45.00	.	MG/L
19979	33.00	.	MG/L
19980	56.00	.	MG/L
19981	54.00	.	MG/L
19982	100.00	.	MG/L

Wet Weight Concentrations of Pollutants in Septage

Pollutant=ARSENIC

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	20.000	UG/L
19975	.	20.000	UG/L
19976	.	20.000	UG/L
19977	.	20.000	UG/L
19978	.	20.000	UG/L
19979	.	20.000	UG/L
19980	.	20.000	UG/L
19981	.	20.000	UG/L
19982	.	20.000	UG/L

Pollutant=BENZENE

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

Pollutant=BENZO(A)PYRENE

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19975	.	10.000	UG/L
19976	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

Wet Weight Concentrations of Pollutants in Septage

---------------------- Pollutant=BERYLLIUM ----------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	5.000	UG/L
19975	.	5.000	UG/L
19976	.	5.000	UG/L
19977	.	5.000	UG/L
19978	.	5.000	UG/L
19979	.	5.000	UG/L
19980	.	5.000	UG/L
19981	.	5.000	UG/L
19982	.	5.000	UG/L

------------- Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE -------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19975	.	10.000	UG/L
19976	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

---------------------- Pollutant=CADMIUM ----------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	9.40	.	UG/L
19975	.	5.000	UG/L
19976	.	5.000	UG/L
19977	.	5.000	UG/L
19978	6.40	.	UG/L
19979	18.40	.	UG/L
19980	.	5.000	UG/L
19981	.	5.000	UG/L
19982	.	5.000	UG/L

Wet Weight Concentrations of Pollutants in Septage

---------------------- Pollutant=CHROMIUM ----------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	53.90	.	UG/L
19975	.	10.000	UG/L
19976	12.10	.	UG/L
19977	32.10	.	UG/L
19978	81.60	.	UG/L
19979	128.00	.	UG/L
19980	33.50	.	UG/L
19981	50.20	.	UG/L
19982	18.70	.	UG/L

---------------------- Pollutant=COPPER ----------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	1340.00	.	UG/L
19975	77.10	.	UG/L
19976	80.30	.	UG/L
19977	115.00	.	UG/L
19978	758.00	.	UG/L
19979	174.00	.	UG/L
19980	1850.00	.	UG/L
19981	62.00	.	UG/L
19982	69.60	.	UG/L

----------------- Pollutant=DDT,DDE,DDD(TOTAL) -----------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.338	UG/L
19975	.	0.338	UG/L
19976	.	0.338	UG/L
19977	.	0.338	UG/L
19978	.	0.338	UG/L
19979	0.92	.	UG/L
19980	2.88	.	UG/L
19981	.	0.338	UG/L
19982	.	0.338	UG/L

Wet Weight Concentrations of Pollutants in Septage

------------------- Pollutant=GAMMA-CHLORDANE -------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.113	UG/L
19975	.	0.113	UG/L
19976	.	0.113	UG/L
19977	.	0.113	UG/L
19978	.	0.113	UG/L
19979	.	0.207	UG/L
19980	.	0.113	UG/L
19981	.	0.113	UG/L
19982	.	0.113	UG/L

--------------------- Pollutant=HEPTACHLOR ---------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	0.25	.	UG/L
19975	.	0.063	UG/L
19976	.	0.063	UG/L
19977	.	0.063	UG/L
19978	.	0.063	UG/L
19979	.	0.115	UG/L
19980	.	0.063	UG/L
19981	.	0.063	UG/L
19982	.	0.063	UG/L

------------------ Pollutant=HEXACHLOROBENZENE ------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19975	.	10.000	UG/L
19976	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

Wet Weight Concentrations of Pollutants in Septage

Pollutant=HEXACHLOROBUTADIENE

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19975	.	10.000	UG/L
19976	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

Pollutant=LEAD

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	121.00	.	UG/L
19975	.	50.000	UG/L
19976	.	50.000	UG/L
19977	.	50.000	UG/L
19978	.	50.000	UG/L
19979	70.30	.	UG/L
19980	79.30	.	UG/L
19981	.	50.000	UG/L
19982	.	50.000	UG/L

Pollutant=LINDANE(GAMMA-BHC)

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.138	UG/L
19975	.	0.138	UG/L
19976	.	0.138	UG/L
19977	0.13	.	UG/L
19978	.	0.138	UG/L
19979	.	0.253	UG/L
19980	0.25	.	UG/L
19981	.	0.138	UG/L
19982	.	0.138	UG/L

Wet Weight Concentrations of Pollutants in Septage

---------------------- Pollutant=MERCURY ----------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.200	UG/L
19975	.	0.200	UG/L
19976	.	0.200	UG/L
19977	0.30	.	UG/L
19978	.	0.200	UG/L
19979	1.30	.	UG/L
19980	0.45	.	UG/L
19981	0.50	.	UG/L
19982	4.05	.	UG/L

-------------------- Pollutant=MOLYBDENUM --------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	14.40	.	UG/L
19975	.	10.000	UG/L
19976	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	10.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

--------------- Pollutant=N-NITROSODIMETHYLAMINE ---------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	50.000	UG/L
19975	.	50.000	UG/L
19976	.	50.000	UG/L
19977	.	50.000	UG/L
19978	.	50.000	UG/L
19979	.	100.000	UG/L
19980	.	50.000	UG/L
19981	.	50.000	UG/L
19982	.	50.000	UG/L

Wet Weight Concentrations of Pollutants in Septage

----------------------- Pollutant=NICKEL -----------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	40.000	UG/L
19975	.	40.000	UG/L
19976	.	40.000	UG/L
19977	79.80	.	UG/L
19978	61.80	.	UG/L
19979	105.00	.	UG/L
19980	41.90	.	UG/L
19981	.	40.000	UG/L
19982	41.60	.	UG/L

--------------- Pollutant=NITRATE+NITRITE (AS N) ---------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	0.20	.	MG/L
19975	.	0.100	MG/L
19976	.	0.100	MG/L
19977	0.90	.	MG/L
19978	0.20	.	MG/L
19979	0.60	.	MG/L
19980	0.60	.	MG/L
19981	0.60	.	MG/L
19982	0.20	.	MG/L

--------------------- Pollutant=PCB(TOTAL) ---------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	1.750	UG/L
19975	.	1.750	UG/L
19976	.	1.750	UG/L
19977	.	1.750	UG/L
19978	.	1.750	UG/L
19979	.	3.218	UG/L
19980	.	1.750	UG/L
19981	.	1.750	UG/L
19982	.	1.750	UG/L

Wet Weight Concentrations of Pollutants in Septage

--------------------- Pollutant=SELENIUM ---------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	50.000	UG/L
19975	.	5.000	UG/L
19976	.	5.000	UG/L
19977	.	5.000	UG/L
19978	.	5.000	UG/L
19979	30.50	.	UG/L
19980	.	5.000	UG/L
19981	.	50.000	UG/L
19982	32.00	.	UG/L

--------------- Pollutant=TOTAL KJELDAHL NITROGEN ---------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	142.00	.	MG/L
19975	9.00	.	MG/L
19976	55.00	.	MG/L
19977	31.00	.	MG/L
19978	70.00	.	MG/L
19979	119.00	.	MG/L
19980	115.00	.	MG/L
19981	175.00	.	MG/L
19982	152.00	.	MG/L

------------------ Pollutant=TOTAL PHOSPHOROUS ------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	32.00	.	MG/L
19975	1.70	.	MG/L
19976	7.00	.	MG/L
19977	25.00	.	MG/L
19978	12.00	.	MG/L
19979	48.00	.	MG/L
19980	36.00	.	MG/L
19981	46.00	.	MG/L
19982	41.00	.	MG/L

Wet Weight Concentrations of Pollutants in Septage

------------------------- Pollutant=ZINC -------------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	5990.00	.	UG/L
19975	182.00	.	UG/L
19976	519.00	.	UG/L
19977	6210.00	.	UG/L
19978	1120.00	.	UG/L
19979	23800.00	.	UG/L
19980	3810.00	.	UG/L
19981	2850.00	.	UG/L
19982	3190.00	.	UG/L

Wet Weight Concentrations of Pollutants in Septage

-------------------- Pollutant=TOTAL SOLIDS --------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	4880.00	.	MG/L
19975	733.00	.	MG/L
19976	653.00	.	MG/L
19977	142000.00	.	MG/L
19978	2310.00	.	MG/L
19979	18500.00	.	MG/L
19980	11300.00	.	MG/L
19981	6580.00	.	MG/L
19982	11700.00	.	MG/L

-------------------- Pollutant=TOXAPHENE --------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	11.375	UG/L
19975	.	11.375	UG/L
19976	.	0.910	UG/L
19977	.	11.375	UG/L
19978	.	11.375	UG/L
19979	.	20.920	UG/L
19980	.	11.375	UG/L
19981	.	11.735	UG/L
19982	.	11.375	UG/L

-------------------- Pollutant=TRICHLOROETHENE --------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

APPENDIX C

Plant Uptake Tables

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TABLE C-1

UPTAKE OF ARSENIC BY FORAGE

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Natural Forage	Sludge	N.R.	0	<0.25	0.001	*Baxter et al., 1983*
				3.03	<0.25		
A	Rape	Sludge	N.R.(3)	0	0.37	0.9	*Anderson & Nilsson, 1972, p.176*
				0.4	0.73		

TABLE C-2

UPTAKE OF ARSENIC BY GARDEN FRUITS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
C	Tomato/Fruit	Lead arsenate	7.5	6.2 62	0.1 0.1	0.001	*Elfving et al., 1978, p.96.*
C	Broccoli/Fruit	Arsenic acid	N.R.	200	0.4	0.002	*Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.*
C	Tomato/Fruit	Arsenic acid	N.R.	200	0.11	0.001	*Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.*
C	Pea/Grain	Arsenic	N.R.	0 300	0.01 0.18	0.001	*Walsh et al, 1977.*
C	Pea/Pod	Arsenic	N.R.	0 300	0.05 0.88	0.003	*Walsh et al, 1977.*

TABLE C-3

UPTAKE OF ARSENIC BY GRAINS AND CEREALS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
C	Millet	Lead arsenate	7.5	6.2 62	0.2 0.9	0.013	*Elfving et al., 1978, p.96.*

TABLE C-4

UPTAKE OF ARSENIC BY LEAFY VEGETABLES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Swiss Chard	Sludge	5.5	0 1.47	0.16 0.66	0.340	*Furr et al., 1976, p. 87.*
A	Swiss Chard	Sludge	6.5	0 1.47	0.63 0.16	0.001	*Furr et al., 1976, p. 87.*
C	Swiss Chard	Lead arsenate	N.R.	18.8 107.2	0.001 0.37	0.004	*Chisholm, 1972, p. 586.*
C	Cabbage	Lead arsenate	7.5	6.2 62	0.1 0.1	0.001	*Elfving et al., 1978, p.96.*
C	Cabbage	Arsenic acid	N.R.	200	<0.01	0.001	*Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.*
C	Swiss Chard	Arsenic acid	N.R.	200	1	0.005	*Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.*
C	Lettuce	Arsenic acid	N.R.	200	0.55	0.003	*Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.*

TABLE C-5

UPTAKE OF ARSENIC BY LEGUMES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	*Reference/ Comments*
C	Green Bean/ Grain	Lead arsenate	N.R.	49 245	0.05 0.22	0.001	*Chisholm, 1972, p. 586.*
C	Green Bean/ Grain	Lead arsenate	N.R.	49 245	0.08 0.17	0.001	*Chisholm, 1972, p. 586.*
C	Green Bean/ Grain	Lead arsenate	N.R.	18.8 107.2	0.001 0.06	0.001	*Chisholm, 1972, p. 586.*
C	Bush Bean/ Grain	Lead arsenate	7.5	6.2 62	0.1 0.1	0.001	*Elfving et al., 1978, p.96.*
C	Green Bean/ Grain	Arsenic acid	N.R.	200	0.14	0.001	*Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.*
C	Bean/Grain	Arsenic	N.R.	0 300	0.01 0.07	0.001	*Walsh et al, 1977.*
C	Bean/Pod	Arsenic	N.R.	0 300	0.27 0.79	0.002	*Walsh et al, 1977.*

TABLE C-6

UPTAKE OF ARSENIC BY POTATOES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
C	Potato/Tuber	Lead arsenate	N.R.	49 245	0.05 0.11	0.001	*Chisholm, 1972, p. 586.*
C	Potato/Peel	Lead arsenate	N.R.	49 245	0.08 0.56	0.002	*Chisholm, 1972, p. 586.*
C	Potato/Tuber	Lead arsenate	N.R.	18.8 107.2	0.001 0.09	0.001	*Chisholm, 1972, p. 586.*
C	Potato/Peel	Lead arsenate	N.R.	18.8 107.2	0.001 1.1	0.012	*Chisholm, 1972, p. 586.*
C	Potato/Tuber	Lead arsenate	7.5	6.2 62	0.1 0.1	0.001	*Elfving et al., 1978, p.96.*
C	Potato/Tuber	Arsenic acid	N.R.	200	1.19	0.006	*Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.*
C	Potato/Tuber	Sodium arsenate	5.5	0 45 90 180 720	0.1 0.1 0.002 0.002 0.005	0.001	*Stevens et al, 1972. Soil treated with Fe(SO(4))(3).*
C	Potato/Tuber	Sodium arsenate	5.5	0 45 90 180 720	0.1 0.1 0.1 0.4 0.006	0.001	*Stevens et al, 1972. Soil treated with Al(2)(SO(4))(3).*

TABLE C-7

UPTAKE OF ARSENIC BY ROOTS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
C	Carrot/Tuber	Lead arsenate	N.R.	49 245	0.05 0.27	0.001	*Chisholm, 1972, p. 586.*
C	Carrot/Tuber	Lead arsenate	N.R.	18.8 107.2	0.001 0.26	0.003	*Chisholm, 1972, p. 586.*
C	Turnip/Tuber	Lead arsenate	N.R.	18.8 107.2	0.001 0.1	0.001	*Chisholm, 1972, p. 586.*
C	Turnip/Peel	Lead arsenate	N.R.	18.8 107.2	0.001 1.08	0.012	*Chisholm, 1972, p. 586.*
C	Carrot/Tuber	Lead arsenate	7.5	6.2 62	0.1 0.9	0.014	*Elfving et al., 1978, p.96.*
C	Onions/Bulb	Lead arsenate	7.5	6.2 62	0.1 0.4	0.005	*Elfving et al., 1978, p.96.*
C	Beet/Tuber	Arsenic acid	N.R.	200	0.86	0.004	*Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.*

TABLE C-8

UPTAKE OF ARSENIC BY SWEET CORN

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	*Reference/ Comments*
C	Corn/Grain	Lead arsenate	N.R.	49 245	0.05 0.07	0.001	*Chisholm, 1972, p. 586.*
C	Corn/Grain	Lead arsenate	N.R.	18.8 107.2	0.001 0.04	0.001	*Chisholm, 1972, p. 586.*
C	Sweet Corn/ Grain	Arsenic acid	N.R.	200	<0.01	0.001	*Pyles & Woolson, 1982. No control data given for soil or plant tissue. Slope calculated without controls.*

TABLE C-9

UPTAKE OF CADMIUM BY FORAGE

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Natural Forage	Sludge	N.R.	0.78	0.11	1.702	*Baxter et al., 1983*
				1.35	1.08		*Means reported*
A	Pea/Vine	Sludge	5.3	0	0.02	0.049	*Dowdy & Larson,*
				0.83	0.13		*1975.*
				1.66	0.16		
				3.32	0.2		
A	Corn/Leaf	Sludge	5.3	0.000	0.026	0.339	*Dowdy & Larson,*
				0.830	0.027		*1975.*
				1.660	0.61		
				3.320	1.32		
A	Corn/Forage	Sludge	5.4	0	1	1.330	*Giordano, Mortvedt,*
				0.008	2.3		*Mays, 1975, p. 394.*
				1.6	3.3		*1972 data used.*
				3.2	5.3		
A	Corn	Sludge	5.4	0	1	0.255	*Giordano, Mortvedt,*
				2.5	3.7		*Mays, 1975, p. 394.*
				5	3.5		*1972 data used.*
				10	4.1		
A	Bean/Vine	Compost	5.4	0	0.5	0.001	*Giordano, Mortvedt,*
				0.8	0.5		*Mays, 1975, p. 394.*
				1.6	0.5		*1972 data used.*
				3.2	0.5		
A	Bean/Vine	Compost	5.4	0	0.5	0.059	*Giordano, Mortvedt,*
				2.5	1.1		*Mays, 1975, p. 394.*
				5	1.2		*1972 data used.*
				10	1.2		
A	Corn	Compost	5.4	0	1.1	0.688	*Giordano, Mortvedt,*
				1.6	3		*Mays, 1975, p. 394.*
				3.2	3.9		*1973 data used.*
				6.4	5.7		
A	Corn	Sludge	5.4	0	1.1	0.299	*Giordano, Mortvedt,*
				5	5.9		*Mays, 1975, p. 394.*
				10	6.6		*1973 data used.*
				20	7.9		
A	Bean/Vine	Compost	5.4	0	0.3	0.130	*Giordano, Mortvedt,*
				1.6	0.4		*Mays, 1975, p. 394.*
				3.2	0.4		*1973 data used.*
				6.4	0.4		

TABLE C-9 (cont.)

UPTAKE OF CADMIUM BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Bean/Vine	Sludge	5.4	0	0.3	0.042	*Giordano, Mortvedt, Mays, 1975, p. 394. 1973 data used.*
				5	1.1		
				10	1.1		
				20	1.3		
A	Corn/Leaf	Sludge	5.2-5.6 Limed	0	0.83	2.510	*Pepper et al, 1983, p. 272 Sultan-corn type.*
				0.75	3.68		
				1.5	6.73		
				3	8.45		
A	Corn/Leaf	Sludge	4.5-4.6 Limed	0	1.01	2.276	*Pepper et al, 1983, p. 272 Sultan-corn type.*
				0.75	5.11		
				1.5	7.45		
				3	8.3		
A	Corn/Leaf	Sludge	5.1-5.6 Limed	0	0.2	1.651	*Pepper et al, 1983, p. 272. Puyallup-corn type.*
				0.75	0.66		
				1.5	2.08		
				3	4.96		
A	Corn/Leaf	Sludge	4.4-4.6 Unlimed	0	0.2	0.926	*Pepper et al, 1983, p. 272. Puyallup-corn type.*
				0.75	1.2		
				1.5	1.5		
				3	3.09		
A	Corn	Sludge	7.0	0	0.05	0.077	*Heffron et al, 1980, p. 59.*
				21.56	1.7		
A	Corn	Sludge	5.4	0	0.29	0.142	*Telford et al, 1982.*
				25.3	3.88		
A	Corn/Grain	Sludge	5.9-6.0	0	0.01	0.001	*Rapppaport et al, 1987. 1984 data used.*
				0.9	0.01		
				1.8	0.01		
A	Corn	Sludge	5.9-6.0	0	0.03	0.022	*Rapppaport et al, 1987. 1984 data used.*
				0.9	0.13		
				1.8	0.07		
A	Barley	Sludge	5.9-6.0	0	0.12	0.110	*Rapppaport et al, 1987. 1984 data used.*
				0.9	0.13		
				1.8	0.14		
A	Sweet Corn/ Leaf	Sludge	6.5	0	0.28	0.139	*Hemphill et al, 1982. Portland sludge*
				1.5	0.49		
A	Sweet Corn/ Leaf	Sludge	6.5	0	0.28	0.001	*Hemphill et al, 1982. Rockcreek sludge.*
				1.5	0.22		

TABLE C-9 (cont.)

UPTAKE OF CADMIUM BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Sweet Corn/ Leaf	Sludge	6.5	0 0.21	0.28 0.24	0.001	*Hemphill et al, 1982. Salem sludge.*
A	Ryegrass	Liquid sludge	6.5	0.6 4.52	0.11 0.3	0.048	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Ryegrass	Bed-dried Sludge	6.5	0.6 12.57	0.11 0.28	0.014	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Ryegrass	Liquid sludge	6.7	1.4 6.7	0.19 0.48	0.055	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Ryegrass	Bed-dried Sludge	6.7	1.4 15.12	0.17 0.48	0.023	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Ryegrass	Liquid sludge	8.0	1.44 5.86	0.04 0.13	0.020	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Ryegrass	Bed-dried Sludge	8.0	1.5 22.12	0.05 0.35	0.015	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Barley/Leaf	Sludge	6.2-6.4	0 23	0.67 0.76	0.004	*Sommers et al, 1991. Ohio data used.*

TABLE C-10

UPTAKE OF CADMIUM BY GARDEN FRUITS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Cantaloupe/ Fruit	Sludge	4.6-6.0	0 11	18 25	0.636	*Giordano et al., 1979 Year 3 (1977) No heat, no lime*
A	Broccoli/ Fruit	Sludge	4.7-6.2	0 11	0.27 0.89	0.056	*Giordano et al., 1979 Year 2 (1976) No heat*
A	Eggplant/ Fruit	Sludge	4.7-6.2	0 11	0.54 1.64	0.100	*Giordano et al., 1979 Year 2 (1976) No heat*
A	Tomato/ Fruit	Sludge	4.7-6.2	0 11	0.52 1.04	0.047	*Giordano et al., 1979 Year 2 (1976) No heat*
A	Pepper/ Fruit	Sludge	4.7-6.2	0	29	0.364	*Giordano et al., 1979 Year 3 (1977) No heat, no lime*
A	Squash/ Fruit	Sludge	5.1-6.0	0 11	0.15 0.27	0.011	*Giordano et al., 1979 Year 1 (1979) No heat. Yellow Crookneck squash*
A	Pepper/ Fruit	Sludge	5.1-6.0	0 11	0.3 1.3	0.091	*Giordano et al., 1979 Year 1 (1979) No heat. California Wonder Variety*
A	Pea/Grain	Sludge	5.3	0 0.83 1.66 3.32	0.03 0.04 0.04 0.04	0.002	*Dowdy & Larson, 1975.*
A	Tomato/Fruit	Sludge	5.3	0 0.83 1.66 3.32	0.08 0.2 0.33 0.33	0.074	*Dowdy & Larson, 1975.*
A	Pea/Pod	Sludge	5.3	0.000 0.830 1.660 3.320	0.020 0.080 0.080 0.060	0.008	*Dowdy & Larson, 1975.*
A	Tomato/Fruit	Sludge	6.6	0 0.7 1.4	0.39 0.55 0.5	0.079	*Keefer et al, 1986. Blue Plains sludge. Early fruiting.*

TABLE C-10 (cont.)

UPTAKE OF CADMIUM BY GARDEN FRUITS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Tomato/Fruit	Sludge	6.6	0 0.7 1.4	0.32 0.4 0.4	0.057	*Keefer et al, 1986. Blue Plains sludge. Late fruiting.*
A	Tomato/Fruit	Sludge	7.1	0 3.1 6.2	0.39 0.75 0.5	0.018	*Keefer et al, 1986. Huntington sludge. Early fruiting.*
A	Tomato/Fruit	Sludge	7.1	0 3.1 6.2	0.32 0.4 0.5	0.029	*Keefer et al, 1986. Huntington sludge. Late fruiting.*
A	Tomato/Fruit	Sludge	6.9	0 0.7 1.4	0.39 0.4 0.55	0.114	*Keefer et al, 1986. Martinsburg sludge. Early fruiting.*
A	Tomato/Fruit	Sludge	6.9	0 0.7 1.4	0.32 0.45 0.43	0.079	*Keefer et al, 1986. Martinsburg sludge. Late fruiting.*
A	Tomato/Fruit	Sludge	6.3	0 0.4 0.8	0.39 0.45 0.65	0.325	*Keefer et al, 1986. Parkersburg sludge.*
A	Tomato/Fruit	Sludge	6.3	0 0.4 0.8	0.32 0.43 0.26	0.001	*Keefer et al, 1986. Parkersburg sludge.*
A	Tomato/Fruit	Sludge	N.R.	0 4 8 16 20	0.9 1.3 1.5 1.9 2	0.053	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*

TABLE C-11

UPTAKE OF CADMIUM BY GRAINS/CEREALS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Wheat/Grain	Sludge	N.R.(3)	0 1.5 6	0.066 0.159 0.19	0.017	*Sabey & Hart, 1975.*
A	Corn/Grain	Sludge	4.9-6.5	0 38.6	0.010 0.170	0.004	*Lisk et al, 1982.*
A	Corn/Grain	Sludge	5.2-5.6	0 0.75 1.5 3	0.27 0.41 0.6 0.41	0.045	*Pepper et al, 1983, p. 272 Sultan-corn type.*
A	Corn/Grain	Sludge	4.5-4.6	0 0.75 1.5 3	0.29 0.5 0.5 0.61	0.094	*Pepper et al, 1983, p. 272 Sultan-corn type.*
A	Corn/Grain	Sludge	5.1-5.6	0 0.75 1.5 3	0.12 0.27 0.43 0.64	0.173	*Pepper et al, 1983, p. 272. Puyallup-corn type.*
A	Corn/Grain	Sludge	4.4-4.6	0 0.75 1.5 3	0.16 0.2 0.39 0.37	0.076	*Pepper et al, 1983, p. 272. Puyallup-corn type.*
A	Corn/Earleaf	Sludge	5.9-6.0	0 0.9 1.8	0.07 0.07 0.06	0.001	*Rapppaport et al, 1987. 1984 data used.*
A	Wheat/Grain	Liquid sludge	6.5	0.6 4.52	0.13 0.29	0.041	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Wheat/Grain	Bed-dried Sludge	6.5	0.6 12.57	0.14 0.33	0.016	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Wheat/Grain	Liquid sludge	6.7	1.4 6.7	0.26 0.52	0.049	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Wheat/Grain	Bed-dried Sludge	6.7	1.4 15.12	0.26 0.55	0.021	*Carlton Smith, 1988. Means of 4 years used. Clay.*

TABLE C-11 (cont.)

UPTAKE OF CADMIUM BY GRAINS/CEREALS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	*Reference/ Comments*
A	Wheat/Grain	Liquid sludge	8.0	1.44 5.86	0.052 0.15	0.022	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Wheat/Grain	Bed-dried Sludge	8.0	1.5 22.12	0.08 0.27	0.009	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Barley/Grain	Sludge	6.2-6.4	0 23	0.04 0.05	0.001	*Sommers et al, 1991. Ohio data used.*

TABLE C-12

UPTAKE OF CADMIUM BY LEAFY VEGETABLES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Kale	Sludge	8.4	5.49	1.669	0.304	*Giordano & Mays, 1977 Year 1 Decatur sludge*
A	Kale	Sludge	8.4	3.92	0.004	0.001	*Giordano & Mays, 1977 Year 1 Tuscumbia sludge*
A	Lettuce	Sludge	8.4	5.49	7.576	1.380	*Giordano & Mays, 1977 Year 1 Decatur sludge*
A	Lettuce	Sludge	8.4	3.92	2.391	0.610	*Giordano & Mays, 1977 Year 1 Tuscumbia sludge*
A	Spinach	Sludge	8.4	5.49	1.801	0.328	*Giordano & Mays, 1977 Year 1 Decatur sludge*
A	Spinach	Sludge	8.4	3.92	0.004	0.001	*Giordano & Mays, 1977 Year 1 Tuscumbia sludge*
A	Lettuce	Sludge	8.4	5.49	5.929	1.080	*Giordano & Mays, 1977 Year 1 Decatur sludge*
A	Lettuce	Sludge	8.4	3.92	1.439	0.367	*Giordano & Mays, 1977 Year 1 Tuscumbia sludge*
A	Lettuce	Sludge	5.6	1.26	0.5544	0.440	*Schauereta, 1980 Year 1 Warwick sludge*
A	Lettuce	Sludge	5.6	1.26	2.457	1.950	*Schauereta, 1980 Year 1 Warwick sludge*
A	Swiss Chard	Sludge	5.7	0.84	1.000	1.190	*Chaney et al., 1978b Backriver sludge*
A	Swiss Chard	Sludge	5.6	2.24	2.200	0.982	*Chaney et al., 1978b Blue Plains sludge*
A	Swiss Chard	Digcompost	6.6	1.5	0.900	0.600	*Chaney et al., 1978b*
A	Swiss Chard	Dried DC	5.5	3.3	23.298	7.060	*Chaney et al., 1978c*

TABLE C-12 (cont.)

UPTAKE OF CADMIUM BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Swiss Chard	Sludge	4.9	0.76	0.897	1.180	*Chaney & Hornick, 1978 CAST 1980 City 4 sludge*
A	Swiss Chard	Sludge	6.0	0.78	0.095	0.122	*Chaney & Hornick, 1978 CAST 1980 City 4L sludge*
A	Swiss Chard	Sludge	4.9	1.48	0.049	0.033	*Chaney & Hornick, 1978 CAST 1980 City 9 Sludge*
A	Swiss Chard	Sludge	6.3	1.95	0.630	0.323	*Chaney & Hornick, 1978 CAST 1980 City 9L sludge*
A	Swiss Chard	Sludge	5.5	9.00	25.830	2.870	*Chaney & Hornick, 1978 CAST 1980 City 13 sludge*
A	Swiss Chard	Sludge	6.2	6.92	2.484	0.359	*Chaney & Hornick, 1978 CAST 1980 City 13L sludge*
A	Swiss Chard	Sludge	5.5	3.19	4.530	1.420	*Chaney & Hornick, 1978 CAST 1980 City 1 sludge*
A	Swiss Chard	Sludge	6.2	4.43	1.675	0.378	*Chaney & Hornick, 1978 CAST 1980 City 1L sludge*
A	Swiss Chard	Sludge	6.6	2.47	0.785	0.318	*Chaney & Hornick, 1978 CAST 1980 City 1H sludge*
A	Swiss Chard	Sludge	5.9	0.32	0.115	0.359	*Chaney & Hornick, 1978 CAST 1980 City 19H sludge*
A	Swiss Chard	Sludge	6.7	12.65	1.505	0.119	*Chaney & Hornick, 1978 CAST 1980 City 39H sludge*
A	Lettuce	Heat-Treated Sludge	5.3-5.4	0 3	1.26 2.62	0.453	*Chaney et al, 1982 Romaine Lettuce 1981 data*

TABLE C-12 (cont.)

UPTAKE OF CADMIUM BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Lettuce	Heat-Treated Sludge	6.2	0 3	0.62 0.93	0.103	*Chaney et al, 1982 Romaine Lettuce `1981 data*
A	Lettuce	Nu-Earth	5.3-5.6	0 21	1.26 30.6	1.397	*Chaney et al, 1982 Romaine Lettuce `1981 data*
A	Lettuce	Nu-Earth	6.2-6.6	0 21	0.62 6.34	0.272	*Chaney et al, 1982 Romaine Lettuce `1981 data*
A	Swiss Chard	Heat-Treated Sludge	5.7	0 3	0.7 1.63	0.310	*Chaney et al., 1982 `1978 data*
A	Swiss Chard	Heat-Treated Sludge	6.7-6.8	0 3	0.33 0.98	0.217	*Chaney et al. 1982 `1978 data*
A	Swiss Chard	Nu-Earth	5.7-6.3	0 21	0.7 1.63	0.044	*Chaney et al., 1982 `1978 data*
A	Swiss Chard	Nu-Earth	6.7	0 21	0.33 0.98	0.031	*Chaney et al., 1982 `1978 data*
A	Collard Greens	Heat-Treated Sludge	5.5-5.6	0 3	0.62 0.54	0.001	*Chaney et al., 1982 `1980 data*
A	Collard Greens	Heat-Treated Sludge	6.4-6.3	0 3	0.53 0.42	0.001	*Chaney et al., 1982 `1980 data*
A	Collard Greens	Nu-Earth	5.5-6.3	0 21	0.62 2.86	0.107	*Chaney et al., 1982 `1980*
A	Collard Greens	Nu-Earth	6.4-6.8	0 21	0.53 2.2	0.080	*Chaney et al., 1982 `1980*
A	Lettuce	Sludge	4.6-6.0	0 11	1.18 8.4	0.656	*Giordano et al., 1979 Year 3 (1977) No heat, no lime Bibb lettuce*
A	Lettuce	Sludge	4.6-6.0	0 11	0.88 2.25	0.125	*Giordano et al., 1979 Year 3 (1977) No heat, no lime Romaine lettuce*

TABLE C-12 (cont.)

UPTAKE OF CADMIUM BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Lettuce	Sludge	4.6-6.0	0 11	0.95 3.1	0.195	*Giordano et al., 1979* *Year 3 (1977)* *No heat, no lime* *Boston Lettuce*
A	Cabbage	Sludge	4.6-6.0	0 11	0.19 0.35	0.015	*Giordano et al., 1979* *Year 3 (1977)* *No heat, no lime*
A	Lettuce	Sludge	4.7-6.2	0 11	0.86 3.56	0.245	*Giordano et al., 1979* *Year 2 (1976)* *No heat* *Great Lakes Lettuce*
A	Lettuce	Sludge	5.1-6.0	0 11	0.3 10.4	0.918	*Giordano et al., 1979* *Year 3 (1977)* *No heat, no lime* *Great Lakes Lettuce*
A	Lettuce	Sludge	5.8	0 0.84	0.6 1.7	1.310	*Chaney et al., 1978* *Romaine Lettuce* *Backriver sludge*
A	Lettuce	Sludge	6.0	0 2.24	0.6 2.5	0.848	*Chaney et al., 1978* *Romaine lettuce* *Blue Plains sludge*
A	Lettuce	Sludge	6.7	0 1.5	0.6 1.1	0.333	*Chaney et al., 1978* *Romaine lettuce* *DigCompost*
A	Lettuce	Sludge	5.6	0 5.04	0.6 26.4	5.119	*Chaney et al., 1978* *Romaine lettuce* *Milorganite*
A	Lettuce	Sludge	5.5	0 3.3	0.6 11.6	3.333	*Chaney et al., 1978* *Romaine lettuce* *Dried DC*
A	Lettuce	Sludge	6.5	0 0.83 1.66 3.32	0.61 1.28 1.72 2.67	0.607	*Dowdy & Larson, 1975.*
A	Turnip/Greens	Sludge	5.8	0 3 5.1	1.000 3.600 4.400	0.680	*Miller & Boswell, 1979, p. 1361.*

TABLE C-12 (cont.)

UPTAKE OF CADMIUM BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Cabbage	Sludge	6.6	0 0.7 1.4	0.08 0.12 0.1	0.014	*Keefer et al, 1986. Blue Plains sludge.*
A	Cabbage	Sludge	7.1	0 3.1 6.2	0.08 0.11 0.14	0.010	*Keefer et al, 1986. Huntington sludge.*
A	Cabbage	Sludge	6.9	0 0.7 1.4	0.08 0.12 0.1	0.014	*Keefer et al, 1986. Martinsburg sludge.*
A	Cabbage	Sludge	6.3	0 0.4 0.8	0.08 0.14 0.19	0.138	*Keefer et al, 1986. Parkersburg sludge.*
A	Lettuce	Composted Sludge	N.R.	0 1.6 2.9 5.7	0.5 2.2 3.1 4.4	0.664	*Chang et al., 1978*
A	Swiss Chard	Composted Sludge	N.R.	0 1.6 2.9 5.7	0.2 0.4 0.7 2.1	0.337	*Chang et al., 1978*
A	Turnip/Greens	Composted Sludge	N.R.	0 1.2 2.2 4.3	1.0 1.2 2.7 2.6	0.414	*Chang et al., 1978*
A	Lettuce	Liquid sludge	6.5	0.6 4.52	0.77 2.36	0.406	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Lettuce	Bed-dried Sludge	6.5	0.6 12.57	0.73 2.27	0.129	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Lettuce	Liquid sludge	6.7	1.4 6.7	5.72 7.38	0.313	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Lettuce	Bed-dried Sludge	6.7	1.4 15.12	4.65 5.74	0.079	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Lettuce	Liquid sludge	8.0	1.44 5.86	0.63 1.39	0.172	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*

TABLE C-12 (cont.)

UPTAKE OF CADMIUM BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Lettuce	Bed-dried Sludge	8.0	1.5 22.12	0.62 1.99	0.066	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Cabbage	Liquid sludge	6.5	0.6 4.52	0.11 0.15	0.010	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Cabbage	Bed-dried Sludge	6.5	0.6 12.57	0.12 0.23	0.009	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Cabbage	Liquid sludge	6.7	1.4 6.7	0.27 0.28	0.002	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Cabbage	Bed-dried Sludge	6.7	1.4 15.12	0.25 0.29	0.003	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Cabbage	Liquid sludge	8.0	1.44 5.86	0.05 0.15	0.023	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Cabbage	Bed-dried Sludge	8.0	1.5 22.12	0.05 0.39	0.016	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Spinach	Sludge	N.R.	0 4 8 16 20	5.4 11.9 18.8 16.9 14.6	0.405	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*
A	Swiss Chard	Sludge	N.R.	0 4 8 16 20	2.2 4.9 8.4 7 10.2	0.323	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*

TABLE C-13

UPTAKE OF CADMIUM BY LEGUMES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Bean/ Grain	Sludge	5.1-6.0	0 11	0.1 0.2	0.009	*Giordano et al., 1979 Year 1 (1979) No heat Contender variety*
A	Bean/Pod	Compost	5.4	0 0.8 1.6 3.2	0.2 0.2 0.2 0.1	0.001	*Giordano, Mortvedt, Mays, 1975, p. 394. 1972 data used.*
A	Bean/Pod	Sludge	5.4	0 2.5 5 10	0.2 0.2 0.2 0.2	0.001	*Giordano, Mortvedt, Mays, 1975, p. 394. 1972 data used.*
A	Bean/Pod	Compost	5.4	0 1.6 3.2 6.4	0.1 0.1 0.1 0.1	0.001	*Giordano, Mortvedt, Mays, 1975, p. 394. 1972 data used.*
A	Bean/Pod	Sludge	5.4	0 5 10 20	0.1 0.2 0.2 0.2	0.004	*Giordano, Mortvedt, Mays, 1975, p. 394. 1972 data used.*
A	Green Bean/ Pod & Seed	Sludge	6.6	0 0.7 1.4	0.1 0.1 0.1	0.001	*Keefer et al, 1986. Blue Plains sludge.*
A	Green Bean/ Pod & Seed	Sludge	7.1	0 3.1 6.2	0.1 0.1 0.1	0.001	*Keefer et al, 1986. Huntington sludge.*
A	Green Bean/ Pod & Seed	Sludge	6.9	0 0.7 1.4	0.1 0.1 0.1	0.001	*Keefer et al, 1986. Martinsburg sludge.*
A	Green Bean/ Pod & Seed	Sludge	6.3	0 0.4 0.8	0.1 0.1 0.1	0.001	*Keefer et al, 1986. Parkersburg sludge.*
A	Green Bean/ Pod & Seed	Sludge	N.R.	0 4 8 16 20	0.1 0.1 0.2 0.3 0.3	0.012	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*

TABLE C-13 (cont.)

UPTAKE OF CADMIUM BY LEGUMES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Soybean/ Grain	Limed digested sludge	7.3-7.5	0.1 0.3 0.54 0.66 1.08 1.42	0.28 0.14 0.25 0.2 0.05 0.1	0.001	*Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.*
A	Soybean/ Grain	Limed raw sludge	7.3-7.7	0.1 0.28 0.32 0.74	0.28 0.14 0.09 0.07	0.001	*Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.*
A	Soybean/ Grain	Raw sludge compost	6.6-7.3	0.1 0.4 0.76 1.26 2.620 4.820	0.280 0.190 0.190 0.220 0.280 0.250	0.001	*Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.*
A	Soybean/ Grain	Heat treated sludge High pH	5.9-6.0	0.140 0.860 1.260 2.840	0.140 0.110 0.190 0.20	0.027	*Chaney et al, 1977. Chaney's values are means of 3 reps.*
A	Soybean/ Grain	Heat treated sludge Low pH	5.3-5.6	0.140 0.780 1.220 2.860	0.340 0.240 0.210 0.230	0.001	*Chaney et al, 1977. Chaney's values are means of 3 reps.*

TABLE C-14

UPTAKE OF CADMIUM BY POTATOES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Potato/ Tuber	Sludge	4.7-6.2	0 11	0.11 0.1	0.001	*Giordano et al., 1979 Year 2 (1976) No heat*
A	Potato	Sludge	5.3	0 0.83 1.66 3.32	0.12 0.11 0.021 0.23	0.038	*Dowdy & Larson, 1975.*
A	Potato/ Tuber	Liquid sludge	6.5	0.6 4.52	0.15 0.19	0.01	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Potato/ Tuber	Bed-dried Sludge	6.5	0.6 12.57	0.16 0.2	0.003	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Potato/ Tuber	Liquid sludge	6.7	1.4 6.7	0.52 0.49	0.001	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Potato/ Tuber	Bed-dried Sludge	6.7	1.4 15.12	0.53 0.41	0.001	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Potato/ Tuber	Liquid sludge	8.0	1.44 5.86	0.06 0.12	0.014	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Potato/ Tuber	Bed-dried Sludge	8.0	1.5 22.12	0.06 0.15	0.004	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
C	Potato/ Tuber	Organic, metal contaminated soil	6.6	39.2	0.29	0.007	*Harris et al, 1978. Vanessa-potato type.*
C	Potato/ Tuber	Organic, metal contaminated soil	6.6	39.2	0.2	0.005	*Harris et al, 1978. Pentland Savelin-potato type.*
C	Potato/ Tuber	Organic, metal contaminated soil	6.6	39.2	0.41	0.010	*Harris et al, 1978. Home Guard-potato type.*
C	Potato/ Tuber	Organic, metal contaminated soil	6.6	39.2	0.15	0.004	*Harris et al, 1978. Desiree-potato type.*

TABLE C-14 (cont.)

UPTAKE OF CADMIUM BY POTATOES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
C	Potato/ Tuber	Organic, metal contaminated soil	6.6	39.2	0.32	0.008	*Harris et al, 1978. King Edward-potato type.*
C	Potato/ Tuber	Organic, metal contaminated soil	6.6	39.2	0.32	0.008	*Harris et al, 1978. Majestic-potato type.*

TABLE C-15

UPTAKE OF CADMIUM BY ROOTS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Carrot/Tuber	Sludge	4.6-6.0	0 11	0.96 2.29	0.121	*Giordano et al., 1979 Year 3 (1977) No heat, no lime*
A	Carrot	Sludge	5.3	0 0.83 1.66 3.32	0.48 0.69 0.95 1.15	0.202	*Dowdy & Larson, 1975.*
A	Radish	Sludge	5.3	0 0.83 1.66 3.32	0.13 0.14 0.18 0.31	0.056	*Dowdy & Larson, 1975.*
A	Radish/Tuber	Sludge	6.6	0 0.7 1.4	0.53 0.66 0.68	0.107	*Keefer et al, 1986. Blue Plains sludge.*
A	Carrot/Tuber	Sludge	6.6	0 0.7 1.4	0.2 0.32 0.2	0.001	*Keefer et al, 1986. Blue Plains sludge.*
A	Radish/Tuber	Sludge	7.1	0 3.1 6.2	0.53 0.79 0.77	0.039	*Keefer et al, 1986. Huntington sludge.*
A	Carrot/Tuber	Sludge	7.1	0 3.1 6.2	0.200 0.200 0.200	0.001	*Keefer et al, 1986. Huntington sludge.*
A	Radish/Tuber	Sludge	6.9	0 0.7 1.4	0.53 0.51 0.57	0.029	*Keefer et al, 1986. Martinsburg sludge.*
A	Carrot/Tuber	Sludge	6.9	0 0.7 1.4	0.2 0.46 0.2	0.001	*Keefer et al, 1986. Martinsburg sludge.*
A	Radish/Tuber	Sludge	6.3	0 0.4 0.8	0.53 0.35 0.39	0.001	*Keefer et al, 1986. Parkersburg sludge.*
A	Carrot/Tuber	Sludge	6.3	0 0.4 0.8	0.2 0.2 0.2	0.001	*Keefer et al, 1986. Parkersburg sludge.*
A	Radish	Composted Sludge	N.R.	0 1.6 2.9 5.7	0.5 0.7 1.9 2.8	0.432	*Chang et al., 1978*

TABLE C-15 (cont.)

UPTAKE OF CADMIUM BY ROOTS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Radish/Tuber	Composted Sludge	N.R.	0 1.6 2.9 5.7	0.2 0.4 0.6 0.9	0.123	*Chang et al., 1978*
A	Carrot/Tuber	Composted Sludge	N.R.	0 1.6 2.9 5.7	0.4 0.9 1.6 2.4	0.358	*Chang et al., 1978*
A	Carrot	Composted Sludge	N.R.	0 1.6 2.9 5.7	0.5 1.6 2.5 3.9	0.594	*Chang et al., 1978*
A	Turnip/Tuber	Composted Sludge	N.R.	0 1.2 2.2 4.3	0.2 0.3 0.3 0.4	0.043	*Chang et al., 1978*
A	Ryegrass	Liquid sludge	6.5	0.6 4.52	0.11 0.3	0.048	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Red Beet/ Tuber	Liquid sludge	6.5	0.6 4.52	0.29 0.63	0.087	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Red Beet/ Tuber	Bed-dried Sludge	6.5	0.6 12.57	0.23 0.69	0.038	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Red Beet/ Tuber	Liquid sludge	6.7	1.4 6.7	1.0 1.22	0.042	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Red Beet/ Tuber	Bed-dried Sludge	6.7	1.4 15.12	0.8 1.26	0.034	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Red Beet/ Tuber	Liquid sludge	8.0	1.44 5.86	0.1 0.26	0.036	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Red Beet/ Tuber	Bed-dried Sludge	8.0	1.5 22.12	0.1 0.49	0.018	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*

TABLE C-15 (cont.)

UPTAKE OF CADMIUM BY ROOTS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Beet/ Tuber	Sludge	N.R.	0	0.5	0.078	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*
				4	1		
				8	1		
				16	2		
				20	2		
A	Carrot/ Tuber	Sludge	N.R.	0	1	0.061	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*
				4	1.3		
				8	1.3		
				16	1.8		
				20	1.7		

TABLE C-16

UPTAKE OF CADMIUM BY SWEET CORN

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Sweet Corn/ Grain	Sludge	5.1-6.0	0 11	0.1 1.8	0.155	*Giordano et al., 1979 Year 1 (1979) No heat Silver Queen corn*
A	Sweet Corn/ Grain	Sludge	5.3	0 0.83 1.66 3.32	0.02 0.02 0.03 0.05	0.01	*Dowdy & Larson, 1975.*
A	Sweet Corn/ Grain	Compost	5.4	0 0.8 1.6 3.2	0.3 0.7 0.9 1.1	0.236	*Giordano, Mortvedt, Mays, 1975, p. 394. 1972 data used.*
A	Sweet Corn/ Grain	Sludge	5.4	0 2.5 5 10	0.3 0.9 1 1.2	0.08	*Giordano, Mortvedt, Mays, 1975, p. 394. 1972 data used.*
A	Corn/Grain	Compost	5.4	0 1.6 3.2 6.4	0.5 0.5 0.6 0.8	0.05	*Giordano, Mortvedt, Mays, 1975, p. 394. 1973 data used.*
A	Corn/Grain	Sludge	5.4	0 5 10 20	0.5 0.7 1.1 1	0.026	*Giordano, Mortvedt, Mays, 1975, p. 394. 1973 data used.*
A	Sweet Corn/ Grain	Sludge	6.6	0 0.7 1.4	0.08 0.16 0.17	0.064	*Keefer et al, 1986. Blue Plains sludge.*
A	Sweet Corn/ Grain	Sludge	7.1	0 3.1 6.2	0.08 0.1 0.15	0.011	*Keefer et al, 1986. Huntington sludge.*
A	Sweet Corn/ Grain	Sludge	6.9	0 0.7 1.4	0.08 0.11 0.18	0.071	*Keefer et al, 1986. Martinsburg sludge.*
A	Sweet Corn/ Grain	Sludge	6.3	0 0.4 0.8	0.08 0.11 0.16	0.1	*Keefer et al, 1986. Parkersburg sludge.*
A	Sweet Corn/ Grain	Sludge	6.5	0 1.5	0.05 0.09	0.026	*Hemphill et al, 1982. Portland sludge.*
A	Sweet Corn/ Grain	Sludge	6.5	0 1.5	0.05 0.1	0.333	*Hemphill et al, 1982. Rockcreek sludge.*

TABLE C-17

UPTAKE OF COPPER BY FORAGE

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Natural Forage	Sludge	N.R.	13.2 27.1	2.28 12.5	0.738	*Baxter et al., 1983 Means reported*
A	Corn/Leaf	Sludge	6.6	0.000 152 304	8.0 6.1 4.9	0.001	*Rappaport, 1987. 1984 data.*
A	Corn/Leaf	Sludge	6.6	0 152 304	7.80 7.7 8.2	0.001	*Rappaport, 1987. 1985 data.*
A	Corn	Sludge	6.6	0 152 304	4.90 5.3 4.5	0.001	*Rappaport, 1987. 1984 data.*
A	Corn	Sludge	6.6	0 152 304	6.60 6.9 6.7	0.003	*Rappaport, 1987. 1985 data.*
A	Barley	Sludge	6.6	0 152 304	1.0 2.5 2.8	0.006	*Rappaport, 1987. 1985 data.*
A	Orchardgrass	Sludge	6.6-7.2	0 50	9.58 10.72	0.023	*Alberici, 1989.*
A	Quackgrass	Sludge	6.6-7.2	0 50	5.96 8.55	0.052	*Alberici, 1989.*
A	Bird's Foot Trefoil	Sludge	6.6-7.2	0 50	10.83 11.8	0.019	*Alberici, 1989.*
A	Tall Fescue	Sludge	6.6-7.2	0 50	7.17 8.22	0.021	*Alberici, 1989.*
A	Corn/Leaf	Sludge	5.3-6.5	2 70 132	5.4 7.1 8	0.020	*Sheaffer et al, 1979. Application rate based on measured DTPA soil values. Ambient data (1976) used.*
A	Corn	Sludge	5.3-6.5	2 70 132	7.3 7.6 9.6	0.017	*Sheaffer et al, 1979. Application rate based on measured DTPA soil values. Ambient data (1976) used.*

TABLE C-17 (cont.)

UPTAKE OF COPPER BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Clover	Sludge	5.3-6.3	2 70 132	7.3 10.1 13.9	0.051	*Sheaffer et al, 1979. Arrowleaf clover.*
A	Clover	Sludge	5.3-6.3	2 70 132	7.1 8.4 9.4	0.018	*Sheaffer et al, 1979. Crimson clover.*
A	Corn/Leaf	Sludge	7.0-7.1	0 67	9.50 9.5	0.001	*Webber et al, 1983, p. 190-193. Brantford site.*
A	Corn	Sludge	5.8-6.3	0 12	4.9 0 5.5	0.05	*Webber et al, 1983, p. 190-193. Burlington site.*
A	Corn/Leaf	Sludge	6.1-6.6	0 53	9.40 6.9	0.001	*Webber et al, 1983, p. 190-193. Galt site.*
A	Corn/Leaf	Sludge	5.7-6.1	0 10	9. 00 9.7	0.07	*Webber et al, 1983, p. 190-193. Georgetown site.*
A	Corn/Leaf	Sludge	6.2-6.3	0 33	9.70 9.5	0.001	*Webber et al, 1983, p. 190-193. Guelph site.*
A	Corn/Leaf	Sludge	6.4-6.6	0 59	7.20 6	0.001	*Webber et al, 1983, p. 190-193. Kitchener site.*
A	Corn/Leaf	Sludge	6.5	0 111	8.0 7.8	0.001	*Webber et al, 1983, p. 190-193. Stratford site.*
A	Sudax	Sludge	5.0-6.0	0 5.4 10.8 21.5 43 86	6.10 7.2 6.4 7.3 6.6 9.4	0.031	*Kelling et al, 1977, p. 353. Arlington site.*
A	Sudax	Sludge	5.3-6.2	0 5.4 10.8 21.5 43 86	5.10 8 9.5 11.5 12.3 14.1	0.087	*Kelling et al, 1977, p. 353. Jonesville site.*

TABLE C-17 (cont.)

UPTAKE OF COPPER BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Corn	Sludge	5.0-6.0	0 5.4 10.8 21.5 43 86	2.20 2.1 2.2 2.5 2.8 4	0.022	*Kelling et al, 1977, p. 353. Burlington site- 4th year.*
A	Corn	Sludge	5.3-6.2	0 5.4 10.8 21.5 43 86	2.20 2.1 2.1 2 2.6 3.1	0.012	*Kelling et al, 1977, p. 353. Jonesville- 3rd crop.*
A	Ryegrass	Liquid sludge	6.5	42 120	6.40 11.9	0.071	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Ryegrass	Bed-dried Sludge	6.5	34 257	6.40 15.4	0.040	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Ryegrass	Liquid sludge	6.7	50 147	8.4 13.5	0.037	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Ryegrass	Bed-dried Sludge	6.7	50 290	8.2 13.5	0.022	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Ryegrass	Liquid sludge	8.0	33 113	9.6 12.3	0.034	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Ryegrass	Bed-dried Sludge	8.0	33 381	9.3 16.7	0.021	*Carlton Smith, 1988. Means of 4 years* used. *Calcareous loam.*
A	Barley/Leaf	Sludge	6.2-6.4	0 135	4.23 4.63	0.003	*Sommers et al, 1991. Ohio data used.*
B	Rape	Sludge	5.6	0 34.35 68.7	25.75 7.19 6.95	0.001	*Narwal et al, 1983. 1st harvest.*
B	Rape	Sludge	6.0	0 34.35 68.7	11.27 7.02 7.54	0.001	*Narwal et al, 1983. 1st harvest.*

TABLE C-17 (cont.)

UPTAKE OF COPPER BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
B	Rape	Sludge	7.5	0 34.35 68.7	6.88 7 14.47	0.110	*Narwal et al, 1983. 1st harvest.*
B	Rape	Sludge	5.6	0 34.35 68.7	19.35 12.36 8.7	0.001	*Narwal et al, 1983. 2nd harvest.*
B	Rape	Sludge	6.0	0 34.35 68.7	17.71 8.51 9.01	0.001	*Narwal et al, 1983. 2nd harvest.*
B	Rape	Sludge	7.5	0 34.35 68.7	8.37 8.78 13.09	0.069	*Narwal et al, 1983. 2nd harvest.*

TABLE C-18

UPTAKE OF COPPER BY GARDEN FRUITS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Tomato/Fruit	Sludge	5.9-7.1	0 17 34	9.3 11.6 11.2	0.056	*Keefer et al, 1986. Blue Plains sludge. Early fruiting.*
A	Tomato/Fruit	Sludge	5.9-7.1	0 17 34	8.6 12.7 9.9	0.038	*Keefer et al, 1986. Blue Plains sludge. Late fruiting.*
A	Tomato/Fruit	Sludge	5.9-7.1	0 342 684	9.3 11.9 14.3	0.007	*Keefer et al, 1986. Huntington sludge. Early fruiting.*
A	Tomato/Fruit	Sludge	5.9-7.1	0 342 684	8.6 9.7 10.6	0.003	*Keefer et al, 1986. Huntington sludge. Late fruiting.*
A	Tomato/Fruit	Sludge	5.9-7.1	0 24 48	9.3 10 11.3	0.042	*Keefer et al, 1986. Martinsburg sludge. Early fruiting.*
A	Tomato/Fruit	Sludge	5.9-7.1	0 24 48	8.6 11.4 11.2	0.054	*Keefer et al, 1986. Martinsburg sludge. Late fruiting.*
A	Celery	Sludge	7.3	0 11.05 22.1 44.2	4.3 6.1 5 4.6	0.001	*Peterson et al, 1989.*
A	Tomato/Fruit	Sludge	7.3	0 11.05 22.1 44.2	16.2 18.6 15.7 15.9	0.001	*Peterson et al, 1989.*
A	Tomato/Fruit	Sludge	5.9-7.1	0 11 22	9.3 12.9 12.5	0.0145	*Keefer et al, 1986. Parkersburg sludge. Early fruiting.*
A	Tomato/Fruit	Sludge	5.9-7.1	0 11 22	8.6 11.9 10.1	0.068	*Keefer et al, 1986. Parkersburg sludge. Late fruiting.*
A	Tomato/Fruit	Sludge	N.R.	0 26 52 103 129	17 17 19 26 18	0.036	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*

TABLE C-18 (cont.)

UPTAKE OF COPPER BY GARDEN FRUITS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	*Reference/ Comments*
B	Green Pepper/ Fruit	Sludge	6.4	0 249	5.8 11	0.021	*Furr et al, 1981. Acid soil, 2nd year.*
B	Green Pepper/ Fruit	Sludge	6.4	0 249	7.1 9.6	0.01	*Furr et al, 1981. Neutral soil, 2nd year.*
B	Pea/Grain	Sludge	6.4	0 249	4.6 8.2	0.014	*Furr et al, 1981. Acid soil, 2nd year.*
B	Pea/Grain	Sludge	6.4	0 249	6.1 9.1	0.012	*Furr et al, 1981. Neutral soil, 2nd year.*

TABLE C-19

UPTAKE OF COPPER BY GRAINS/CEREALS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Corn/Grain	Sludge	6.6	0 152 304	4.5 3.8 3.9	0.001	*Rappaport, 1987. 1984 data.*
A	Corn/Grain	Sludge	6.6	0 152 304	2.2 2.9 2.3	0.004	*Rappaport, 1987. 1985 data.*
A	Corn/Grain	Sludge	5.3-6.5	2 70 132	1.1 1.7 1.6	0.004	*Sheaffer et al, 1979. Application rate based on measured DTPA soil values. Ambient temp. data (1976) used.*
A	Oats/Grain	Sludge	5.3-6.3	2 70 132	1.5 2.6 2.5	0.008	*Sheaffer et al, 1979.*
A	Rye/Grain	Sludge	5.3-6.3	2 70 132	4.5 6.6 6.7	0.017	*Sheaffer et al, 1979.*
A	Wheat/Grain	Sludge	5.3-6.3	2 70 132	2.1 3.2 3.7	0.012	*Sheaffer et al, 1979.*
A	Wheat/Grain	Sludge	N.R.(3)	0 90 360	3.5 4.46 5.96	0.007	*Sabey and Hart, 1975, p. 255.*
A	Rye/Grain	Sludge	5.0-6.0	0 5.4 10.8 21.5 43 86	3.9 5.8 7 8.2 9.4 11.7	0.08	*Kelling et al, 1977, p. 353. Arlington site.*
A	Rye/Grain	Sludge	5.3-6.2	0 5.4 10.8 21.5 43 86	5.6 5.3 5.5 5.7 7 8.9	0.042	*Kelling et al, 1977, p. 353. Jonesville site.*
A	Corn/Grain	Sludge	5.0-6.0	0 5.4 10.8 21.5 43 86	1.4 1.4 1.2 1.1 1.2 1.2	0.001	*Kelling et al, 1977, p. 353 Burlington site-4th year.*

TABLE C-19 (cont.)

UPTAKE OF COPPER BY GRAINS/CEREALS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Wheat/Grain	Liquid sludge	6.5	42 120	5 7	0.026	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Wheat/Grain	Bed-dried Sludge	6.5	34 257	5 8	0.013	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Wheat/Grain	Liquid sludge	6.7	50 147	6 7	0.010	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Wheat/Grain	Bed-dried Sludge	6.7	50 290	6 8	0.008	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Wheat/Grain	Liquid sludge	8.0	33 113	5 6	0.013	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Wheat/Grain	Bed-dried Sludge	8.0	33 381	5 7	0.006	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Barley/Grain	Sludge	6.2-6.4	0 135	3.49 3.55	0.001	*Sommers et al, 1991. Ohio data used.*

TABLE C-20

UPTAKE OF COPPER BY LEAFY VEGETABLES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Lettuce	Heat-Treated Sludge	5.3-5.4	0 90	7.7 11.5	0.042	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Heat-Treated Sludge	6.2	0 90	7.5 10.5	0.033	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Nu-Earth	5.3-5.6	0 116	7.7 10.7	0.026	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Nu-Earth	6.2-6.6	0 116	7.5 8.7	0.01	*Chaney et al., 1982 Romaine Lettuce*
A	Swiss Chard	Heat-Treated Sludge	5.7	0 90	10.3 21.2	0.121	*Chaney et al., 1982*
A	Swiss Chard	Heat-Treated Sludge	6.7-6.8	0 90	10.8 16.4	0.062	*Chaney et al., 1982*
A	Swiss Chard	Nu-Earth	5.7-6.3	0 116	10.3 15.8	0.047	*Chaney et al., 1982*
A	Swiss Chard	Nu-Earth	6.7	0 116	10.8 13.9	0.027	*Chaney et al., 1982*
A	Collard Greens	Heat-Treated Sludge	5.5-5.6	0 90	5.5 7.5	0.022	*Chaney et al., 1982*
A	Collard Greens	Heat-Treated Sludge	6.3-6.4	0 90	4.5 6.9	0.027	*Chaney et al., 1982*
A	Collard Greens	Nu-Earth	5.5-6.3	0 116	5.5 6.4	0.008	*Chaney et al., 1982*
A	Collard Greens	Nu-Earth	6.4-6.8	0 116	4.5 5.9	0.012	*Chaney et al., 1982*
A	Cabbage	Sludge	5.9-7.1	0 17 34	3.1 3.4 3.3	0.006	*Keefer et al, 1986. Blue Plains sludge.*
A	Cabbage	Sludge	5.9-7.1	0 342 684	3.1 4.1 4.4	0.002	*Keefer et al, 1986. Huntington sludge.*
A	Cabbage	Sludge	5.9-7.1	0 24 48	3.1 3.7 3.4	0.006	*Keefer et al, 1986. Martinsburg sludge.*

TABLE C-20 (cont.)

UPTAKE OF COPPER BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Cabbage	Sludge	5.9-7.1	0 11 22	3.1 3.4 3.7	0.027	*Keefer et al, 1986. Parkersburg sludge.*
A	Cabbage	Sludge	7.3	0 11.05 22.1 44.2	2.9 3.4 3.1 3.1	0.001	*Peterson et al, 1989.*
A	Lettuce	Sludge	7.3	0 11.05 22.1 44.2	18.8 16.4 16.1 15.7	0.001	*Peterson et al, 1989.*
A	Lettuce	Liquid sludge	6.5	42 120	11 16	0.064	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Lettuce	Bed-dried Sludge	6.5	34 257	8 19	0.049	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Lettuce	Liquid sludge	6.7	50 147	18 18	0.001	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Lettuce	Bed-dried Sludge	6.7	50 290	17 16	0.001	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Lettuce	Liquid sludge	8.0	33 113	13 14	0.013	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Lettuce	Bed-dried Sludge	8.0	33 381	13 16	0.009	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Cabbage	Liquid sludge	6.5	42 120	3.7 4.9	0.015	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Cabbage	Bed-dried Sludge	6.5	34 257	3.8 5.6	0.008	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Cabbage	Liquid sludge	6.7	50 147	3.3 4.8	0.015	*Carlton Smith, 1988. Means of 5 years used. Clay.*

TABLE C-20 (cont.)

UPTAKE OF COPPER BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Cabbage	Bed-dried Sludge	6.7	50 290	3.2 4.6	0.006	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Cabbage	Liquid sludge	8.0	33 113	2.8 3.8	0.023	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Cabbage	Bed-dried Sludge	8.0	33 381	2.8 5.8	0.009	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Spinach	Sludge	N.R.	0 26 52 103 129	13 17 20 18 18	0.029	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*
A	Swiss Chard	Sludge	N.R.	0 26 52 103 129	21 29 36 27 32	0.048	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*
B	Lettuce	Sludge	5.8-7.7	0 19.8 39.6 79.2	17.2 26.3 18.5 16.3	0.001	*Hue et al, 1988. Akaka Andept soil.*
B	Lettuce	Sludge	8.2-8.4	0 19.8 39.6 79.2	21 24 31.8 36	0.197	*Hue et al, 1988. Lualualei Vertical soil.*
B	Lettuce	Sludge	5.4-8.1	0 19.8 39.6 79.2	26.5 27.2 24.8 21.3	0.001	*Hue et al, 1988. Wahiawa Oxisol soil.*
B	Lettuce	Sludge	6.4	0 249	6.7 8.7	0.008	*Furr et al, 1981. Acid soil, 2nd year.*

TABLE C-20 (cont.)

UPTAKE OF COPPER BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
B	Spinach	Sludge	6.4	0 249	4.2 12	0.031	*Furr et al, 1981.* *Acid soil, 2nd year.*
B	Lettuce	Sludge	6.4	0 249	6.5 9.3	0.011	*Furr et al, 1981.* *Neutral soil, 2nd year.*
B	Spinach	Sludge	6.4	0 249	5.3 11.1	0.023	*Furr et al, 1981.* *Neutral soil, 2nd year.*

TABLE C - 21

UPTAKE OF COPPER BY LEGUMES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Green Bean/ Grain	Sludge	5.9-7.1	0 17 34	10.5 9.8 9.5	0.001	*Keefer et al, 1986. Blue Plains sludge.*
A	Green Bean/ Grain	Sludge	5.9-7.1	0 342 684	10.5 10 10.9	0.001	*Keefer et al, 1986. Huntington sludge.*
A	Green Bean/ Grain	Sludge	5.9-7.1	0 24 48	10.5 10.4 10.3	0.001	*Keefer et al, 1986. Martinsburg sludge.*
A	Green Bean/ Grain	Sludge	5.9-7.1	0 11 22	10.5 11.3 10.4	0.001	*Keefer et al, 1986. Parkersburg sludge.*
A	Snap Bean/ Grain	Sludge	5.3-6.5	0 130 269 520	2.9 8 8.3 8.5	0.009	*Dowdy et al, 1978, p. 255. 3rd year data used.*
A	Snap Bean/ Grain	Sludge	5.3-6.5	0 26.3 52.6 66 105 132 263	4.1 6.7 7.4 8 8.8 8.4 8.6	0.013	*Latterell et al, 1978, p. 255.*
A	Bean/ Grain	Sludge	7.3	0 11.05 22.1 44.2	10.7 9.9 15.1 24.5	0.339	*Peterson et al, 1989.*
A	Green Bean/ Pod & Seed	Sludge	N.R.	0 26 52 103 129	10 10 10 9 9	0.001	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*
A	Soybean/ Grain	Limed digested sludge	7.3-7.5	14 21 26 38 56 74	14.8 13.8 13.4 12.7 12.6 13.5	0.001	*Chaney et al, 1977. For control, used calcerous soil data. Chaney's values are means of 3 reps.*

TABLE C - 21 (cont.)

UPTAKE OF COPPER BY LEGUMES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Soybean/ Grain	Limed raw sludge	7.3-7.7	14 25 25 47	14.8 14.3 14.1 13.2	0.001	*Chaney et al, 1977. For control, used calcerous soil data. Chaney's values are means of 3 reps.*
A	Soybean/ Grain	Raw sludge compost	6.6-7.3	14 23 33 38 97 172	14.8 13.2 12.7 13 13.5 13.3	0.001	*Chaney et al, 1977. For control, used calcerous soil data. Chaney's values are means of 3 reps.*
A	Soybean/ Grain	Heat treated sludge High pH	5.9-6.0	12 37 40 78	14.5 14.3 14.1 13.7	0.001	*Chaney et al, 1977. Chaney's values are means of 3 reps.*
A	Soybean/ Grain	Heat treated sludge Low pH	5.3-5.6	13 34 46 87	13.7 13.2 12.4 11	0.001	*Chaney et al, 1977. Chaney's values are means of 3 reps.*

TABLE C-22

UPTAKE OF COPPER BY POTATOES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Potato/Tuber	Liquid sludge	6.5	42 120	0.15 0.19	0.001	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Potato/Tuber	Bed-dried Sludge	6.5	34 257	0.16 0.2	0.001	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Potato/Tuber	Liquid sludge	6.7	50 147	0.52 0.61	0.001	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Potato/Tuber	Bed-dried Sludge	6.7	50 290	0.53 0.41	0.001	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Potato/Tuber	Liquid sludge	8.0	33 113	0.05 0.116	0.001	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Potato/Tuber	Bed-dried Sludge	8.0	33 381	0.06 0.15	0.001	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
B	Sweet Potato/ Tuber	Sludge	6.4	0 249	3.4 5.2	0.007	*Furr et al, 1981. Acid soil, 2nd year.*
B	Sweet Potato/ Tuber	Sludge	6.9	0 249	4.6 5.9	0.005	*Furr et al, 1981. Neutral soil, 2nd year.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	1504	7.71	0.005	*Harris et al, 1978. Vanessa-potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	1504	0.55	0.006	*Harris et al, 1978. Pentland Javelin-potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	1504	8.55	0.006	*Harris et al, 1978. Home Guard-potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	1504	8.33	0.006	*Harris et al, 1978. Desiree-potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	1504	6.76	0.004	*Harris et al, 1978. King Edward-potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	1504	9.03	0.006	*Harris et al, 1978. Majestic-potato type.*

TABLE C-23

UPTAKE OF COPPER BY ROOTS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Radish/Tuber	Sludge	5.9-7.1	0 17 34	3.9 4.7 4.4	0.015	*Keefer et al, 1986. Blue Plains sludge.*
A	Carrot/Tuber	Sludge	5.9-7.1	0 17 34	7.5 6.5 7.1	0.001	*Keefer et al, 1986. Blue Plains sludge.*
A	Radish/Tuber	Sludge	5.9-7.1	0 342 684	3.9 5.4 6.4	0.004	*Keefer et al, 1986. Huntington sludge.*
A	Carrot/Tuber	Sludge	5.9-7.1	0 342 684	7.5 7.5 12.5	0.007	*Keefer et al, 1986. Huntington sludge.*
A	Radish/Tuber	Sludge	5.9-7.1	0 24 48	3.9 4.1 4.5	0.013	*Keefer et al, 1986. Martinsburg sludge.*
A	Carrot/Tuber	Sludge	5.9-7.1	0 24 48	7.5 7.8 7.8	0.006	*Keefer et al, 1986. Martinsburg sludge.*
A	Radish/Tuber	Sludge	5.9-7.1	0 11 22	3.9 2.4 2.6	0.001	*Keefer et al, 1986. Parkersburg sludge.*
A	Carrot/Tuber	Sludge	5.9-7.1	0 11 22	7.5 7 6.2	0.001	*Keefer et al, 1986. Parkersburg sludge.*
A	Onion/Bulb	Sludge	7.3	0 11.05 22.1 44.2	6.2 5.6 6.1 4.6	0.001	*Peterson et al, 1989.*
A	Red Beet/ Tuber	Liquid sludge	6.5	42 120	7.4 8.4	0.013	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Red Beet/ Tuber	Bed-dried Sludge	6.5	34 257	7.2 8.9	0.008	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Red Beet/ Tuber	Liquid sludge	6.7	50 147	8.8 8.9	0.001	*Carlton Smith, 1988. Means of 5 years used. Clay.*

TABLE C-23 (cont.)

UPTAKE OF COPPER BY ROOTS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Red Beet/ Tuber	Bed-dried Sludge	6.7	50 290	8.6 8.8	0.001	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Red Beet/ Tuber	Liquid sludge	8.0	33 113	7.6 8.6	0.013	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Red Beet/ Tuber	Bed-dried Sludge	8.0	33 381	7.1 9.4	0.007	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
B	Kohlrabi/ Tuber	Sludge	6.4	0 249	1.3 4.3	0.012	*Furr et al, 1981. Neutral soil, 2nd year.*
B	Turnip/ Tuber	Sludge	6.9	0 249	1.8 7.8	0.024	*Furr et al, 1981. Neutral soil, 2nd year.*

TABLE C-24

UPTAKE OF COPPER BY SWEET CORN

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Sweet Corn/ Grain	Sludge	5.9-7.1	0	2.9	0.001	*Keefer et al, 1986. Blue Plains sludge.*
				17	3.1		
				34	2.6		
A	Sweet Corn/ Grain	Sludge	5.9-7.1	0	2.9	0.001	*Keefer et al, 1986. Huntington sludge.*
				342	2.7		
				684	2.9		
A	Sweet Corn/ Grain	Sludge	5.9-7.1	0	2.9	0.002	*Keefer et al, 1986. Martinsburg sludge.*
				24	3.1		
				48	3		
A	Sweet Corn/ Grain	Sludge	5.9-7.1	0	2.4	0.005	*Keefer et al, 1986. Parkersburg sludge.*
				11	3		
				22	3		

TABLE C-25

UPTAKE OF LEAD BY FORAGE

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Natural Forage	Sludge	N.R.	17.531 31.8	2.3 0.75	0.001	*Baxter et al., 1983*
A	Ryegrass	Liquid Sludge	6.5	56.8 132.8	2.0 2.2	0.003	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Ryegrass	Bed-dried Sludge	6.5	56.6 218.6	1.7 2	0.002	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Ryegrass	Liquid Sludge	6.7	63.0 154.4	1.9 2	0.001	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Ryegrass	Bed-dried Sludge	6.7	62.4 225.4	2.2 2.7	0.003	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Ryegrass	Liquid Sludge	8.0	111.2 159.6	3.5 3.6	0.002	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Ryegrass	Bed-dried Sludge	8.0	110.6 331	3.3 3.8	0.002	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Corn	Sludge	5.3-5.6	0.0 156 312 624	3.4 1.5 1.1 2.5	0.001	*Giordano et al., 1975.*
A	Corn	Sludge	5.3	0.0 58 116 232	3.5 5 5 4	0.001	*Dowdy & Larson, 1975.*
A	Reed Canary Grass	Liquid sludge	6.2-7.4	0 22	0.9 2.5	0.073	*Duncomb et al., 1982.*

TABLE C-26

UPTAKE OF LEAD BY GARDEN FRUITS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Pea/Grain	Sludge	5.3	0	<0.1	0.001	*Dowdy & Larson, 1975.*
				58	<0.1		
				116	<0.1		
				232	<0.1		
A	Tomato/Fruit	Sludge	5.3	0	<0.4	0.001	*Dowdy & Larson, 1975.*
				58	<0.4		
				116	<0.4		
				232	<0.4		
A	Corn/Grain	Sludge	5.3	0	<0.2	0.001	*Dowdy & Larson, 1975.*
				58	<0.2		
				116	<0.2		
				232	<0.2		
A	Pea/Pod	Sludge	5.3	0	0.4	0.001	*Dowdy & Larson, 1975.*
				58	0.4		
				116	0.4		
				232	0.6		
A	Tomato/Fruit	Sludge	5.9-6.6	0	0.76	0.001	*Keefer et al., 1986.*
				25	0.68		*Blue Plains sludge.*
				50	0.82		*Early fruiting.*
A	Tomato/Fruit	Sludge	5.9-6.6	0	0.93	0.001	*Keefer et al., 1986.*
				25	0.4		*Blue Plains sludge.*
				50	0.62		*Late fruiting.*
A	Tomato/Fruit	Sludge	5.9-7.1	0	0.76	0.007	*Keefer et al., 1986.*
				33	0.62		*Huntington sludge.*
				66	1.24		*Early fruiting.*
A	Tomato/Fruit	Sludge	5.9-7.1	0	0.93	0.011	*Keefer et al., 1986.*
				33	1.58		*Huntington sludge.*
				66	1.64		*Late fruiting.*
A	Tomato/Fruit	Sludge	5.9-6.3	0	0.76	0.002	*Keefer et al., 1986.*
				32	0.56		*Martinsburg sludge.*
				64	0.82		*Early fruiting.*
A	Tomato/Fruit	Sludge	5.9-6.3	0	0.93	0.001	*Keefer et al., 1986.*
				32	0.96		*Martinsburg sludge.*
				64	0.46		*Late fruiting.*
A	Tomato/Fruit	Sludge	5.9-6.6	0	0.76	0.001	*Keefer et al., 1986.*
				55	0.82		*Parkersburg sludge.*
				110	0.7		*Early fruiting.*

TABLE C-26 (cont.)

UPTAKE OF LEAD BY GARDEN FRUITS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Tomato/Fruit	Sludge	5.9-6.6	0	0.93	0.003	*Keefer et al., 1986. Parkersburg sludge. Late fruiting.*
				55	1.42		
				110	1.24		

TABLE C-27

UPTAKE OF LEAD BY GRAINS/CEREALS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Wheat/Grain	Liquid Sludge	6.5	56.8 132.8	0.80 0.8	0.001	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Wheat/Grain	Bed-dried Sludge	6.5	56.6 218.6	0.80 0.8	0.001	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Wheat/Grain	Liquid Sludge	6.7	63.0 154.4	0.80 0.8	0.001	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Wheat/Grain	Bed-dried Sludge	6.7	62.4 225.4	0.90 1	0.001	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Wheat/Grain	Liquid Sludge	8.0	111.2 159.6	0.80 0.8	0.001	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Wheat/Grain	Bed-dried Sludge	8.0	110.6 331	0.90 1	0.001	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Corn/Grain	Sludge	5.3-5.6	0.0 156 312 624	0.9 0.5 0.6 1	0.001	*Giordano et al., 1975.*
A	Corn/Grain	Sludge	5.3	0.0 58 116 232	<0.2 <0.2 <0.2 <0.2	0.001	*Dowdy & Larson, 1975.*
A	Oat/Grain	Limed digested sludge	7.3-7.5	20.0 29 33 42.6 59.8 73.4	0.38 0.27 0.36 0.97 0.51 0.54	0.004	*Chaney et al, 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.*
A	Oat/Grain	Limed raw sludge	7.3-7.7	20.2 27.6 31.8 51.8	0.38 0.4 0.36 0.44	0.002	*Chaney et al, 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.*

TABLE C-27 (cont.)

UPTAKE OF LEAD BY GRAINS/CEREALS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Oat/Grain	Raw sludge compost	6.6-7.3	20.2	0.38	0.001	*Chaney et al, 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.*
				33	0.37		
				43.8	0.46		
				63	0.46		
				112.2	0.39		
				186.6	0.51		
A	Oat/Grain	Heat treated sludge High pH	5.9-6.0	21.4	0.57	0.001	*Chaney et al, 1977. Chaney's values are means of 3 reps.*
				47	0.36		
				48.8	0.03		
				88.8	0.03		
A	Oat/Grain	Heat treated sludge Low pH	5.3-5.6	21.4	0.38	0.004	*Chaney et al, 1977. Chaney's values are means of 3 reps.*
				43.8	0.36		
				52.8	0.4		
				92.8	0.67		

TABLE C-28

UPTAKE OF LEAD BY LEAFY VEGETABLES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Lettuce	Heat-Treated Sludge	5.3-5.4	0 81	1 1	0.001	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Heat-Treated Sludge	6.2	0 81	1.1 1	0.001	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Nu-Earth	5.3-5.6	0 87	1 1.1	0.001	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Nu-Earth	6.2-6.6	0 87	1.1 0.6	0.001	*Chaney et al., 1982 Romaine Lettuce*
A	Swiss Chard	Heat-Treated Sludge	5.7	0 81	3.4 2.1	0.001	*Chaney et al., 1982*
A	Swiss Chard	Heat-Treated Sludge	6.7-6.8	0 81	2.7 1.5	0.001	*Chaney et al., 1982*
A	Swiss Chard	Nu-Earth	5.7	0 87	3.4 1.2	0.001	*Chaney et al., 1982*
A	Swiss Chard	Nu-Earth	6.7-6.8	0 87	2.7 1.5	0.001	*Chaney et al., 1982*
A	Collard Greens	Heat-Treated Sludge	5.5-5.6	0 81	2.4 1.9	0.001	*Chaney et al., 1982*
A	Collard Greens	Heat-Treated Sludge	6.4-6.3	0 81	1.9 2.5	0.007	*Chaney et al., 1982*
A	Collard Greens	Nu-Earth	5.5-6.3	0 87	2.4 2.2	0.001	*Chaney et al., 1982*
A	Collard Greens	Nu-Earth	6.4-6.8	0 87	1.9 1.9	0.001	*Chaney et al., 1982*
A	Lettuce	Liquid Sludge	6.5	56.8 132.8	1.3 1.6	0.004	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Lettuce	Bed-dried Sludge	6.5	56.6 218.6	0.9 0.9	0.001	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Lettuce	Liquid Sludge	6.7	63 154.4	2.28 2.34	0.001	*Carlton Smith, 1988. Means of 5 years used. Clay.*

TABLE C-28 (cont.)

UPTAKE OF LEAD BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Lettuce	Bed-dried Sludge	6.7	62.4 225.4	1.7 2.7	0.006	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Lettuce	Liquid Sludge	8.0	111.2 159.6	3.9 3.5	0.001	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Lettuce	Bed-dried Sludge	8.0	110.6 331	3.4 3.4	0.001	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Cabbage	Liquid Sludge	6.5	56.8 132.8	0.7 0.9	0.003	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Cabbage	Bed-dried Sludge	6.5	56.6 218.6	0.8 0.8	0.001	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Cabbage	Liquid Sludge	6.7	63 154.4	0.7 0.7	0.001	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Cabbage	Bed-dried Sludge	6.7	62.4 225.4	0.8 0.8	0.001	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Cabbage	Liquid Sludge	8.0	111.2 159.6	1. 0 1.1	0.002	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Cabbage	Bed-dried Sludge	8.0	110.6 331	1.0 1.1	0.001	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Lettuce	Sludge	5.3	0 58 116 232	1.1 1.4 0.7 0.8	0.001	*Dowdy & Larson, 1975.*
A	Turnip Greens	Sludge	5.2-5.8	0 57 114	7.8 10.5 12.3	0.039	*Miller & Boswell, 1979.*
A	Cabbage	Sludge	5.9-6.6	0 25 50	0.58 0.38 0.52	0.001	*Keefer et al., 1986. Blue Plains sludge.*

TABLE C-28 (cont.)

UPTAKE OF LEAD BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Cabbage	Sludge	5.9-7.1	0	0.58	0.001	*Keefer et al., 1986. Huntington sludge.*
				33	0.74		
				66	0.52		
A	Cabbage	Sludge	5.9-6.3	0	0.58	0.004	*Keefer et al., 1986. Martinsburg sludge.*
				32	0.8		
				64	0.84		
A	Cabbage	Sludge	5.9-6.6	0	0.58	0.003	*Keefer et al., 1986. Parkersburg sludge.*
				55	0.72		
				110	0.88		

TABLE C-29

UPTAKE OF LEAD BY LEGUMES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Bush Bean/ Pod	Sludge	5.3-5.6	0	1.4	0.001	*Giordano et al., 1975.*
				156	1.4		
				312	1.2		
				624	1.2		
A	Green Bean/ Pod & Seed	Sludge	5.9-6.6	0	0.83	0.001	*Keefer et al., 1986. Blue Plains sludge.*
				25	0.66		
				50	0.46		
A	Green Bean/ Pod & Seed	Sludge	5.9-7.1	0	0.83	0.006	*Keefer et al., 1986. Huntington sludge.*
				33	0.54		
				66	1.2		
A	Green Bean/ Pod & Seed	Sludge	5.9-6.3	0	0.83	0.001	*Keefer et al., 1986. Martinsburg sludge.*
				32	0.86		
				64	0.8		
A	Green Bean/ Pod & Seed	Sludge	5.9-6.6	0	0.83	0.001	*Keefer et al., 1986. Parkersburg sludge.*
				55	0.8		
				110	0.98		
A	Soybean/ Grain	Limed digested sludge	7.3-7.5	20.2	0.35	0.003	*Chaney et al, 1977. For control, used used calcareous soil data. Chaney's values are means of 3 reps.*
				29.8	0.99		
				53	0.73		
				42.6	0.29		
				59.8	0.58		
				73.4	0.73		
A	Soybean/ Grain	Limed raw sludge	7.3-7.7	20.2	0.35	0.001	*Chaney et al, 1977. For control, used used calcareous soil data. Chaney's values are means of 3 reps.*
				27.6	0.62		
				31.8	0.57		
				51.8	0.4		
A	Soybean/ Grain	Raw sludge compost	6.6-7.3	20.2	0.35	0.001	*Chaney et al, 1977. For control, used used calcareous soil data. Chaney's values are means of 3 reps.*
				33	0.56		
				43.8	0.38		
				63	0.46		
				112.2	0.57		
				186.6	0.29		
A	Soybean/ Grain	Heat treated sludge High pH	5.9-6.0	21.4	0.25	0.001	*Chaney et al, 1977. Chaney's values are means of 3 reps.*
				4	0.62		
				48.8	0.29		
				88.8	0.27		
A	Soybean/ Grain	Heat treated sludge Low pH	5.3-5.6	21.4	0.75	0.001	*Chaney et al, 1977. Chaney's values are means of 3 reps.*
				43.8	0.38		
				52.8	0.25		
				92.8	0.38		

TABLE C-30

UPTAKE OF LEAD BY POTATOES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Potato/Tuber	Sludge	5.3	0 58 116 232	<0.4 <0.4 <0.4 0.7	0.001	*Dowdy & Larson, 1975*
C	Potato/Tuber	Organic-metal contaminated soil	6.6	1742	0.41	0.001	*Harris et all, 1978. Vanessa-potato type.*
C	Potato/Tuber	Organic-metal contaminated soil	6.6	1742	0.55	0.001	*Harris et all, 1978. Pentland Javelin-potato K20*
C	Potato/Tuber	Organic-metal contaminated soil	6.6	1742	0.26	0.001	*Harris et all, 1978. Home Guard-potato type.*
C	Potato/Tuber	Organic-metal contaminated soil	6.6	1742	1.04	0.001	*Harris et all, 1978. Desiree-potato type.*
C	Potato/Tuber	Organic-metal contaminated soil	6.6	1742	0.66	0.001	*Harris et all, 1978. King Edward-potato type.*
C	Potato/Tuber	Organic-metal contaminated soil	6.6	1742	0.29	0.001	*Harris et all, 1978. Majestic-potato type.*

TABLE C-31

UPTAKE OF LEAD BY ROOTS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Red Beet/ Tuber	Liquid Sludge	6.5	56.8 132.8	0.7 0.9	0.003	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Red Beet/ Tuber	Bed-dried Sludge	6.5	56.6 218.6	0.8 0.9	0.001	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Red Beet/ Tuber	Liquid Sludge	6.7	63 154.4	0.7 0.8	0.001	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Red Beet/ Tuber	Bed-dried Sludge	6.7	62.4 225.4	0.8 0.8	0.001	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Red Beet/ Tuber	Liquid Sludge	8.0	111.2 159.6	1.1 1.1	0.001	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Red Beet/ Tuber	Bed-dried Sludge	8.0	110.6 331	1.1 1.1	0.001	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Carrot/ Tuber	Sludge	5.3	0 58 116 232	<0.4 <0.4 0.9 0.9	0.002	*Dowdy & Larson, 1975.*
A	Radish/ Tuber	Sludge	5.3	0 58 116 232	0.5 <0.4 0.4 0.7	0.001	*Dowdy & Larson, 1975.*
A	Radish/ Tuber	Sludge	5.9-6.6	0 25 50	0.7 0.62 0.56	0.001	*Keefer et al., 1986. Blue Plains sludge.*
A	Carrot/ Tuber	Sludge	5.9-6.6	0 25 50	1.78 0.6 2.24	0.009	*Keefer et al., 1986. Blue Plains sludge.*
A	Radish/ Tuber	Sludge	5.9-7.1	0 33 66	0.7 0.58 0.86	0.002	*Keefer et al., 1986. Huntington sludge.*
A	Carrot/ Tuber	Sludge	5.9-7.1	0 33 66	1.78 1.24 1	0.001	*Keefer et al., 1986. Huntington sludge.*

TABLE C-31 (cont.)

UPTAKE OF LEAD BY ROOTS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	*Reference/ Comments*
A	Radish	Sludge	5.9-6.3	0 32 64	0.7 0.76 0.82	0.002	*Keefer et al., 1986. Martinsburg sludge.*
A	Carrot	Sludge	5.9-6.3	0 32 64	1.78 1.4 1.1	0.001	*Keefer et al., 1986. Martinsburg sludge.*
A	Radish/ Tuber	Sludge	5.9-6.6	0 55 110	0.7 0.92 0.96	0.003	*Keefer et al., 1986. Parkersburg sludge.*
A	Carrot/ Tuber	Sludge	5.9-6.6	0 55 110	1.78 1.4 1.26	0.001	*Keefer et al., 1986. Parkersburg sludge.*

TABLE C-32

UPTAKE OF LEAD BY SWEET CORN

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Sweet Corn/ Grain	Sludge	5.9-6.6	0 25 50	<0.1 <0.1 <0.1	0.001	*Keefer et al., 1986. Blue Plains sludge.*
A	Sweet Corn/ Grain	Sludge	5.9-7.1	0 33 66	<0.10 <0.10 <0.10	0.001	*Keefer et al., 1986. Huntington sludge.*
A	Sweet Corn/ Grain	Sludge	5.9-6.3	0 32 64	<0.10 <0.10 <0.10	0.001	*Keefer et al., 1986. Martinsburg sludge.*
A	Sweet Corn/ Grain	Sludge	5.9-6.6	0 55 110	<0.10 <0.10 <0.10	0.001	*Keefer et al., 1986. Parkersburg sludge.*

TABLE C-33

UPTAKE OF MERCURY BY GARDEN FRUITS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Broccoli/Fruit	Sludge	6.8	0 0.7804	0.0031 0.0169	0.018	*Cappon, C.T. 1981.*
A	Cauliflower	Sludge	6.8	0 0.7804	0.0051 0.0109	0.007	*Cappon, C.T. 1981.*
A	Cucumber/ Fruit	Sludge	6.8	0 0.7804	0.0012 0.0046	0.004	*Cappon, C.T. 1981. Slicing cucumber.*
A	Cucumber/ Fruit	Sludge	6.8	0 0.7804	0.0080 0.0047	0.001	*Cappon, C.T. 1981 Pickling cucumber.*
A	Pumpkin/ Fruit	Sludge	6.8	0 0.7804	0.0007 0.0025	0.002	*Cappon, C.T. 1981*
A	Tomato/ Fruit	Sludge	6.8	0 0.7804	0.0015 0.0075	0.008	*Cappon, C.T. 1981*
B	Tomato/ Fruit	Sludge	5.3–7.1	0 2.34	0.1 0.2	0.043	*Furr & Kelly 1976, p. 87.*

TABLE C-34

UPTAKE OF MERCURY BY GRAINS/CEREALS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	*Reference/ Comments*
B	Millet/Grain	Sludge	5.3–7.1	0 2.34	0.4 0.5	0.0427	*Furr & Kelly 1976, p. 87.*

TABLE C - 35

UPTAKE OF MERCURY BY LEAFY VEGETABLES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Cabbage	Sludge	6.8	0 0.7804	0.0029 0.0139	0.014	*Cappon, C.T. 1981.*
A	Lettuce	Sludge	6.8	0 0.7804	0.0029 0.0328	0.038	*Cappon, C.T. 1981*
A	Lettuce	Sludge	6.8	0 0.7804	0.0046 0.0405	0.046	*Cappon, C.T. 1981*
A	Parsley	Sludge	6.8	0 0.7804	0.0025 0.0077	0.007	*Cappon, C.T. 1981*
A	Swiss Chard	Sludge	5.5	0 1.3	1 0.53	0.001	*Furr & Stoewsand, 1976, p. 87.*
A	Swiss Chard	Sludge	6.5	0 1.3	1 0.93	0.001	*Furr & Stoewsand, 1976, p. 87.*
A	Swiss Chard	Sludge	5.5-6.0	0 0.09	0.2 0.1	0.001	*Chaney et al, 1978. Blue Plains sludge.*
A	Swiss Chard	Sludge	5.5-6.0	0 0.336	0.2 <0.05	0.001	*Chaney et al, 1978. Blue Plains compost.*
B	Cabbage	Sludge	5.3–7.1	0 2.62	0.3 0.2	0.001	*Furr & Kelly 1976, p. 87.*

TABLE C-36

UPTAKE OF MERCURY BY LEGUMES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Bush Bean/ Pod	Sludge	6.8	0 0.7804	0.0036 0.0045	0.001	*Cappon, C.T. 1981.*
A	Bush Bean/ Grain	Sludge	6.8	0 0.7804	0.0001 0.0004	0.001	*Cappon, C.T. 1981.*
B	Bush Bean/ Grain	Sludge	5.3–7.1	0 2.62	0.300 0.100	0.001	*Furr & Kelly 1976, p. 88*

TABLE C-37

UPTAKE OF MERCURY BY POTATOES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	*Reference/ Comments*
B	Potato/Tuber	Sludge	5.3–7.1	0	0.1	0.001	*Furr & Kelly*
				2.34	0.1		*1976, p. 87.*

TABLE C-38

UPTAKE OF MERCURY BY ROOTS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	*Reference/ Comments*
A	Beet/Tuber	Sludge	6.8	0 0.7804	0.0025 0.0072	0.006	*Cappon, C.T. 1981.*
A	Onion/Bulb	Sludge	6.8	0 0.7804	0.0067 0.0171	0.013	*Cappon, C.T. 1981*
A	Radish/Tuber	Sludge	6.8	0 0.7804	0.0013 0.0066	0.007	*Cappon, C.T. 1981 Red radish.*
A	Radish/Tuber	Sludge	6.8	0 0.7804	0.0008 0.0043	0.004	*Cappon, C.T. 1981 White radish.*
B	Carrot/Tuber	Sludge	5.3–7.1	0 2.62	0.1 0.04	0.001	*Furr & Kelly 1976, p. 87.*
B	Onion/Bulb	Sludge	5.3–7.1	0 2.34	0.1 0.2	0.043	*Furr & Kelly 1976, p. 87.*

TABLE C-39

UPTAKE OF MOLYBDENUM BY FORAGE

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Corn	Sludge	4.6-5.3	0	1.9	0.683	*Pierzynski & Jacobs*
				33	29.8		*1986. Year 1,*
				66	47		*Experiment 1.*
A	Corn	Sludge	4.7-6.4	0	7.5	2.486	*Pierzynski & Jacobs*
				63	265		*1986. Year 2,*
				141	365		*Experiment 1.*
A	Corn	Sludge	5.0-6.9	0	6	5.106	*Pierzynski & Jacobs*
				63	300		*1986. Year 3,*
				141	724		*Experiment 1.*
A	Corn/Leaf	Sludge	4.6-5.3	0	3	0.909	*Pierzynski & Jacobs*
				33	40.5		*1986. Year 1,*
				66	63		*Experiment 1.*
A	Corn/Leaf	Sludge	4.7-6.4	0	2.2	1.723	*Pierzynski & Jacobs*
				63	137		*1986. Year 2,*
				141	247		*Experiment 1.*
A	Corn/Leaf	Sludge	5.0-6.9	0	8.8	4.907	*Pierzynski & Jacobs*
				63	265		*1986. Year 3,*
				141	697		*Experiment 1.*
A	Soybean	Sludge	4.6-5.3	0	2.7	0.814	*Pierzynski & Jacobs*
				33	43.9		*1986. Year 1,*
				66	56.4		*Experiment 1.*
A	Soybean	Sludge	4.7-6.4	0	3.1	2.257	*Pierzynski & Jacobs*
				63	140		*1986. Year 2,*
				141	321		*Experiment 1.*
A	Soybean	Sludge	5.0-6.9	0	5.4	3.229	*Pierzynski & Jacobs*
				63	185		*1986. Year 3,*
				141	459		*Experiment 1.*
A	Soybean/ Leaf	Sludge	4.6-5.3	0	2.1	0.768	*Pierzynski & Jacobs*
				33	38.1		*1986. Year 1,*
				66	52.8		*Experiment 1.*
A	Soybean/ Leaf	Sludge	4.7-6.4	0	2.4	1.893	*Pierzynski & Jacobs*
				63	103		*1986. Year 2,*
				141	268		*Experiment 1.*
A	Soybean/ Leaf	Sludge	5.0-6.9	0	9.3	3.164	*Pierzynski & Jacobs*
				63	158		*1986. Year 3,*
				141	452		*Experiment 1.*

TABLE C-39 (cont.)

UPTAKE OF MOLYBDENUM BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Corn	Sludge	4.6-5.4	0 42	6.6 92.7	2.050	*Pierzynski & Jacobs 1986. Year 1, Experiment 2.*
A	Corn	Sludge	4.7-6.5	0 291 300	6.6 730 330	1.739	*Pierzynski & Jacobs 1986. Year 2, Experiment 2.*
A	Corn	Sludge	5.0-7.1	0 291 300	6.6 1300 630	3.293	*Pierzynski & Jacobs 1986. Year 3, Experiment 2.*
A	Corn/Leaf	Sludge	4.6-5.4	0 42	6.4 122	2.752	*Pierzynski & Jacobs 1986. Year 1, Experiment 2.*
A	Corn/Leaf	Sludge	4.7-6.5	0 291 300	6.4 462 197	1.072	*Pierzynski & Jacobs 1986. Year 2, Experiment 2.*
A	Corn/Leaf	Sludge	5.0-7.1	0 291 300	6.4 804 130	1.506	*Pierzynski & Jacobs 1986. Year 3, Experiment 2.*
A	Bromegrass	Sludge	N.R.(3)	0 4.08	0.33 1.85	0.375	*Soon & Bates, 1985. Used means of cuts 1 & 2. Calcium enriched sludge.*
A	Bromegrass	Sludge	N.R.	0 9.44	0.33 1.4	0.113	*Soon & Bates, 1985. Used means of cuts 1 & 2. Ferric chloride enriched sludge.*
A	Bromegrass	Sludge	N.R.	0 10.8	0.33 1.155	0.076	*Soon & Bates, 1985. Used means of cuts 1 & 2. Aluminum sulfate enriched sludge.*
A	Corn	Sludge	N.R.	0 9.68	0.24 0.67	0.044	*Soon & Bates, 1985. Connestoga. Calcium enriched sludge.*
A	Corn	Sludge	N.R.	0 10	0.24 0.28	0.004	*Soon & Bates, 1985. Connestoga. Ferric chloride enriched sludge.*

TABLE C-39 (cont.)

UPTAKE OF MOLYBDENUM BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Corn	Sludge	N.R.	0 12.16	0.24 0.28	0.003	*Soon & Bates, 1985. Connestoga. Aluminum sulfate enriched sludge.*
A	Corn/ Forage	Sludge	N.R.	0 6.08	1.01 3.67	0.438	*Soon & Bates. Caledon. Calcium enriched sludge.*
A	Corn/ Forage	Sludge	N.R.	0 11.92	1.01 0.65	0.001	*Soon & Bates. Caledon. Ferric chloride enriched sludge.*
A	Corn/ Forage	Sludge	N.R.	0 12.72	1.01 0.72	0.001	*Soon & Bates. Caledon. Aluminum sulfate enriched sludge.*
B	Alfalfa	Sludge	6.0-6.6	40 88 188	201 486 659	2.887	*Pierzynski & Jacobs 1986. 2nd cutting.*
B	Alfalfa	Sludge	7.0-7.5	40 88 188	487 876 895	2.367	*Pierzynski & Jacobs 1986. 2nd cutting.*
B	Alfalfa	Sludge	7.7-8.2	40 88 188	483 773 944	2.901	*Pierzynski & Jacobs 1986. 2nd cutting.*

TABLE C-40

UPTAKE OF MOLYBDENUM BY GRAINS/CEREALS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Corn/Grain	Sludge	4.6-5.3	0 33 66	0.2 1.5 2	0.027	*Pierzynski & Jacobs 1986. Year 1, Experiment 1.*
A	Corn/Grain	Sludge	4.7-6.4	0 63 141	0.4 3.7 5.7	0.037	*Pierzynski & Jacobs 1986. Year 2, Experiment 1.*
A	Corn/Grain	Sludge	5.0-6.9	0 63 141	0.6 3.6 6.9	0.045	*Pierzynski & Jacobs 1986. Year 3, Experiment 1.*
A	Corn/Grain	Sludge	4.6-5.4	0 42	0.5 3.6	0.074	*Pierzynski & Jacobs 1986. Year 1, Experiment 2.*
A	Corn/Grain	Sludge	4.7-6.5	0 291 300	0.5 12 6.3	0.029	*Pierzynski & Jacobs 1986. Year 2, Experiment 2.*
A	Corn/Grain	Sludge	5.0-7.1	0 291 300	0.5 16.5 9.2	0.041	*Pierzynski & Jacobs 1986. Year 3, Experiment 2.*
A	Corn/Grain	Sludge	N.R.	0 9.68	0.13 0.25	0.012	*Soon & Bates, 1985. Connestoga. Calcium enriched sludge.*
A	Corn/Grain	Sludge	N.R.	0 10	0.13 0.17	0.004	*Soon & Bates, 1985. Connestoga. Ferric chloride enriched sludge.*
A	Corn/Grain	Sludge	N.R.	0 12.2	0.13 0.18	0.004	*Soon & Bates, 1985. Connestoga. Aluminum sulfate enriched sludge.*
A	Corn	Sludge	N.R.	0 6.08	0.25 0.73	0.079	*Soon & Bates. Caledon. Calcium enriched sludge.*
A	Corn	Sludge	N.R.	0 11.92	0.25 0.25	0.001	*Soon & Bates. Caledon. Ferric chloride enriched sludge.*

TABLE C-40 (cont.)

UPTAKE OF MOLYBDENUM BY GRAINS/CEREALS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Corn	Sludge	N.R.	0	0.25	0.003	*Soon & Bates. Caledon. Aluminum sulfate enriched sludge.*
				12.72	0.29		
B	Corn	Sludge	6.0-6.6	40	74	1.482	*Pierzynski & Jacobs 1986. 2nd cutting.*
				88	315		
				188	329		
B	Corn/Grain	Sludge	7.0-7.5	40	260	0.674	*Pierzynski & Jacobs 1986. 2nd cutting.*
				88	403		
				188	383		
B	Corn/Grain	Sludge	7.7-8.2	40	273	0.346	*Pierzynski & Jacobs 1986. 2nd cutting.*
				88	470		
				188	362		

TABLE C-41

UPTAKE OF MOLYBDENUM BY LEGUMES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Soybean/ Grain	Sludge	4.6-5.3	0 33 66	14.3 70.9 122	1.632	*Pierzynski & Jacobs, 1986. Year 1, Experiment 1.*
A	Soybean/ Grain	Sludge	4.7-6.4	0 63 141	8.9 107 241	1.649	*Pierzynski & Jacobs, 1986. Year 2, Experiment 1.*
A	Soybean/ Grain	Sludge	5.0-6.9	0 63 141	19.9 114 242	1.578	*Pierzynski & Jacobs, 1986. Year 3, Experiment 1.*
B	Soybean/ Grain	Sludge	6.0-6.6	40 88 188	300 800 986	4.213	*Pierzynski & Jacobs, 1986. 2nd cutting.*
B	Soybean/ Grain	Sludge	7.0-7.5	40 88 188	736 1010 1070	2.005	*Pierzynski & Jacobs, 1986. 2nd cutting.*
B	Soybean/ Grain	Sludge	7.7-8.2	40 88 188	391 585 692	1.887	*Pierzynski & Jacobs, 1986. 2nd cutting.*

TABLE C-42

UPTAKE OF NICKEL BY FORAGE

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Natural Forage	Sludge	N.R.	9.75 15	<0.57 2.8	0.425	*Baxter et al., 1983* *Means reported*
A	Reed Canary Grass	Sludge	6.2-7.4	0 1.3	2.4 2.6	0.154	*Duncomb et al., 1982.*
A	Corn/Forage	Sludge	6.2-7.4	0 1.1	1 0.9	0.001	*Duncomb et al., 1982.*
A	Corn	Sludge	6.6	0 8.6 17.2	0.23 0.36 0.54	0.018	*Rappaport et al., 1987.* *Year 1.*
A	Corn	Sludge	6.6	0 8.6 17.2	0.75 1.32 1.33	0.034	*Rappaport et al., 1987.* *Year 1.*
A	Corn/Forage	Sludge	6.6	0 8.6 17.2	0.54 0.66 0.66	0.007	*Rappaport et al., 1987.* *Year 2.*
A	Barley	Sludge	6.6	0 8.6 17.2	0.51 0.92 0.74	0.013	*Rappaport et al., 1987.* *Year 2.*
A	Ryegrass	Liquid Sludge	6.5	71.4 84.7	3.2 7.6	0.331	*Carlton Smith, 1988.* *Mean of 5 years used.* *Sandy loam.*
A	Ryegrass	Bed-dried Sludge	6.5	70.3 108.5	3.2 7.8	0.12	*Carlton Smith, 1988.* *Mean of 4 years used.* *Sandy loam.*
A	Ryegrass	Liquid Sludge	6.7	85.2 101.6	3.8 7.7	0.238	*Carlton Smith, 1988.* *Mean of 5 years used.* *Clay.*
A	Ryegrass	Bed-dried Sludge	6.7	85.1 140.9	3.7 7.7	0.072	*Carlton Smith, 1988.* *Mean of 4 years used.* *Clay.*
A	Ryegrass	Liquid Sludge	8.0	23.7 40.2	1.6 3.9	0.139	*Carlton Smith, 1988.* *Mean of 5 years used.* *Calcareous loam.*
A	Ryegrass	Bed-dried Sludge	8.0	23.9 126.9	1.5 14	0.121	*Carlton Smith, 1988.* *Mean of 5 years used.* *Calcareous loam.*

TABLE C-42 (cont.)

UPTAKE OF NICKEL BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
B	Rape	Sludge	5.6	0 2.3 4.6	1.34 0.46 0.93	0.001	*Narwal et al, 1983. First harvest.*
B	Rape	Sludge	6	0 2.31 4.62	0.24 0.3 0.38	0.03	*Narwal et al., 1983. First harvest.*
B	Rape	Sludge	7.5	0 2.31 4.62	0.11 0.3 0.46	0.076	*Narwal et al., 1983. First harvest.*
B	Rape	Sludge	5.6	0 2.31 4.62	3.75 1.42 1.73	0.001	*Narwal et al., 1983. Second harvest.*
B	Rape	Sludge	6	0 2.31 4.62	1.3 0.62 0.81	0.001	*Narwal et al., 1983. Second harvest.*
B	Rape	Sludge	7.5	0 2.31 4.62	0.49 0.38 0.37	0.001	*Narwal et al., 1983. Second harvest.*

TABLE C-43

UPTAKE OF NICKEL BY GARDEN FRUITS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Tomato/Fruit	Sludge	5.9-6.6	0	0.61	0.001	*Keefer et al., 1986.*
				8	0.65		*Blue Plains sludge.*
				16	0.35		
A	Tomato/Fruit	Sludge	5.9-6.6	0	0.43	0.001	*Keefer et al., 1986.*
				8	0.6		*Blue Plains sludge.*
				16	0.4		
A	Tomato/Fruit	Sludge	5.9-7.1	0	0.61	0.001	*Keefer et al., 1986.*
				1270	0.5		*Huntington sludge.*
				2540	0.5		*Early fruiting.*
A	Tomato/Fruit	Sludge	5.9-7.1	0	0.43	0.001	*Keefer et al., 1986.*
				1270	0.55		*Huntington sludge.*
				2540	0.45		*Late fruiting.*
A	Tomato/Fruit	Sludge	5.9-6.9	0	0.61	0.083	*Keefer et al., 1986.*
				2	0.6		*Martinsburg sludge.*
				4	0.94		*Early fruiting.*
A	Tomato/Fruit	Sludge	5.9-6.9	0	0.43	0.093	*Keefer et al., 1986.*
				2	0.65		*Martinsburg sludge.*
				4	0.8		*Late fruiting.*
A	Tomato/Fruit	Sludge	5.9-6.3	0	0.61	0.003	*Keefer et al., 1986.*
				24	0.6		*Parkersburg sludge.*
				48	0.75		*Early fruiting.*
A	Tomato/Fruit	Sludge	5.9-6.3	0	0.43	0.001	*Keefer et al., 1986.*
				24	0.45		*Parkersburg sludge.*
				48	0.4		
A	Celery	Sludge	7.3	0	<0.3	0.001	*Peterson et al., 1989.*
				2.856	<0.3		
				5.712	<0.3		
				11.424	<0.3		
A	Tomato/Fruit	Sludge	7.3	0	<0.3	0.001	*Peterson et al., 1989.*
				2.856	<0.3		
				5.712	<0.3		
				11.424	<0.3		
A	Tomato/Fruit	Sludge	N.R.	0	1.1	0.022	*Lue-Hing et al, 1984.*
				9	1.3		*1977 data used.*
				17	1.1		*Nu-Earth.*
				34	2.2		
				43	1.8		

TABLE C-43 (cont.)

UPTAKE OF NICKEL BY GARDEN FRUITS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
B	Green Pepper/ Fruit	Sludge	6.4	0 38	0.4 2.3	0.05	*Furr et al., 1981.*
B	Green Pepper/ Fruit	Sludge	6.9	0 38	0.4 1.5	0.029	*Furr et al., 1981.*
B	Pea/Grain	Sludge	6.4	0 38	1.7 5.3	0.095	*Furr et al., 1981.*
B	Pea/Grain	Sludge	6.9	0 38	1.3 2.4	0.029	*Furr et al., 1981.*

TABLE C-44

UPTAKE OF NICKEL BY GRAINS/CEREALS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Corn/Grain	Sludge	6.2-7.4	0 1.1	0.6 0.4	0.001	*Duncomb et al., 1982*
A	Corn/Grain	Sludge	6.6	0 8.6 17.2	0.39 1.04 1.34	0.055	*Rappaport et al., 1987. Year 1.*
A	Corn/Grain	Sludge	6.6	0 8.6 17.2	0.11 0.34 0.37	0.015	*Rappaport et al., 1987. Year 2.*
A	Corn	Sludge	6.6	0 8.6 17.2	0.14 0.18 0.18	0.002	*Rappaport et al., 1987. Year 2.*
A	Wheat/Grain	Liquid Sludge	6.5	71.4 84.7	1.5 1.8	0.023	*Carlton Smith, 1988. Mean of 5 years used. Sandy loam.*
A	Wheat/Grain	Bed-dried Sludge	6.5	70.3 108.5	1.3 1.5	0.005	*Carlton Smith, 1988. Mean of 4 years used. Sandy loam.*
A	Wheat/Grain	Liquid Sludge	6.7	85.2 101.6	1.6 1.4	0.001	*Carlton Smith, 1988. Mean of 5 years used. Clay.*
A	Wheat/Grain	Bed-dried Sludge	6.7	85.1 140.9	0.9 1.4	0.009	*Carlton Smith, 1988. Mean of 4 years used. Clay.*
A	Wheat/Grain	Liquid Sludge	8.0	23.7 40.2	0.8 0.9	0.006	*Carlton Smith, 1988. Mean of 5 years used. Calcareous loam.*
A	Wheat/Grain	Bed-dried Sludge	8.0	23.9 126.9	0.9 1.1	0.002	*Carlton Smith, 1988. Mean of 4 years used. Calcareous loam.*

TABLE C-43 (cont.)

UPTAKE OF NICKEL BY GARDEN FRUITS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
B	Green Pepper/ Fruit	Sludge	6.4	0 38	0.4 2.3	0.05	*Furr et al., 1981.*
B	Green Pepper/ Fruit	Sludge	6.9	0 38	0.4 1.5	0.029	*Furr et al., 1981.*
B	Pea/Grain	Sludge	6.4	0 38	1.7 5.3	0.095	*Furr et al., 1981.*
B	Pea/Grain	Sludge	6.9	0 38	1.3 2.4	0.029	*Furr et al., 1981.*

TABLE C-44

UPTAKE OF NICKEL BY GRAINS/CEREALS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Corn/Grain	Sludge	6.2-7.4	0 1.1	0.6 0.4	0.001	*Duncomb et al., 1982*
A	Corn/Grain	Sludge	6.6	0 8.6 17.2	0.39 1.04 1.34	0.055	*Rappaport et al., 1987. Year 1.*
A	Corn/Grain	Sludge	6.6	0 8.6 17.2	0.11 0.34 0.37	0.015	*Rappaport et al., 1987. Year 2.*
A	Corn	Sludge	6.6	0 8.6 17.2	0.14 0.18 0.18	0.002	*Rappaport et al., 1987. Year 2.*
A	Wheat/Grain	Liquid Sludge	6.5	71.4 84.7	1.5 1.8	0.023	*Carlton Smith, 1988. Mean of 5 years used. Sandy loam.*
A	Wheat/Grain	Bed-dried Sludge	6.5	70.3 108.5	1.3 1.5	0.005	*Carlton Smith, 1988. Mean of 4 years used. Sandy loam.*
A	Wheat/Grain	Liquid Sludge	6.7	85.2 101.6	1.6 1.4	0.001	*Carlton Smith, 1988. Mean of 5 years used. Clay.*
A	Wheat/Grain	Bed-dried Sludge	6.7	85.1 140.9	0.9 1.4	0.009	*Carlton Smith, 1988. Mean of 4 years used. Clay.*
A	Wheat/Grain	Liquid Sludge	8.0	23.7 40.2	0.8 0.9	0.006	*Carlton Smith, 1988. Mean of 5 years used. Calcareous loam.*
A	Wheat/Grain	Bed-dried Sludge	8.0	23.9 126.9	0.9 1.1	0.002	*Carlton Smith, 1988. Mean of 4 years used. Calcareous loam.*

TABLE C-45

UPTAKE OF NICKEL BY LEAFY VEGETABLES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Swiss Chard	Nu-Earth	`5.7-6.3	0 0.6	2.9 11.9	15.000	*Chaney et al., 1982*
A	Swiss Chard	Nu-Earth	6.7	0 0.6	1.7 6	7.167	*Chaney et al., 1982*
A	Collard Greens	Heat-Treated Sludge	`5.5-5.6	0 8	2.9 2.4	0.001	*Chaney et al., 1982*
A	Collard Greens	Heat-Treated Sludge	`6.4-6.3	0 8	1.8 1.5	0.001	*Chaney et al., 1982*
A	Collard Greens	Nu-Earth	`5.5-6.3	0 0.6	2.9 4.2	2.167	*Chaney et al., 1982*
A	Collard Greens	Nu-Earth	`6.4-6.8	0 0.6	1.8 3.9	3.500	*Chaney et al., 1982*
A	Lettuce	Heat-Treated Sludge	`5.3-5.4	0 8	1.8 2.4	0.075	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Heat-Treated Sludge	`6.2-5.4	0 8	1.6 0.8	0.001	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Nu-Earth	`5.3-5.6	0 0.6	1.8 4.5	4.500	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Nu-Earth	`6.2-6.6	0 0.6	1.6 1.6	0.001	*Chaney et al., 1982 Romaine Lettuce*
A	Swiss Chard	Heat-Treated Sludge	5.7	0 8	2.9 8.3	0.675	*Chaney et al., 1982*
A	Swiss Chard	Heat-Treated Sludge	`6.7-6.8	0 8	1.7 1.5	0.001	*Chaney et al., 1982*
A	Cabbage	Sludge	5.9-6.6	0 8 16	0.2 0.22 0.6	0.025	*Keefer et al., 1986. Blue Plains sludge.*
A	Cabbage	Sludge	5.9-7.1	0 1270 2540	0.2 0.22 0.26	0.001	*Keefer et al., 1986. Huntington sludge.*
A	Cabbage	Sludge	5.9-6.9	0 2 4	0.2 0.3 0.22	0.005	*Keefer et al., 1986. Martinsburg sludge.*

TABLE C-45 (cont.)

UPTAKE OF NICKEL BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Cabbage	Sludge	5.9-6.3	0	0.2	0.003	*Keefer et al., 1986.*
				24	0.2		*Parkersburg sludge.*
				48	0.32		
A	Cabbage	Sludge	7.3	0	<0.3	0.002	*Peterson et al., 1989.*
				2.856	1.2		
				5.712	0.5		
				11.424	0.6		
A	Lettuce	Sludge	7.3	0	2	0.001	*Peterson et al., 1989.*
				2.856	2.6		
				5.712	1.9		
				11.424	1.8		
A	Lettuce	Liquid Sludge	6.5	71.4	1.3	0.023	*Carlton Smith, 1988.*
				84.7	1.6		*Mean of 5 years used.*
							Sandy loam.
A	Lettuce	Bed-dried	6.5	70.3	0.9	0.001	*Carlton Smith, 1988.*
		Sludge		108.5	0.9		*Mean of 4 years used.*
							Sandy loam.
A	Lettuce	Liquid Sludge	6.7	85.2	2.3	0.001	*Carlton Smith, 1988.*
				101.6	2.3		*Mean of 5 years used.*
							Clay.
A	Lettuce	Bed-dried	6.7	85.1	1.7	0.018	*Carlton Smith, 1988.*
		Sludge		140.9	2.7		*Mean of 4 years used.*
							Clay.
A	Lettuce	Liquid Sludge	8.0	23.7	1.2	0.018	*Carlton Smith, 1988.*
				40.2	1.5		*Mean of 5 years used.*
							Calcareous loam.
A	Lettuce	Bed-dried	8.0	23.9	1.3	0.012	*Carlton Smith, 1988.*
		Sludge		126.9	2.5		*Mean of 4 years used.*
							Calcareous loam.
A	Cabbage	Liquid Sludge	6.5	71.4	4	0.053	*Carlton Smith, 1988.*
				84.7	4.7		*Mean of 5 years used.*
							Sandy loam.
A	Cabbage	Bed-dried	6.5	70.3	3.9	0.001	*Carlton Smith, 1988.*
		Sludge		108.5	3.6		*Mean of 4 years used.*
							Sandy loam.
A	Cabbage	Liquid Sludge	6.7	85.2	2	0.110	*Carlton Smith, 1988.*
				101.6	3.8		*Mean of 5 years used.*
							Clay.
A	Cabbage	Bed-dried	6.7	85.1	2.1	0.030	*Carlton Smith, 1988.*
		Sludge		140.9	3.8		*Mean of 4 years used.*

TABLE C-45 (cont.)

UPTAKE OF NICKEL BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
							Clay.
A	Cabbage	Liquid Sludge	8.0	23.7 40.2	0.9 1.6	0.042	Carlton Smith, 1988. Mean of 5 years used. Calcareous loam.
A	Cabbage	Bed-dried Sludge	8.0	23.9 126.9	1 3.2	0.021	Carlton Smith, 1988. Mean of 4 years used. Calcareous loam.
A	Spinach	Sludge	N.R.(3)	0 9 17 34 43	2.9 3 4.7 4.8 4.2	0.037	Lue-Hing et al, 1984. 1977 data used. Nu-Earth.
A	Swiss Chard	Sludge	N.R.	0 9 17 34 43	2 1.4 1.7 2.8 4	0.051	Lue-Hing et al, 1984. 1977 data used. Nu-Earth.
A	Romaine	Sludge	5.75-7.7	0 3.8	1.7 0.7	0.001	Chaney et al., 1982. Limed raw sludge.
A	Romaine	Sludge	5.75-7.7	0 3.4	1.7 0.5	0.001	Chaney et al., 1982. Digested sludge.
A	Romaine	Sludge	5.75-7.6	0 45	1.7 0.6	0.001	Chaney et al., 1982. Compost sludge.
A	Romaine	Sludge	5.75-6.9	0 45	1.7 0.6	0.001	Chaney et al., 1982. Compost sludge.
A	Romaine	Sludge	5.75-5.8	0 8.3	1.7 1.6	0.001	Chaney et al., 1982. Heat treated sludge.
A	Romaine	Sludge	5.75-6.1	0 59	1.7 3.05	0.023	Chaney et al., 1982. Nu-Earth.
A	Swiss Chard	Sludge	5.75-7.7	0 3.8	2.3 0.8	0.001	Chaney et al., 1982. Limed raw sludge.
A	Swiss Chard	Sludge	5.75-7.6	0 3.4	2.3 1.2	0.001	Chaney et al., 1982. Digested sludge.
A	Swiss Chard	Sludge	5.75-7.7	0 45	2.3 0.8	0.001	Chaney et al., 1982. Composted sludge.
A	Swiss Chard	Sludge	5.75-6.9	0 8.3	2.3 4.9	0.313	Chaney et al., 1982. Heat treated sludge.

TABLE C-45 (cont.)

UPTAKE OF NICKEL BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Swiss Chard	Sludge	5.75-5.8	0 59	2.3 8.95	0.113	*Chaney et al., 1982. Nu Earth sludge.*
A	Collard Greens	Sludge	5.75-7.7	0 3.8	5 5.6	0.158	*Chaney et al., 1982. Limed raw sludge*
A	Collard Greens	Sludge	5.75-7.6	0 3.4	5 6.6	0.471	*Chaney et al., 1982. Digested sludge.*
A	Collard Greens	Sludge	5.75-6.9	0 45	5 6.3	0.029	*Chaney et al., 1982. Composted sludge.*
A	Collard Greens	Sludge	5.75-5.8	0 83	5 7.2	0.027	*Chaney et al., 1982. Heat treated sludges*
A	Collard Greens	Sludge	5.75-6.1	0 59	5 6.15	0.019	*Chaney et al., 1982. Nu Earth sludge.*
B	Lettuce	Sludge	N.R.	0 1.3 2.6 5.2	2.1 2.5 2.2 2	0.001	*Hue et al., 1988. Akaka Andept-soil type.*
B	Lettuce	Sludge	N.R.	0 1.3 2.6 5.2	5.1 6.9 7.3 5.8	0.068	*Hue et al., 1988. Lualualei Vertisol-soil type.*
B	Lettuce	Sludge	N.R.	0 1.3 2.6 5.2	4.8 10.4 12.4 17.2	2.251	*Hue et al., 1988. Wahiawa Oxisol-soil type.*
B	Lettuce	Sludge	6.4	0 38	0.6 3	0.063	*Furr et al., 1981.*
B	Lettuce	Sludge	6.9	0 38	0.8 1.7	0.024	*Furr et al., 1981.*
B	Spinach	Sludge	6.4	0 38	1 3.9	0.076	*Furr et al., 1981.*
B	Spinach	Sludge	6.9	0 38	0.7 3	0.061	*Furr et al., 1981.*

TABLE C-46

UPTAKE OF NICKEL BY LEGUMES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Green Bean/ Pod & Seed	Sludge	5.9-6.6	0 8 16	0.24 0.26 0.18	0.001	*Keefer et al., 1986. Blue Plains sludge.*
A	Green Bean/ Pod & Seed	Sludge	5.9-7.1	0 1270 2540	0.24 0.14 0.24	0.001	*Keefer et al., 1986. Huntington sludge.*
A	Green Bean/ Pod & Seed	Sludge	5.9-6.9	0 2 4	0.24 0.3 0.74	0.125	*Keefer et al., 1986. Martinsburg sludge.*
A	Green Bean/ Pod & Seed	Sludge	5.9-6.3	0 24 48	0.24 0.3 0.48	0.005	*Keefer et al., 1986. Parkersburg sludge.*
A	Bean/Grain	Sludge	7.3	0 2.856 5.712 11.424	1.5 2.3 2.1 2.7	0.09	*Peterson et al., 1989.*
A	Green Bean/ Pod & Seed	Sludge	N.R.	0 9 17 34 43	2.1 2.8 4.4 6.1 7.1	0.119	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*
A	Soybean/ Grain	Limed Digested Sludge	7.3-7.5	22.6 22.6 20.6 19.2 23.8 24.6	7.41 2 8.25 7.16 10.37 7.48	0.23	*Chaney et al., 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.*
A	Soybean/ Grain	Limed Raw Sludge	7.3-7.7	22.6 22.4 23.8 22	7.41 6.27 7.29 6.42	0.502	*Chaney et al., 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.*
A	Soybean/ Grain	Raw Sludge Compost	6.6-7.3	22.6 24 28.2 37.2 56.6 80	7.41 8.72 6.69 7.47 6.96 4.15	0.001	*Chaney et al., 1977. For control, used calcareous soil data. Chaney's values are means of 3 reps.*

TABLE C-46 (cont.)

UPTAKE OF NICKEL BY LEGUMES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Soybean/ Grain	Heat Treated Sludge High pH	5.9-6.0	24.6 28 20.4 20.4	8.13 7.21 5.69 6.4	0.198	*Chaney et al., 1977. Chaney's values are means of 3 reps.*
A	Soybean/ Grain	Heat Treated Sludge Low pH	5.3-5.6	21.6 23.8 26 25.4	6.81 9.49 7.74 7.78	0.152	*Chaney et al., 1977. Chaney's values are means of 3 reps.*

TABLE C-47

UPTAKE OF NICKEL BY POTATOES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Potato/Tuber	Liquid Sludge	6.5	71.4 84.7	1.5 1.7	0.015	*Carlton Smith, 1988. Mean of 5 years used. Sandy loam.*
A	Potato/Tuber	Bed-dried Sludge	6.5	70.3 108.5	1.5 1.7	0.005	*Carlton Smith, 1988. Mean of 4 years used. Sandy loam.*
A	Potato/Tuber	Liquid Sludge	6.7	85.2 101.6	1.2 1.7	0.03	*Carlton Smith, 1988. Mean of 5 years used. Clay.*
A	Potato/Tuber	Bed-dried Sludge	6.7	85.1 140.9	1 1.4	0.007	*Carlton Smith, 1988. Mean of 4 years used. Clay.*
A	Potato/Tuber	Liquid Sludge	8.0	23.7 40.2	0.6 0.6	0.001	*Carlton Smith, 1988. Mean of 5 years used. Calcareous loam.*
A	Potato/Tuber	Bed-dried Sludge	8.0	23.9 126.9	0.7 0.8	0.001	*Carlton Smith, 1988. Mean of 4 years used. Calcareous loam.*
B	Sweet Potato/ Tuber	Sludge	6.4	0 38	0.3 1.2	0.024	*Furr et al., 1981.*
B	Sweet Potato/ Tuber	Sludge	6.9	0 38	0.1 0.5	0.011	*Furr et al., 1981.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	368	4	0.011	*Harris et al, 1978. Vanessa-potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	368	4.75	0.013	*Harris et al, 1978. Portland Javelin-potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	368	4.25	0.012	*Harris et al, 1978. Home Guard-potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	368	4.01	0.011	*Harris et al, 1978. Desiree-potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	368	3.47	0.009	*Harris et al, 1978. King Edward-potato type.*

TABLE C-47 (cont.)

UPTAKE OF NICKEL BY POTATOES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
C	Potato/Tuber	Organic, metal contaminated soil	6.6	368	5.46	0.015	*Harris et al, 1978. Majestic-potato type.*

TABLE C-48

UPTAKE OF NICKEL BY ROOTS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Radish/Tuber	Sludge	5.9-6.6	0 8 16	0.92 1.34 0.7	0.001	*Keefer et al., 1986. Blue Plains sludge.*
A	Carrot/Tuber	Sludge	5.9-6.6	0 8 16	0.4 0.4 0.4	0.001	*Keefer et al., 1986. Blue Plains sludge.*
A	Radish/Tuber	Sludge	5.9-7.1	0 1270 2540	0.92 1.08 1.92	0.001	*Keefer et al., 1986. Huntington sludge.*
A	Carrot/Tuber	Sludge	5.9-7.1	0 1270 2540	0.4 0.4 0.4	0.001	*Keefer et al., 1986. Huntington sludge.*
A	Radish/Tuber	Sludge	5.9-6.9	0 2 4	0.92 0.68 0.72	0.001	*Keefer et al., 1986. Martinsburg sludge.*
A	Carrot/Tuber	Sludge	5.9-6.9	0 2 4	0.4 0.4 0.4	0.001	*Keefer et al., 1986. Martinsburg sludge.*
A	Radish/Tuber	Sludge	5.9-6.3	0 24 48	0.92 0.58 0.64	0.001	*Keefer et al., 1986. Parkersburg sludge.*
A	Carrot/Tuber	Sludge	5.9-6.3	0 24 48	0.4 0.4 0.4	0.001	*Keefer et al., 1986. Parkersburg sludge.*
A	Red Beet/Tuber	Sludge	6.2	0 285 570 1140	2.5 2.5 3.8 6.3	0.004	*Williams, 1977.*
A	Red Beet/Tuber	Sludge	7	0 285 570 1140	1.3 2.5 6.3 5	0.003	*Williams, 1977.*
A	Onion/Bulb	Sludge	6.3	0 285 570	6.3 16.3 23.8	0.031	*Williams, 1977.*

TABLE C-48 (cont.)

UPTAKE OF NICKEL BY ROOTS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Onion/Bulb	Sludge	6.8	0 285 570 1140	2.5 6.3 7.5 18.8	0.014	*Williams, 1977.*
A	Onion/Bulb	Sludge	7.3	0 2.856 5.712 11.424	<0.3 <0.3 <0.3 <0.3	0.001	*Peterson et al., 1989.*
A	Red Beet/Tuber	Liquid Sludge	6.5	71.4 84.7	3.4 3.9	0.038	*Carlton Smith, 1988. Mean of 5 years used. Sandy loam.*
A	Red Beet/Tuber	Bed-dried Sludge	6.5	70.3 108.5	2.2 2.7	0.013	*Carlton Smith, 1988. Mean of 4 years used. Sandy loam.*
A	Red Beet/Tuber	Liquid Sludge	6.7	85.2 101.6	1.6 2.7	0.067	*Carlton Smith, 1988. Mean of 5 years used. Clay.*
A	Red Beet/Tuber	Bed-dried Sludge	6.7	85.1 140.9	1.6 2	0.007	*Carlton Smith, 1988. Mean of 4 years used. Clay.*
A	Red Beet/Tuber	Liquid Sludge	8.0	23.7 40.2	1 1	0.001	*Carlton Smith, 1988. Mean of 5 years used. Calcareous loam.*
A	Red Beet/Tuber	Bed-dried Sludge	8.0	23.9 126.9	1.1 1.1	0.001	*Carlton Smith, 1988. Mean of 4 years used. Calcareous loam.*
A	Beet/Tuber	Sludge	N.R.	0 9 17 34 43	0.4 0.6 0.6 0.9 1.6	0.027	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth*
A	Carrot/Tuber	Sludge	N.R.	0 9 17 34 43	1.1 0.9 1.5 1.7 2.7	0.036	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*
B	Kohlrabi/Tuber	Sludge	6.4	0 38	0.9 5.3	0.116	*Furr et al., 1981.*

TABLE C-48 (cont.)

UPTAKE OF NICKEL BY ROOTS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	*Reference/ Comments*
B	Kohlrabi/Tuber	Sludge	6.9	0 38	0.2 1.1	0.024	*Furr et al., 1981.*
B	Turnip/Tuber	Sludge	6.4	0 38	0.7 3	0.061	*Furr et al., 1981.*
B	Turnip/Tuber	Sludge	6.9	0 38	0.2 0.9	0.018	*Furr et al., 1981.*

TABLE C-49

UPTAKE OF NICKEL BY SWEET CORN

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	*Reference/ Comments*
A	Sweet Corn/ Grain	Sludge	5.9-6.6	0	0.17	0.001	*Keefer et al., 1986. Blue Plains sludge.*
				8	0.52		
				16	0.1		
A	Sweet Corn/ Grain	Sludge	5.9-7.1	0	0.17	0.001	*Keefer et al., 1986. Huntington sludge.*
				1270	0.14		
				2540	0.42		
A	Sweet Corn	Sludge	5.9-6.9	0	0.17	0.001	*Keefer et al., 1986. Martinsburg sludge.*
				2	0.12		
				4	0.14		
A	Sweet Corn/ Grain	Sludge	5.9-6.3	0	0.17	0.001	*Keefer et al., 1986. Parkersburg sludge.*
				24	0.32		
				48	0.12		

TABLE C-50

UPTAKE OF SELENIUM BY FORAGE

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Barley	Sludge	5.8-7.0	0 3.64	<0.05 0.08	0.008	*Logan et al., 1987. Greenfield.*
A	Barley	Sludge	7	0 3.6	0.06 0.05	0.001	*Logan et al., 1987. Domino.*
B	Millet	Sludge	6.8	0 1.446	0.04 0.06	0.014	*Furr et al, 1980. Kalamazoo sludge/ Teel soil.*
B	Millet	Sludge	5.5	0 1.111	0.03 0.03	0.001	*Furr et al, 1980. Indianapolis sludge/ Darien Soil.*

TABLE C-51

UPTAKE OF SELENIUM BY GARDEN FRUITS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	*Reference/ Comments*
A	Broccoli/Fruit	Sludge	6.8	0 0.7804	0.016 0.026	0.013	Cappon, C.T. 1981.
A	Cauliflower	Sludge	6.8	0 0.7804	0.025 0.0348	0.012	Cappon, C.T. 1981.
A	Cucumber/Fruit	Sludge	6.8	0 0.7804	0.006 0.0102	0.006	Cappon, C.T. 1981. Slicing cucumber.
A	Cucumber/Fruit	Sludge	6.8	0 0.7804	0.005 0.0076	0.004	Cappon, C.T. 1981. Pickling cucumber.
A	Pumpkin/Fruit	Sludge	6.8	0 0.7804	0.012 0.0183	0.008	Cappon, C.T. 1981.
A	Tomato/Fruit	Sludge	6.8	0 0.7804	0.026 0.0564	0.039	Cappon, C.T. 1981.
B	Tomato/Tuber	Sludge	6.8	0 1.446	0.03 0.08	0.035	Furr et al, 1980. Kalamazoo sludge/ Teel soil.
B	Tomato/Fruit	Sludge	5.5	0 1.111	0.01 0.02	0.009	Furr et al, 1980. Indianapolis sludge/ Darien Soil.

TABLE C-52

UPTAKE OF SELENIUM BY GRAINS/CEREALS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Barley/Grain	Sludge	5.8-7.0	0 3.6	0.05 0.05	0.001	*Logan et al., 1987. Greenfield.*
A	Barley/Grain	Sludge	7	0 3.6	<0.05 <0.05	0.001	*Logan et al., 1987. Domino.*
B	Millet/Grain	Sludge	6.8	0 1.446	0.03 0.11	0.055	*Furr et al, 1980. Kalamazoo sludge/ Teel soil.*
B	Millet/Grain	Sludge	5.5	0 1.111	0.02 0.03	0.009	*Furr et al, 1980. Indianapolis sludge/ Darien Soil.*

TABLE C-53

UPTAKE OF SELENIUM BY LEAFY VEGETABLES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	*Reference/ Comments*
A	Swiss Chard	Sludge	6.1-7.8	0 4.17 8.34	0.06 0.08 0.08	0.002	*Logan et al., 1987. Romona.*
A	Cabbage	Sludge	6.8	0 0.7804	0.0120 0.0348	0.029	*Cappon, C.T. 1981.*
A	Lettuce	Sludge	6.8	0 0.7804	0.0150 0.0234	0.011	*Cappon, C.T. 1981.*
A	Lettuce	Sludge	6.8	0 0.7804	0.0121 0.0414	0.038	*Cappon, C.T. 1981.*
A	Parsley	Sludge	6.8	0 0.7804	0.0048 0.0043	0.001	*Cappon, C.T. 1981.*
B	Cabbage	Sludge	6.8	0 1.446	0.07 0.1	0.021	*Furr et al. 1980. Kalamazoo sludge/ Teel soil.*
B	Cabbage	Sludge	5.5	0 1.111	0.03 0.03	0.001	*Furr et al, 1980. Indianapolis sludge/ Darien Soil.*

TABLE C-54

UPTAKE OF SELENIUM BY LEGUMES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Bush Bean/ Pod	Sludge	6.8	0 0.7804	0.0084 0.0174	0.012	*Cappon, C.T. 1981.*
A	Bush Bean/ Seed	Sludge	6.8	0 0.7804	0.0012 0.0110	0.013	*Cappon, C.T. 1981.*
B	Bean/ Grain	Sludge	5.5	0 1.111	0.02 0.05	0.027	*Furr et al, 1980. Indianapolis sludge/ Darien Soil.*
B	Bean/ Grain	Sludge	6.8	0 1.446	0.04 0.12	0.055	*Furr et al, 1980. Kalamazoo sludge/ Teel Soil.*

TABLE C-55

UPTAKE OF SELENIUM BY POTATOES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
B	Potato/Tuber	Sludge	6.8	0 1.446	0.03 0.1	0.048	*Furr et al, 1980. Kalamazoo sludge/ Teel soil.*
B	Potato/Tuber	Sludge	5.5	0 1.111	0.01 0.02	0.009	*Furr et al, 1980. Indianapolis sludge/ Darien Soil.*

TABLE C-56

UPTAKE OF SELENIUM BY ROOTS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Radish/Tuber	Sludge	6.1-7.8	0 4.17 8.34	0.2 0.21 0.22	0.002	*Logan et al., 1987. Romona.*
A	Beet/Tuber	Sludge	6.8	0 0.7804	0.0033 0.0078	0.006	*Cappon, C.T. 1981.*
A	Onion/Bulb	Sludge	6.8	0 0.7804	0.0273 0.0467	0.025	*Cappon, C.T. 1981.*
A	Radish/Tuber	Sludge	6.8	0 0.7804	0.0271 0.0565	0.038	*Cappon, C.T. 1981.*
B	Carrot/Tuber	Sludge	6.8	0 1.446	0.04 0.11	0.048	*Furr et al, 1980. Kalamazoo sludge/ Teel soil.*
B	Onion/Bulb	Sludge	6.8	0 1.446	0.02 0.08	0.042	*Furr et al, 1980. Kalamazoo sludge/ Teel soil.*
B	Carrot/Tuber	Sludge	5.5	0 1.111	0.02 0.03	0.009	*Furr et al, 1980. Indianapolis sludge/ Darien Soil.*
B	Onion/Bulb	Sludge	5.5	0 1.111	0.01 0.02	0.009	*Furr et al, 1980. Indianapolis sludge/ Darien Soil.*

TABLE C-57

UPTAKE OF ZINC BY FORAGE

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	*Reference/ Comments*
A	Natural Forage	Sludge	N.R.	45.5	11.7	1.412	*Baxter et al., 1983*
				90.9	75.8		*Means reported*
A	Barley	Sludge compost	7.2-7.5	0	20.3	0.031	*Chang et al, 1983.*
				80	23.5		*Domino loam.*
				160	29		*1976.*
				320	30		
A	Barley	Sludge compost	7.0-7.1	0	14.2	0.038	*Chang et al, 1983.*
				160	20		*Domino loam.*
				320	22.5		*1977.*
				640	30.2		
A	Barley	Sludge compost	7.1-7.3	0	17.9	0.027	*Chang et al, 1983.*
				240	17.1		*Domino loam.*
				480	20.4		*1978.*
				960	43		
A	Barley	Sludge compost	6.8-7.1	0	23.3	0.021	*Chang et al, 1983.*
				320	29.2		*Domino loam.*
				640	27.6		*1979.*
				1280	51		
A	Barley	Sludge compost	6.6-7.2	0	21.1	0.008	*Chang et al, 1983.*
				500	25.9		*Domino loam.*
				800	31.6		*1980.*
				1600	33.6		
A	Barley	Sludge compost	6.4-7.1	0	20.7	0.010	*Chang et al, 1983.*
				480	15.6		*Domino loam.*
				960	29.5		*1981.*
				1920	40.7		
A	Barley	Liquid sludge	5.3-6.1	0	16.5	0.108	*Chang et al, 1983.*
				67.7	28.8		*Domino loam.*
				130.4	31.8		*1977.*
				252.4	48.8		
A	Barley	Liquid sludge	5.3-5.8	0	18.4	0.014	*Chang et al, 1983.*
				135.4	41.5		*Domino loam.*
				440.8	29.2		*1978.*
				504.8	34.6		
A	Barley	Liquid sludge	5.6-6.6	0	16.1	0.033	*Chang et al, 1983.*
				203.1	25		*Domino loam.*
				391.2	34.3		*1979.*
				757.2	41.2		

TABLE C-57 (cont.)

UPTAKE OF ZINC BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Barley	Liquid sludge	5.8-6.8	0 270.8 521.6 1009.6	20.1 29.9 46.8 37.9	0.018	*Chang et al, 1983. Domino loam. 1980.*
A	Barley	Liquid sludge	5.8-6.9	0 338.5 652. 1262	24.6 37.9 41.4 51.4	0.019	*Chang et al, 1983. Domino loam. 1981.*
A	Barley	Sludge composted	7.2-7.5	0 80 160 320	16.3 19.4 19.8 27.5	0.034	*Chang et al, 1983. Greenfield sandy loam. 1976.*
A	Barley	Sludge composted	7.0-7.1	0 160 320 640	12.5 21.8 22.8 24.5	0.016	*Chang et al, 1983. Greenfield sandy loam. 1977.*
A	Barley	Sludge composted	7.1-7.3	0 240 480 960	25 23 33.4 36.5	0.014	*Chang et al, 1983. Greenfield sandy loam. 1978.*
A	Barley	Sludge composted	6.8-7.1	0 320 640 1280	21.2 31.5 33 39.4	0.013	*Chang et al, 1983. Greenfield sandy loam. 1979.*
A	Barley	Sludge composted	6.6-7.2	0 500 800 1600	17.8 31.5 33 39.4	0.013	*Chang et al, 1983. Greenfield sandy loam. 1980.*
A	Barley	Sludge composted	6.4-7.1	0 580 960 1920	22.4 47.1 55.9 57.3	0.017	*Chang et al, 1983. Greenfield sandy loam. 1981.*
A	Barley	Liquid sludge	5.3-6.1	0 66.8 132.5 248.7	26.1 31 49.5 53	0.117	*Chang et al, 1983. Greenfield sandy loam. 1977.*
A	Barley	Liquid sludge	5.3-6.2	0 133.6 265 497.4	19.6 35.3 57.3 49.6	0.072	*Chang et al, 1983. Greenfield sandy loam. 1978.*

TABLE C-57 (cont.)

UPTAKE OF ZINC BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Barley	Liquid sludge	5.6-6.6	0	18.4	0.031	*Chang et al, 1983. Greenfield sandy loam. 1979.*
				200.4	32.1		
				397.5	35.2		
				746.1	43.7		
A	Barley	Liquid sludge	5.8-6.8	0	18.4	0.024	*Chang et al, 1983. Greenfield sandy loam. 1980.*
				267.2	32.1		
				530	35.2		
				994.8	43.7		
A	Barley	Liquid sludge	5.5-6.9	0	20.9	0.047	*Chang et al, 1983. Greenfield sandy loam. 1981.*
				334	43.2		
				662.5	50.6		
				1243.5	81.9		
A	Corn/Leaf	Sludge	7.4	0	14.5	0.084	*Hinesly et al, 1982. 1978.*
				432	39.9		
				770	61.3		
				1204	118		
A	Corn	Sludge	7.4	0	6.12	0.153	*Hinesly et al, 1982. 1978.*
				432	32.9		
				770	79.3		
				1204	192		
A	Corn/Leaf	Sludge	7.4	0	14.8	0.201	*Hinesly et al, 1982. 1979.*
				200	75		
				390	73		
				606	139		
A	Corn	Sludge	7.4	0	5.47	0.305	*Hinesly et al, 1982. 1979.*
				200	36.5		
				390	93.2		
				606	190		
A	Corn/Leaf	Sludge	7.4	0	13.7	0.217	*Hinesly et al, 1982. 1980.*
				268	49.2		
				321	76		
				537	130		
A	Corn	Sludge	7.4	0	10.4	0.245	*Hinesly et al, 1982. 1980.*
				268	51.7		
				321	109		
				537	204		

TABLE C-57 (cont.)

UPTAKE OF ZINC BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Corn	Sludge	5.3-6.5	0 120 241 482	22 79 186 293	0.576	*Dowdy & Larson, 1975.*
A	Corn	Sludge	5.9-6.0	0 124 248	21 18 28	0.028	*Rappaport et al, 1987. Year 1 (1984).*
A	Corn	Sludge	5.9-6.0	0 124 248	14 50 53	0.157	*Rappaport et al, 1987. Year 1 (1984).*
A	Corn	Sludge	5.9-6.0	0 124 248	14 27 31	0.069	*Rappaport et al, 1987. Year 2 (1985).*
A	Corn	Sludge	5.9-6.0	0 124 248	10 37 45	0.141	*Rappaport et al, 1987. Year 2 (1985).*
A	Corn	Sludge	5.7	0 81	28 36	0.099	*Hemphill et al, 1982. Portland sludge.*
A	Corn	Sludge	5.7	0 35	28 29	0.029	*Hemphill et al, 1982. Rockcreek sludge.*
A	Corn	Sludge	5.7	0 30	28 25	0.001	*Hemphill et al, 1982. Salem sludge.*
A	Ryegrass	Liquid sludge	6.5	232 395	25 68	0.264	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Ryegrass	Bed-dried Sludge	6.5	232 606	24 58	0.091	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Ryegrass	Liquid sludge	6.7	276 494	29 70	0.188	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Ryegrass	Bed-dried Sludge	6.7	276 702	28 59	0.073	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Ryegrass	Liquid sludge	8.0	138 292	35 54	0.123	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*

TABLE C-57 (cont.)

UPTAKE OF ZINC BY FORAGE (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Ryegrass	Bed-dried Sludge	8.0	138 776	34 73	0.061	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Barley/Leaf	Sludge	6.2-6.4	0 480	18.6 15.5	0.001	*Sommers et al, 1991. Ohio data used.*

TABLE C-58

UPTAKE OF ZINC BY GARDEN FRUITS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Squash/Fruit	Sludge	5.1-6.0	0 403	19 21	0.005	*Giordano et al, 1979. Year 1 (1975).*
A	Pepper/Fruit	Sludge	5.1-6.0	0 403	36 45	0.022	*Giordano et al, 1979. Year 1 (1975).*
A	Broccoli/Fruit	Sludge	4.7-6.2	0 403	87 99	0.030	*Giordano et al, 1979. Year 2 (1976).*
A	Eggplant/Fruit	Sludge	4.7-6.2	0 403	15 22	0.017	*Giordano et al, 1979. Year 2 (1976).*
A	Tomato/Fruit	Sludge	4.7-6.2	0 403	26 40	0.035	*Giordano et al, 1979. Year 2 (1976).*
A	Cantaloupe/ Fruit	Sludge	4.6-6.7	0 403	18 25	0.017	*Giordano et al, 1979. Year 3 (1977).*
A	Pepper/Fruit	Sludge	4.6-6.7	0 403	29 33	0.010	*Giordano et al, 1979. Year 3 (1977).*
A	Pea/Grain	Sludge	5.3-6.5	0 120 241 482	70 106 105 130	0.111	*Dowdy & Larson, 1975.*
A	Tomato/Fruit	Sludge	5.3-6.5	0 120 241 482	9 18 22 31	0.044	*Dowdy & Larson, 1975.*
A	Pea/Pod	Sludge	5.3-6.5	0 120 241 482	28 95 106 134	0.197	*Dowdy & Larson, 1975.*
A	Tomato/Fruit	Sludge	5.3-6.5	0 81 162	42 59 52	0.062	*Keefer et al, 1986. Blue Plains sludge. Early fruiting.*
A	Tomato/Fruit	Sludge	5.3-6.5	0 81 162	38 51 47	0.056	*Keefer et al, 1986. Blue Plains sludge. Late fruiting.*
A	Tomato/Fruit	Sludge	5.3-6.5	0 238 476	42 60 65	0.048	*Keefer et al, 1986. Huntington sludge. Early fruiting.*

TABLE C-58 (cont.)

UPTAKE OF ZINC BY GARDEN FRUITS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Tomato/Fruit	Sludge	5.3-6.5	0 238 476	38 48 46	0.048	*Keefer et al, 1986. Huntington sludge. Late fruiting.*
A	Tomato/Fruit	Sludge	5.3-6.5	0 176 352	42 44 46	0.004	*Keefer et al, 1986. Martinsburg sludge. Early fruiting.*
A	Tomato/Fruit	Sludge	5.3-6.5	0 176 352	38 47 47	0.026	*Keefer et al, 1986. Martinsburg sludge. Late fruiting.*
A	Tomato/Fruit	Sludge	5.3-6.5	0 63 126	42 52 58	0.127	*Keefer et al, 1986. Parkersburg sludge. Early fruiting.*
A	Tomato/Fruit	Sludge	5.3-6.5	0 63 126	38 48 46	0.063	*Keefer et al, 1986. Parkersburg sludge. Late fruiting.*
A	Celery	Sludge	7.3	0 36 71 143	26 45 31 31	0.001	*Peterson et al, 1989.*
A	Tomato/Fruit	Sludge	7.3	0 36 71 143	31 30 31 28	0.001	*Peterson et al, 1989.*
A	Tomato/Fruit	Sludge	N.R.	0 66 132 265 331	36 38 38 43 42	0.020	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*

TABLE C-59

UPTAKE OF ZINC BY GRAINS/CEREALS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Corn/Grain	Sludge	7.4	0	19.5	0.015	*Hinesly et al, 1982. 1978.*
				432	26.3		
				770	31.2		
				1204	38		
A	Corn/Grain	Sludge	7.4	0	12.8	0.026	*Hinesly et al, 1982. 1979.*
				200	21		
				390	31.2		
				606	27.1		
A	Corn/Grain	Sludge	7.4	0	15.4	0.041	*Hinesly et al, 1982. 1980.*
				268	23.5		
				321	29.4		
				537	37.4		
A	Corn/Grain	Sludge	5.3-6.5	0	41	0.049	*Dowdy & Larson, 1975.*
				120	47		
				241	48		
				482	65		
A	Corn/Grain	Sludge	5.9-6.0	0	30	0.024	*Rappaport et al, 1987. Year 1 (1984).*
				124	40		
				248	36		
A	Corn/Grain	Sludge	5.9-6.0	0	17	0.036	*Rappaport et al, 1987. Year 2 (1985).*
				124	28		
				248	26		
A	Wheat/Grain	Liquid sludge	6.5	232	29	0.184	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
				395	59		
A	Wheat/Grain	Bed-dried Sludge	6.5	232	30	0.86	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
				606	62		
A	Wheat/Grain	Liquid sludge	6.7	276	32	0.101	*Carlton Smith, 1988. Means of 5 years used. Clay.*
				494	54		
A	Wheat/Grain	Bed-dried Sludge	6.7	276	31	0.056	*Carlton Smith, 1988. Means of 4 years used. Clay.*
				702	55		
A	Wheat/Grain	Liquid sludge	8.0	138	38	0.071	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
				292	49		

TABLE C-59 (cont.)

UPTAKE OF ZINC BY GRAINS/CEREALS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Wheat/Grain	Bed-dried Sludge	8.0	138 776	40 61	0.033	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Barley/Grain	Sludge	6.2-6.4	0 480	19.9 0.008	0.008	*Sommers et al, 1991. Ohio data used.*

TABLE C-60

UPTAKE OF ZINC BY LEAFY VEGETABLES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	*Reference/ Comments*
A	Lettuce	Heat-Treated Sludge	5.3-5.4	0 297	76 225	0.502	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Heat-Treated Sludge	6.2	0 297	39 67	0.094	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Nu-Earth	5.3-5.6	0 414	76 242	0.401	*Chaney et al., 1982 Romaine Lettuce*
A	Lettuce	Nu-Earth	6.2-6.6	0 414	39 74	0.085	*Chaney et al., 1982 Romaine Lettuce*
A	Swiss Chard	Heat-Treated Sludge	5.7	0 297	97 420	1.088	*Chaney et al., 1982*
A	Swiss Chard	Heat-Treated Sludge	6.7-6.8	0 297	38 115	0.259	*Chaney et al., 1982*
A	Swiss Chard	Nu-Earth	5.7	0 414	97 420	0.78	*Chaney et al., 1982*
A	Swiss Chard	Nu-Earth	6.7-6.8	0 414	38 115	0.186	*Chaney et al., 1982*
A	Collard Greens	Heat-Treated Sludge	5.5-5.6	0 297	47 170	0.414	*Chaney et al., 1982*
A	Collard Greens	Heat-Treated Sludge	6.3-6.4	0 297	37 74	0.125	*Chaney et al., 1982*
A	Collard Greens	Nu-Earth	5.5-6.3	0 414	47 88	0.099	*Chaney et al., 1982*
A	Collard Greens	Nu-Earth	6.4-6.8	0 414	37 75	0.092	*Chaney et al., 1982*
A	Lettuce	Sludge	6.0	0 305.8	47 419	1.216	*Chaney et al., 1978 Romaine Lettuce*
A	Lettuce	Sludge	6.0	0 301.3	47 307	0.863	*Chaney et al., 1978 Romaine Lettuce*
A	Lettuce	Sludge	6.0	0 208.3	47 75	0.134	*Chaney et al., 1978 Romaine Lettuce*
A	Lettuce	Sludge	6.0	0 79.5	47 187	1.761	*Chaney et al., 1978 Romaine Lettuce*

TABLE C-60 (cont.)

UPTAKE OF ZINC BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Lettuce	Sludge	6.0	0 72.2	47 209	2.244	*Chaney et al., 1978 Romaine Lettuce*
A	Lettuce	Sludge	5.1-6.0	0 403	54 131	0.191	*Giordano et al, 1979. Year 1 (1975). Great Lakes lettuce.*
A	Lettuce	Sludge	4.7-6.2	0 403	48 74	0.065	*Giordano et al, 1979. Year 2 (1976). Great Lakes lettuce.*
A	Lettuce	Sludge	4.6-6.7	0 403	46 103	0.141	*Giordano et al, 1979. Year 3 (1977). Bibb lettuce.*
A	Lettuce	Sludge	4.6-6.7	0 403	35 53	0.045	*Giordano et al, 1979. Year 3 (1977). Romaine lettuce.*
A	Lettuce	Sludge	4.6-6.7	0 403	29 116	0.216	*Giordano et al, 1979. Year 3 (1977). Boston lettuce.*
A	Cabbage	Sludge	4.6-6.7	0 403	48 59	0.027	*Giordano et al, 1979. Year 3 (1977).*
A	Lettuce	Sludge	5.3-6.5	0 120 241 482	21 94 155 225	0.415	*Dowdy & Larson, 1975*
A	Cabbage	Sludge	5.3-6.5	0 81 162	27 28 28	0.006	*Keefer et al, 1986. Blue Plains sludge.*
A	Cabbage	Sludge	5.3-6.5	0 238 476	27 26 26	0.001	*Keefer et al, 1986. Huntington sludge.*
A	Cabbage	Sludge	5.3-6.5	0 176 352	27 35 33	0.017	*Keefer et al, 1986. Martinsburg sludge.*
A	Cabbage	Sludge	5.3-6.5	0 63 126	27 41 51	0.19	*Keefer et al, 1986. Parkersburg sludge.*

TABLE C-60 (cont.)

UPTAKE OF ZINC BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Turnip/Greens	Sludge	5.2-5.8	0	83	0.994	*Miller & Boswell, 1979.*
				170	346		
				340	421		
A	Cabbage	Sludge	7.3	0	30	0.009	*Peterson et al, 1989.*
				36	33		
				71	32		
				143	32		
A	Lettuce	Sludge	7.3	0	85	0.039	*Peterson et al, 1989.*
				36	108		
				71	85		
				143	98		
A	Lettuce	Liquid sludge	6.5	232	59	0.27	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
				395	103		
A	Lettuce	Bed-dried Sludge	6.5	232	57	0.091	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
				606	91		
A	Lettuce	Liquid sludge	6.7	276	80	0.252	*Carlton Smith, 1988. Means of 5 years used. Clay.*
				484	135		
A	Lettuce	Bed-dried Sludge	6.7	276	75	0.073	*Carlton Smith, 1988. Means of 4 years used. Clay.*
				702	106		
A	Lettuce	Liquid sludge	8.0	138	64	0.065	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
				292	74		
A	Lettuce	Bed-dried Sludge	8.0	138	67	0.02	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
				776	80		
A	Cabbage	Liquid sludge	6.5	232	395	0.067	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
				395	36		
A	Cabbage	Bed-dried Sludge	6.5	232	26	0.032	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
				606	38		

TABLE C-60 (cont.)

UPTAKE OF ZINC BY LEAFY VEGETABLES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Cabbage	Liquid sludge	6.7	276 494	23 41	0.083	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Cabbage	Bed-dried Sludge	6.7	276 702	21 38	0.04	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Cabbage	Liquid sludge	8.0	138 292	2 32	0.045	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Cabbage	Bed-dried Sludge	8.0	138 776	25 48	0.036	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Spinach	Sludge	N.R.(3)	0 66 132 265 331	166 310 523 358 365	0.487	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*
A	Swiss Chard	Sludge	N.R.	0 66 132 265 331	78 148 234 141 225	0.283	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*

TABLE C-61

UPTAKE OF ZINC BY LEGUMES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Bean/Pod	Sludge	5.1-6.0	0 403	31 51	0.05	*Giordano et al, 1979. Year 1 (1975).*
A	Bean/Grain	Sludge	5.1-6.0	0 403	64 73	0.022	*Giordano et al, 1979. Year 1 (1975).*
A	Green Bean/ Grain	Sludge	5.3-6.5	0 81 162	39 35 38	0.001	*Keefer et al, 1986. Blue Plains sludge.*
A	Green Bean/ Grain	Sludge	5.3-6.5	0 476 238	39 47 35	0.017	*Keefer et al, 1986.*
A	Green Bean/ Grain	Sludge	5.3-6.5	0 176 352	39 42 44	0.014	*Keefer et al, 1986. Martinsburg sludge.*
A	Green Bean/ Grain	Sludge	5.3-6.5	0 63 126	39 42 42	0.024	*Keefer et al, 1986. Parkersburg sludge.*
A	Green Bean/ Grain	Sludge	7.3	0 36 71 143	38 52 49 44	0.018	*Peterson et al, 1989.*
A	Green Bean/ Pod & Seed	Sludge	N.R.	0 66 132 265 331	34 36 38 36 37	0.006	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*
A	Soybean/ Grain	Limed digested sludge	7.3-7.5	70.6 107.4 87.2 132.4 179.2 225.2	39.5 43.5 43.1 40.4 43.9 44.1	0.02	*Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.*
A	Soybean/ Grain	Limed raw sludge	7.3-7.7	70.6 95.8 95 151.8	39.5 42.3 42.2 42.4	0.027	*Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.*

TABLE C-61 (cont.)

UPTAKE OF ZINC BY LEGUMES (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Soybean/ Grain	Raw sludge compost	6.6-7.3	70.6	39.5	0.026	*Chaney et al, 1977. For control used calcareous soil data. Chaney's values are means of 3 reps.*
				101.4	44.8		
				125.4	44.1		
				196.4	47.5		
				318.8	45.9		
				525.6	54.5		
A	Soybean/ Grain	Heat treated sludge High pH	5.9-6.0	75.2	44	0.055	*Chaney et al, 1977. Chaney's values are means of 3 reps.*
				150.2	48.5		
				170.4	52		
				298.4	56.5		
A	Soybean/ Grain	Heat treated sludge Low pH	5.3-5.6	78.2	44.8	0.032	*Chaney et al, 1977. Chaney's values are means of 3 reps.*
				144.6	57		
				176	51.6		
				325	55.3		

TABLE C-62

UPTAKE OF ZINC BY POTATOES

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Potato/Tuber	Sludge	4.7-6.2	0 403	16 19	0.007	*Giordano et al, 1979. Year 2 (1976).*
A	Potato/Tuber	Sludge	5.3-6.5	0 120 241 482	24 31 41 53	0.061	*Dowdy & Larson, 1975.*
A	Potato/Tuber	Liquid sludge	6.5	232 395	13 16	0.018	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Potato/Tuber	Bed-dried Sludge	6.5	232 606	13 16	0.008	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Potato/Tuber	Liquid sludge	6.7	276 494	15 18	0.014	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Potato/Tuber	Bed-dried Sludge	6.7	276 702	15 17	0.005	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Potato/Tuber	Liquid sludge	8.0	138 292	7 9	0.013	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Potato/Tuber	Bed-dried Sludge	8.0	138 776	8 12	0.006	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	3622	36.2	0.01	*Harris et al, 1978. Vanessa--potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	3622	48	0.013	*Harris et al, 1978. Pentland Javelin-- --potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	3622	55.2	0.015	*Harris et al, 1978. Home Guard-- --potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	3622	52.7	0.015	*Harris et al, 1978. Desiree--potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	3622	36.2	0.010	*Harris et al, 1978. King Edward--potato type.*
C	Potato/Tuber	Organic, metal contaminated soil	6.6	3622	43.7	0.012	*Harris et al, 1978. Majestic-potato type.*

TABLE C-63

UPTAKE OF ZINC BY ROOTS

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (μg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Carrot/Tuber	Sludge	4.6-6.7	0	29	0.001	*Giordano et al, 1979.*
				403	30		*Year 3 (1977).*
A	Carrot/Tuber	Sludge	5.3-6.5	0	23	0.164	*Dowdy & Larson, 1975.*
				120	53		
				241	72		
				482	104		
A	Radish/Tuber	Sludge	5.3-6.5	0	37	0.131	*Dowdy & Larson, 1975.*
				120	40		
				241	50		
				482	98		
A	Radish/Tuber	Sludge	5.3-6.5	0	42	0.006	*Keefer et al, 1986.*
				81	43		*Blue Plains sludge.*
				162	43		
A	Carrot/Tuber	Sludge	5.3-6.5	0	99	0.025	*Keefer et al, 1986.*
				81	232		*Blue Plains sludge.*
				162	103		
A	Radish/Tuber	Sludge	5.3-6.5	0	42	0.08	*Keefer et al, 1986.*
				238	52		*Huntington sludge.*
				476	42		
A	Carrot/Tuber	Sludge	5.3-6.5	0	99	0.001	*Keefer et al, 1986.*
				238	67		*Huntington sludge.*
				476	51		
A	Radish/Tuber	Sludge	5.3-6.5	0	42	0.054	*Keefer et al, 1986.*
				176	52		*Martinsburg sludge.*
				352	61		
A	Carrot/Tuber	Sludge	5.3-6.5	0	99	0.004	*Keefer et al, 1986.*
				176	84		*Martinsburg sludge.*
				352	83		
A	Radish/Tuber	Sludge	5.3-6.5	0	42	0.206	*Keefer et al, 1986.*
				63	65		*Parkersburg sludge.*
				126	68		
A	Carrot/Tuber	Sludge	5.3-6.5	0	99	0.001	*Keefer et al, 1986.*
				63	66		*Parkersburg sludge.*
				126	60		
A	Onion/Bulb	Sludge	7.3	0	35	0.001	*Peterson et al, 1989.*
				36	31		
				71	29		
				143	31		

TABLE C-63 (cont.)

UPTAKE OF ZINC BY ROOTS (cont.)

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Red Beet/Tuber	Liquid sludge	6.5	232 395	27 57	0.184	*Carlton Smith, 1988. Means of 5 years used. Sandy loam.*
A	Red Beet/Tuber	Bed-dried Sludge	6.5	232 606	25 43	0.048	*Carlton Smith, 1988. Means of 4 years used. Sandy loam.*
A	Red Beet/Tuber	Liquid sludge	6.7	276 494	31 73	0.193	*Carlton Smith, 1988. Means of 5 years used. Clay.*
A	Red Beet/Tuber	Bed-dried Sludge	6.7	276 702	30 53	0.054	*Carlton Smith, 1988. Means of 4 years used. Clay.*
A	Red Beet/Tuber	Liquid sludge	8.0	138 292	26 32	0.039	*Carlton Smith, 1988. Means of 5 years used. Calcareous loam.*
A	Red Beet/Tuber	Bed-dried Sludge	8.0	138 776	25 32	0.009	*Carlton Smith, 1988. Means of 4 years used. Calcareous loam.*
A	Beet/Tuber	Sludge	N.R.	0 66 132 265 331	29 37 44 51 60	0.087	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*
A	Carrot/Tuber	Sludge	N.R.	0 66 132 265 331	26 21 27 29 30	0.019	*Lue-Hing et al, 1984. 1977 data used. Nu-Earth.*

TABLE C-64

UPTAKE OF ZINC BY SWEET CORN

Study Type (1)	Plant/ Tissue	Chemical Form Applied	Soil pH	Application Rates (kg/ha)	Tissue Concentration (µg/g DW)	Uptake Slope (2)	Reference/ Comments
A	Sweet Corn/ Grain	Sludge	5.1-6.0	0 403	25 40	0.037	*Giordano et al, 1979. Year 1 (1975).*
A	Sweet Corn/ Grain	Sludge	5.3-6.5	0 81 162	24 26 27	0.019	*Keefer et al, 1986. Blue Plains sludge.*
A	Sweet Corn/ Grain	Sludge	5.3-6.5	0 238 476	24 25 24	0.001	*Keefer et al, 1986. Huntington sludge.*
A	Sweet Corn/ Grain	Sludge	5.3-6.5	0 176 352	24 29 31	0.02	*Keefer et al, 1986. Martinsburg sludge.*
A	Sweet Corn/ Grain	Sludge	5.3-6.5	0 63 126	24 30 35	0.095	*Keefer et al, 1986. Parkersburg sludge.*
A	Sweet Corn/ Grain	Sludge	5.7	0 81	40 45	0.062	*Hemphill et al, 1982. Portland sludge.*
A	Sweet Corn/ Grain	Sludge	5.7	0 35	40 40	0.001	*Hemphill et al, 1982. Rockcreek sludge.*
A	Sweet Corn/ Grain	Sludge	5.7	0 30	40 39	0.001	*Hemphill et al, 1982. Salem sludge.*

APPENDIX D

Animal Uptake Tables

CONTENTS

TABLE D-1 UPTAKE OF CADMIUM BY ANIMALS

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	Tissue Concentration range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used in [k]	Footnote references
Cattle	6	Kidney	6	Sludge amended diet			0.77	0.31		77.02	1.34899913	0.638	Boyer et al., 1981 (p.286)	1	h
							12.3	2.0		77.02	8.70322019				
Cattle	6	Kidney	3	Sludge amended diet			0.14				1.19	1.277	Johnson et al., 1981 (p.112)	1	h
							10.6				14.55				
Cattle	12	Kidney	4	[l]	2	18	0.1111	270	46	77.02	1174.93473	1033.943	Vreman et al., 1986	1	h,l,m
			4		152	18	8.4444	2250	660	77.02	9791.12272				
Cattle	8	Kidney	2	[l]	2	20	0.1	300	130	77.02	23106	296783.733	Vreman et al., 1986	1	h,l,n
			2		32	20	1.6	6060	700	77.02	468281.6				
Cattle	8	Kidney	2	Harbor sludge	2	20	0.1	300	130	77.02	23106	280489.291	Vreman et al., 1986	1	h,n
			1		10	21	0.4762	1670		77.02	128623.4				
Cattle	8	Kidney	2	Sewage sludge	2	20	0.1	300	130	77.02	23106	53914.000	Vreman et al., 1986	1	h,n
			2		6	21	0.2857	430	70	77.02	33118.6				
Cattle	6	Muscle	6	Sludge amended diet			0.77	0.02		70.62	0.06807352	0.003	Boyer et al., 1981 (p.286)	1	h
							12.3	0.03		70.62	0.10211028				
Cattle	6	Muscle	3	Sludge amended diet			0.14				0.01	0.002	Johnson et al., 1981 (p.112)	1	h
							10.6				0.03				
Cattle	12	Muscle	12	[l]	2	18	0.1111	5	1	70.62	17.0183799	0.001	Vreman et al., 1986	1	h,l,m
			12		152	18	8.4444	4	1	70.62	13.6147039				
Cattle	8	Muscle	2	[l]	2	20	0.1	2	0	70.62	6.80735194	11.346	Vreman et al., 1986	1	h,l,n
			2		32	20	1.6	7	1	70.62	23.8257318				
Cattle	8	Muscle	2	Harbor sludge	2	20	0.1	2	0	70.62	6.80735194	18.095	Vreman et al., 1986	1	h,n
			1		10	21	0.4762	4		70.62	13.6147039				
Cattle	8	Muscle	2	Sewage sludge	2	20	0.1	2	0	70.62	6.80735194	18.327	Vreman et al., 1986	1	h,n
			2		6	21	0.2857	3	1	70.62	10.2110279				
Cattle	6	Liver	6	Sludge amended diet			0.77	0.08		68.99	0.2579813	0.397	Boyer et al., 1981 (p.286)	2	h
							12.3	1.5		68.99	4.83714931				
Cattle	6	Liver	6	Sludge amended diet			0.14				0.19	0.452	Johnson et al., 1981 (p.112)	2	h
							10.6				4.92				
Cattle	12	Liver	4	[l]	2	18	0.1111	65	14	68.99	209.609603	454.692	Vreman et al., 1986	2	h,l,m
			4		152	18	8.4444	1240	200	68.99	3998.71009				
Cattle	8	Liver	2	[l]	2	20	0.1	60	20	68.99	193.485972	3095.776	Vreman et al., 1986	2	h,l,n
			2		32	20	1.6	1500	160	68.99	4837.14931				
Cattle	8	Liver	2	Harbor sludge	2	20	0.1	60	20	68.99	193.485972	857.216	Vreman et al., 1986	2	h,n
			1		10	21	0.4762	160		68.99	515.962593				
Cattle	8	Liver	2	Sewage sludge	2	20	0.1	60	20	68.99	193.485972	694.565	Vreman et al., 1986	2	h,n

TABLE D-1 UPTAKE OF CADMIUM BY ANIMALS (cont.)

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [i]	Reference	Used in [k]	Footnote references
			2		6	21	0.2857	100	30	68.99	322.47662				
Cattle	12	Milk	12	[l]	2	18	0.1111	0.26		87.30	2.04724409	0.123	Vreman et al., 1986	6	h,l,m
			12		152	18	8.4444	0.39		87.30	3.07086614				
Cattle	8	Milk	4	[l]	2	20	0.1	0.15		87.30	1.18110236	0.262	Vreman et al., 1986	6	h,l,n
			4		32	20	1.6	0.20		87.30	1.57480315				
Cattle	8	Milk	4	Harbor sludge	2	20	0.1	0.15		87.30	1.18110236	0.001	Vreman et al., 1986	6	h,n
			2		10	21	0.4762	0.10		87.30	0.78740157				
Cattle	8	Milk	4	Sewage sludge	2	20	0.1	0.15		87.30	1.18110236	2.120	Vreman et al., 1986	6	h,n
			4		6	21	0.2857	0.20		87.30	1.57480315				
Sheep	5	Kidney		Sludge grown corn silage			0.05				5.4	7.939	Heffron et al., 1980 (p.60)	3	h,o
	9						1.7				18.5				
Sheep	5	Bone		Sludge grown corn silage			0.05				0.01	0.006	Heffron et al., 1980 (p.60)		h,o
	9						1.7				0.02				
Sheep	5	Liver		Sludge grown corn silage			0.05				1.2	2.788	Heffron et al., 1980 (p.60)	3	h,o
	9						1.7				5.8				
Sheep	5	Muscle		Sludge grown corn silage			0.05				0.005	0.003	Heffron et al., 1980 (p.60)	3	h,o
	9						1.7				0.01				
Pig	10	Liver		CdCl(2)			0.23	0.07		71.06	0.24187975	6.316	Sharma et al., 1979	4	i
							2.41	0.4		71.06	1.38217001				
							10.12	17		71.06	58.7422253				
Swine	12	Liver		CdCl(2)			0.36	0		71.06	0	0.573	Osuna et al., 1981 (p.1545) Experiment 1	4	e,g
							78.6	12.98		71.06	44.8514167				
Swine	12	Liver		Sludge amended diet			0.12	0		71.06	0	0.074	Osuna et al., 1981 (p.1545) Experiment 1	4	e,g
							147.3	3.15		71.06	10.8845888				
Pig	NR	Kidney		CdCl(2)			0.23	0.2		74.73	0.59358924	16.659	Sharma et al., 1979	4	i
							2.41	10.97		74.73	43.4111595				
							10.12	42.30		74.73	167.392165				
Swine	12	Kidney		CdCl(2)			0.36	0		80.06	0	3.971	Osuna et al., 1981 (p.1545) Experiment 1	4	e,g
							78.6	61.95		80.06	310.682046				
Swine	12	Kidney		Sludge amended diet			0.12	0		80.06	0	0.800	Osuna et al., 1981 (p.1545) Experiment 1	4	e,g
							147.3	23.49		80.06	117.80341				
Swine	12	Muscle		CdCl(2)			0.36	0		71.95	0	0.001	Osuna et al., 1981 (p.1545) Experiment 1	4	e,g
							78.6	0		71.95	0				
Swine	12	Muscle		Sludge amended diet			0.12	0		71.95	0	0.001	Osuna et al., 1981 (p.1545) Experiment 1	4	e,g
							147.3	0		71.95	0				
Chicken	6	Kidney		CdSO(4).8H(2)O			0.18				0.39	5.052	Leach et al., 1979	5	g

TABLE D-1 UPTAKE OF CADMIUM BY ANIMALS (cont.)

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [i]	Uptake Slope [j]	Reference	Used in [k]	Footnote references
							3.18				9.27		Experiment 1		
							12.18				49.69				
							48.18				239.07				
Chicken	5	Kidney		CdSO(4).8H(2)O			0.07				8.5	7.460	Leach et al., 1979 Experiment 2	5	g
							3.07				30.8				
							12.07				92.6				
							48.07				365.9				
Chicken	12–15	Kidney		CdSO(4).8H(2)O			0.22				17.1	7.523	Leach et al., 1979 Experiment 3	5	g
							3.22				273.9				
							12.22				708.3				
							48.22				540.7				
Chicken	6	Liver		CdSO(4).8H(2)O			0.18				0.23	1.837	Leach et al., 1979 Experiment 1	5	g
							3.18				4.75				
							12.18				15.13				
							48.18				87.19				
Chicken	5	Liver		CdSO(4).8H(2)O			0.07				1.6	1.858	Leach et al., 1979 Experiment 2	5	g
							3.07				9				
							12.07				26.5				
							48.07				91.8				
Chicken	12–15	Liver		CdSO(4).8H(2)O			0.22				2.99	4.051	Leach et al., 1979 Experiment 3	5	g
							3.22				33.47				
							12.22				41.82				
							48.22				203.54				
Chicken		Muscle		CdCl(2)			0.32	0.063		75.46	0.25672372	0.057	Sharma et al., 1979	5	i
							1.88	0.140		75.46	0.57049715				
							13.06	0.263		75.46	1.07171964				
Chicken	6	Muscle		CdSO(4).8H(2)O			0.18				0.07	0.014	Leach et al., 1979 Experiment 1	5	g
							3.18				0.15				
							12.18				0.26				
							48.18				0.75				
Chicken	12–15	Muscle		CdSO(4).8H(2)O			0.22				0.12	0.132	Leach et al., 1979 Experiment 3	5	g
							3.22				0.57				
							12.22				1.66				
							48.22				6.46				
Chicken		Eggs/yolk		CdCl(2)			0.32	0.13		51.10	0.26584867	0.003	Sharma et al., 1979	7	i
							1.88	0.14		51.10	0.28629857				
							13.06	0.15		51.10	0.30674847				
Chicken	5	Egg		CdSO(4).8H(2)O			0.07				0.05	0.001	Leach et al., 1979 Experiment 2	7	g
							3.07				0.08				
							12.07				0.07				
							48.07				0.13				
Chicken	12–15	Egg		CdSO(4).8H(2)O			0.22				0.16	0.002	Leach et al., 1979	7	g

TABLE D-1 UPTAKE OF CADMIUM BY ANIMALS (cont.)

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	Tissue Concentration range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used In [k]	Footnote references
							3.22				0.13		Experiment 3		
							12.22				0.14				
							48.22				0.22				
Guinea Pig	4	Muscle		[r]			1.2				0.1	0.001	Furr et al., 1976b		h,p
							3.3				0.07				
Guinea Pig	4	Muscle		[r]			1.2				0.1	0.001	Furr et al., 1976b		h,q
							4.1				0.05				
Guinea Pig	4	Liver		[r]			1.2				2.0	0.001	Furr et al., 1976b		h,p
							3.3				1.8				
Guinea Pig	4	Liver		[r]			1.2				2.0	0.138	Furr et al., 1976b		h,q
							4.1				2.4				
Guinea Pig	4	Kidney		[r]			1.2				6.2	0.571	Furr et al., 1976b		h,p
							3.3				7.4				
Guinea Pig	4	Kidney		[r]			1.2				6.2	1.517	Furr et al., 1976b		h,q
							4.1				10.6				

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef; 2 beef liver; 3 lamb; 4 pork; 5 poultry; 6 dairy; 7 eggs.
l Cows fed soluble compounds of arsenic pentoxide, cadmium, lead, and mercury acetate.
m Grazing cows
n Cows kept indoors
o Diet consisted of 4/5 corn and 1/5 soybean meal. No concentration for cadmium in soybean meal given, therefore assumed same as corn.
p Soil pH6.5
q Soil pH5.5
r Guinea pigs fed selenium in Swiss chard grown in sewage sludge.

Note: percent moisture data from USDA, 1963

TABLE D-2. UPTAKE OF MERCURY BY ANIMALS

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [i]	Reference	Used in [k]	Footnote references
Cattle	6	Muscle		Sludge			0.02				0.01	0.003676	Johnson et al., 1981	1,3,4,5	h
							2.6				0.02				
Cattle	12	Muscle	12	[I]	0.2	18	0.01111	3	1	70.62	10.21102791	40.844112	Vreman et al., 1986	1,3,4,5	h,l,m
			12		1.7	18	0.09444	4	1	70.62	13.61470388				
Cattle	8	Muscle	2	[I]	0.2	20	0.01	2	0	70.62	6.80735194	0.001	Vreman et al., 1986	1,3,4,5	h,l,n
			2		1.7	20	0.085	2	1	70.62	6.80735194				
Cattle	8	Muscle	2	Harbor sludge	0.2	20	0.01	2	0	70.62	6.80735194	0.001	Vreman et al., 1986	1,3,4,5	h,n
			1		3.1	21	0.14762	1		70.62	3.40367597				
Cattle	8	Muscle	2	Sewage sludge	0.2	20	0.01	2	0	70.62	6.80735194	0.001	Vreman et al., 1986	1,3,4,5	h,n
			2		1.2	21	0.05714	2	1	70.62	6.80735194				
Cattle	6	Kidney		Sludge			0.02				0.09	0.755814	Johnson et al., 1981	1,3,4,5	h
							2.6				2.04				
Cattle	12	Kidney	4	[I]	0.2	18	0.01111	9	46*	77.02	39.16449086	783.28982	Vreman et al., 1986	1,3,4,5	h,l,m
			4		1.7	18	0.09444	24	660	77.02	104.4386423				
Cattle	8	Kidney	2	[I]	0.2	20	0.01	5	1	77.02	21.75805048	4293.5886	Vreman et al., 1986	1,3,4,5	h,l,n
			2		1.7	20	0.085	79	7	77.02	343.7771976				
Cattle	8	Kidney	2	Harbor sludge	0.2	20	0.01	5	1	77.02	21.75805048	1422.9313	Vreman et al., 1986	1,3,4,5	h,n
			1		3.1	21	0.14762	50		77.02	217.5805048				
Cattle	8	Kidney	2	Sewage sludge	0.2	20	0.01	5	1	77.02	21.75805048	2030.7514	Vreman et al., 1986	1,3,4,5	h,n
			2		1.2	21	0.05714	27	5	77.02	117.4934726				
Cattle	6	Liver		Sludge			0.02				0.01	0.1007752	Johnson et al., 1981	2,3,4,5	h
							2.6				0.27				
Cattle	12	Liver	4	[I]	0.2	18	0.01111	7	1	68.99	22.57336343	116.09158	Vreman et al., 1986	2,3,4,5	h,l,m
			4		1.7	18	0.09444	10	2	68.99	32.24766204				
Cattle	8	Liver	2	[I]	0.2	20	0.01	3	1	68.99	9.674298613	968.9283	Vreman et al., 1986	2,3,4,5	h,l,n
			2		1.7	20	0.085	26	7	68.99	83.84392132				
Cattle	8	Liver	2	Harbor sludge	0.2	20	0.01	3	1	68.99	9.674298613	257.75813	Vreman et al., 1986	2,3,4,5	h,n
			1		3.1	21	0.14762	14		68.99	45.14672686				
Cattle	8	Liver	2	Sewage sludge	0.2	20	0.01	3	1	68.99	9.674298613	410.42479	Vreman et al., 1986	2,3,4,5	h,n
			2		1.2	21	0.05714	9	3	68.99	29.02289584				

TABLE D-2. UPTAKE OF MERCURY BY ANIMALS (cont.)

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	Tissue Concentration range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used In [k]	Footnote references
Cattle	12	Milk	12	[l]	0.2	18	0.01111	2.3	0.03	87.3	18.11023622	0.001	Vreman et al., 1986	6,7	h,l,m
			12		1.7	18	0.09444	0.9	0.10	87.3	7.086614173				
Cattle	8	Milk	4	[l]	0.2	20	0.01	0.5		87.3	3.937007874	10.498688	Vreman et al., 1986	6,7	h,l,n
			4		1.7	20	0.085	0.6	0.1	87.3	4.724409449				
Cattle	8	Milk	4	Harbor sludge	0.2	20	0.01	0.5		87.3	3.937007874	108.71046	Vreman et al., 1986	6,7	h,n
			2		3.1	21	0.14762	2.4	0	87.3	18.8976378				
Cattle	8	Milk	4	Sewage sludge	0.2	20	0.01	0.5		87.3	3.937007874	133.61966	Vreman et al., 1986	6,7	h,n
			4		1.2	21	0.05714	1.3	0.5	87.3	10.23622047				
Guinea Pig	4	Muscle		[o]			1.0				0.64	7.7142857	Furr et al., 1976b	3,4,5	h,o,p
							0.93				0.10				
Guinea Pig	4	Muscle		[o]			1.0				0.64	0.3913043	Furr et al., 1976b	3,4,5	h,o,q
							0.54				0.46				
Guinea Pig	4	Liver		[o]			1.0				0.44	0.4285714	Furr et al., 1976b	3,4,5	h,o,p
							0.93				0.41				
Guinea Pig	4	Liver		[o]			1.0				0.44	0.1086957	Furr et al., 1976b	3,4,5	h,o,q
							0.54				0.39				
Guinea Pig	4	Kidney		[o]			1.0				0.10	0.001	Furr et al., 1976b	3,4,5	h,o,p
							0.93				0.27				
Guinea Pig	4	Kidney		[o]			1.0				0.10	0.001	Furr et al., 1976b	3,4,5	h,o,q
							0.54				0.20				

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef; 2 beef liver; 3 lamb; 4 pork; 5 poultry; 6 dairy; 7 eggs.
l Cows fed soluble compounds of arsenic pentoxide, cadmium, lead, and mercury acetate. Feed concentration reported as concentration of mercury acetate.
m Grazing cows
n Cows kept indoors

TABLE D-2. UPTAKE OF MERCURY BY ANIMALS (cont.)

Species		Tissue Analyzed		Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g)	Tissue Concentration		percent moisture (%)	Tissue Conc. (µg/g DW)	Uptake Slope	Reference	Used in	Footnote references
	N		N					(µg/g WW)	range (+/-)						
	[a]		[b]				[c]	[d]			[illegible]	[illegible]		[illegible]	

o Guinea pigs fed selenium in Swiss chard grown in sewage sludge.
p Soil pH6.5
q Soil pH5.5

Note: percent moisture data from USDA, 1963

TABLE D-3. UPTAKE OF SELENIUM BY ANIMALS

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	Tissue Concentration range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [i]	Reference	Used In [k]	Footnote references
Pig		Muscle		Natural diet			0.027 0.493	0.034 0.521		71.95 71.95	0.12121212 1.8573975	3.7257197	Ky et al., 1973 as cited in NAS, 1980 (p.339)	3,4,5,6,7	h
Pig		Muscle		Sodium selenite			0.04 0.44	0.12 0.48		71.95 71.95	0.42780749 1.71122995	3.2085561	Ky et al., 1973 as cited in NAS, 1980 (p.339)	3,4,5,6,7	h
Pig		Liver		Sodium selenite			0.04 0.44	0.61 0.84		71.06 71.06	2.10780926 2.90255701	1.9868694	Ky et al., 1973 as cited in NAS, 1980 (p.339)	3,4,5,6,7	h
Pig		Kidney		Sodium selenite			0.04 0.44	2.14 2.17		80.06 80.06	10.7321966 10.8826479	0.3761284	Ky et al., 1973 as cited in NAS, 1980 (p.339)	3,4,5,6,7	h
Guinea Pig	4	Kidney		[l]			0.06 0.06				1.61 1.69	0.001	Furr et al., 1976b (pp.87-88)	3,5,6,7	h,l,m
Guinea Pig	4	Muscle		[l]			0.06 0.06				0.38 0.37	0.5	Furr et al., 1976b (pp.87-88)	3,5,6,7	h,l,m
Guinea Pig	4	Liver		[l]			0.08 0.06				1.12 0.90	11	Furr et al., 1976b (pp.87-88)	3,5,6,7	h,l,m
Mouse (male)	5 16	Heart		Sodium selenite			0.06 3.06	0.22 1.29		73 73	0.81481481 4.77777778	1.3209877	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g,o
Mouse (male)	19 51	Heart		Sodium selenate			0.06 3.06	0.10 0.59		73 73	0.37037037 2.18518519	0.6049383	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g,p
Mouse (female)	23 18	Heart		Sodium selenite			0.06 3.06	0.24 1.20		73 73	0.88888889 4.44444444	1.1851852	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g
Mouse (female)	19 43	Heart		Sodium selenite			0.06 3.06	0.19 0.46		73 73	0.7037037 1.7037037	0.3333333	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g
Mouse (male)	5 16	Liver		Sodium selenite			0.06 3.06	0.55 1.92		71 71	1.89655172 6.62068966	1.5747126	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g
Mouse (male)	19 51	Liver		Sodium selenite			0.06 3.06	0.15 1.54		71 71	0.51724138 5.31034483	1.5977011	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g
Mouse (female)	23 18	Liver		Sodium selenite			0.06 3.06	0.54 2.58		71 71	1.86206897 8.89655172	2.3448276	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g
Mouse (female)	19 43	Liver		Sodium selenite			0.06 3.06	0.22 0.76		71 71	0.75862069 2.62068966	0.6206897	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g
Mouse (male)	5 16	Kidney		Sodium selenite			0.06 3.06	0.95 2.34		77 77	4.13043478 10.173913	2.0144928	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g
Mouse (male)	19 51	Kidney		Sodium selenite			0.06 3.06	0.44 2.05		77 77	1.91304348 8.91304348	2.3333333	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g

TABLE D-3. UPTAKE OF SELENIUM BY ANIMALS (cont.)

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	Tissue Concentration range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used in [k]	Footnote references
Mouse (female)	23	Kidney		Sodium selenite			0.06	1.19		77	5.17391304	1.057971	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g
	18						3.06	1.92		77	8.34782609				
Mouse (female)	19	Kidney		Sodium selenite			0.06	0.56		77	2.43478261	0.4637681	Schroeder & Mitchener, 1972 (p.62)	3,5,6,7	g
	43						3.06	0.88		77	3.82608696				
Cattle	6	Kidney		Sludge amended diet			0	1.35		77.02	5.87467363	0.5119541	Boyer et al., 1981 (p.286)	3,5,6,7	h
							1.7	1.55		77.02	6.74499565				
Cattle	6	Liver		Sludge amended diet			0	0.42		68.99	1.35440181	1.1950604	Boyer et al., 1981 (p.286)	3,5,6,7	h
							1.7	1.05		68.99	3.38600451				
Cattle	6	Muscle		Sludge amended diet			0	0.23		70.62	0.78284547	0.1401514	Boyer et al., 1981 (p.286)	3,5,6,7	h
							1.7	0.30		70.62	1.02110279				

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used in" indicates that the study is used for calculating the following food group uptake slope: 1 beef; 2 beef liver; 3 lamb; 4 pork; 5 poultry; 6 dairy; 7 eggs.
l Guinea pigs fed selenium in Swiss chard grown in sewage sludge.
m Soil pH6.5
n Soil pH5.5
o Mice also fed 2 µg/g sodium tellurite.
p Mice also fed 2 µg/g potassium tellurate and 5 µg/g chromium.

Note: percent moisture data from USDA, 1963. Data for mouse tissue approximated from data on other species.

TABLE D-4. UPTAKE OF ZINC BY ANIMALS

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	Tissue Concentration range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used in [k]	Footnote references
Cattle	6	Kidney	6	Sludge			36	19.1		77.62	85.34405719	0.017963	Boyer et al., 1981 (pp.286-289)	1,6	h
			6				235	19.9		77.62	88.91867739				
Cattle	6	Kidney	6	Sludge			26.3				93	0.014306	Johnson et al., 1981 (p.112)	1,6	h
			6				236				96				
Cattle	6	Liver	6	Sludge			36	35.8		68.99	115.4466301	0.006482	Boyer et al., 1981 (pp.286-289)	2,6	h
			6				235	36.2		68.99	116.7365366				
Cattle	6	Liver	6	Sludge			26.3				143	0.001	Johnson et al., 1981 (p.112)	2,6	h
			6				236				132				
Cattle	6	Muscle	6	Sludge			36	66.8		70.62	227.3655548	0.027368	Boyer et al., 1981 (pp.286-289)	1,6	h
			6				235	68.4		70.62	232.8114364				
Cattle	6	Muscle	3	Sludge			26.3				340	0.001	Johnson et al., 1981 (p.112)	1,6	h
			3				236				267				
Sheep	5	Kidney		Sludge-grown corn silage			19				3271	17.63265	Heffron et al., 1980, 1980 (p.69)	3	h,l
	9						68				4135				
Sheep	5	Bone		Sludge-grown corn silage			19				625	0.755102	Heffron et al., 1980, 1980 (p.69)		h,l
	9						68				662				
Sheep	5	Liver		Sludge-grown corn silage			19				1523	2.122449	Heffron et al., 1980, 1980 (p.69)	3	h,l
	9						68				1627				
Sheep	5	Muscle		Sludge-grown corn silage			19				108	0.877551	Heffron et al., 1980, 1980 (p.69)	3	h,l
	9						68				151				
Pig	12	Kidney		Sludge-grown corn silage			183.4	24.03		80.06	120.5115346	0.113588	Osuna et al., 1981	4	e,i
							773.7	37.4		80.06	187.5626881				
Pig	12	Liver		Sludge-grown corn silage			183.4	37.8		71.06	130.6150657	0.079025	Osuna et al., 1981	4	e,i
							773.7	51.3		71.06	177.2633034				
Pig	12	Muscle		Sludge-grown corn silage			183.4	13.99		71.95	49.87522282	0.001	Osuna et al., 1981	4	e,i
							773.7	12.49		71.95	44.52762923				
Mallard duck	6	Kidney		ZnCO(3)			0	27		74.73	106.8480625	0.116343	Gassaway and Buss, 1972 (p.1,115)	5,7	i
							3000	413		74.73	1634.34903				
							6000	453		74.73	1792.639493				
							9000	311		74.73	1230.70835				
							12000	519		74.73	2053.818757				
Mallard duck	6	Liver		ZnCO(3)			0	54		73.59	204.4680045	0.079768	Gassaway and Buss, 1972 (p.1,115)	5,7	i
							3000	401		73.59	1518.364256				
							6000	483		73.59	1828.852707				
							9000	461		73.59	1745.550928				
							12000	340		73.59	1287.39114				
Mallard duck	6	Breast muscle		ZnCO(3)			0	14		75.46	57.04971475	0.00489	Gassaway and Buss, 1972 (p.1,115)	5,7	i

TABLE D-4. UPTAKE OF ZINC BY ANIMALS (cont.)

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used in [k]	Footnote references
							3000	32		75.46	130.399348				
							6000	30		75.46	122.2493888				
							9000	34		75.46	138.5493073				
							12000	31		75.46	126.3243684				
Guinea pig	4	Kidney		Sludge-grown chard			159.0				19	0.003619	Furr et al., 1976b (pp.87-88)		h,o
	4						850				22				m
	2						1050				22				n
Guinea pig	4	Liver		Sludge-grown chard			159.0				28	0.001	Furr et al., 1976b (pp.87-88)		h,o
	4						850				30				m
	2						1050				27				n
Guinea pig	4	Muscle		Sludge-grown chard			159.0				15	0.001	Furr et al., 1976b (pp.87-88)		h,o
	4						850				13				m
	2						1050				16				n

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef; 2 beef liver; 3 lamb; 4 pork; 5 poultry; 6 dairy; 7 eggs.
l Diet consisted of 4/5 corn and 1/5 soybean meal. No concentration for zinc in soybean meal given, therefore assumed same as corn.
m Soil pH6.5
n Soil pH5.5
o Tissue samples combined for analysis.

Note: percent moisture data from USDA, 1983. Used chicken data for mallard duck tissue.

TABLE D-5. UPTAKE OF ALDRIN/DIELDRIN BY ANIMALS

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [i]	Reference	Used in [k]	Footnote references
Cattle		Milk fat		Dieldrin			3.25	18		57	41.8604651	12.8801	Braund et al.,1969 as cited in Fries, 1982 (p.15)	4,6	e,h
Cattle		Fat		Aldrin			50	31		20.21	38.8519865	0.77704	Rumsey & Bond, 1947 as cited in Fries, 1982 (p.15)	1,4	e,i,l
Cattle		Fat		Aldrin			10				49	1.93333	Claborn, 1956 (pp.18-23)	1,4	g
							25				78				
Cattle		Fat		Tech. Aldrin 60%			2.5				5.2	5.12	Claborn, 1956 (pp.18-23)	1,4	g
							5				18				
Cattle		Fat		Dieldrin			1				6	2.80902	Claborn, 1956 (pp.18-23)	1,4	g
							2.5				14.3				
							10				44				
							25				75				
Sheep		Fat		Dieldrin			25				126	2.6	Davidson, 1970 as cited in Fries, 1982 (p.15)	3,4	e,h
							50				191				
Sheep		Fat		Aldrin			5				17	1.53333	Claborn, 1956 (pp.18-23)	3,4	g
							10				55				
							25				78				
Sheep		Fat		Tech. Aldrin 60%			2.5				4.7	0.52	Claborn, 1956 (pp.18-23)	3,4	g
							5				6				
Sheep		Fat		Dieldrin			1				6	2.80902	Claborn, 1956 (pp.18-23)	3,4	g
							2.5				14.3				
							10				44				
							25				75				
Rat (male)		Liver		Dieldrin			0.1	0.0159		71	0.05482759	0.52925	Walker et al., 1969 as cited in EPA, 1980a (p.c-14)	2,5	i,m
							1	0.0155		71	0.05344828				
							10	1.476		71	5.08965517				
Rat (female)		Liver		Dieldrin			0.1	0.0348		71	0.12	1.00069	Walker et al., 1969 as cited in EPA, 1980a (p.c-14)	2,5	i,m
							1	0.4295		71	1.48103448				
							10	2.965		71	10.2241379				
Rat (male)		Liver		Dieldrin			0.1	0.0259		71	0.08931034	6.90988	Walker et al., 1969 as cited in EPA, 1980a (p.c-14)	2,5	i,m
							1	1.493		71	5.14827586				
							10	19.72		71	68				
Rat (female)		Liver		Dieldrin			0.1	0.8974		71	3.09448276	18.6072	Walker et al., 1969 as cited in EPA, 1980a (p.c-14)	2,5	i,m
							1	13.90		71	47.9310345				
							10	57.81		71	199.344828				

TABLE D-5. UPTAKE OF ALDRIN/DIELDRIN BY ANIMALS (cont.)

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used in [k]	Footnote references
Barn owl		Egg		Dieldrin			0	0.31		73.70	1.17870722	21.5681	Mendenhall et al., 1983 (p.238)	7	g,n,o
							0.58	3.6		73.70	13.6882129				
Barn owl		Egg		Dieldrin				0.20		7[illegible].70	0.76045627	51.7897	Mendenhall et al, 1983 (p.238)	7	g,n,p
							0.58	8.1		73.70	30.7984791				
Barn owl (male)	2	Carcass		Dieldrin			0	0.33		73.83	1.26098586	61.0728	Mendenhall et al., 1983 (p.237)	5	g,n
	12						0.58	9.6		73.83	36.6832251				
Barn owl (female)	2	Carcass		Dieldrin			0	0.15		73.83	0.57317539	59.6234	Mendenhall et al., 1983 (p.237)	5	g,p
	7						0.58	9.2		73.83	35.1547574				

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.
l Residue mostly dieldrin
m Control tissue concentration given but no control feed concentration. Control feed data therefore not presented.
n Tissue concentrations are geometric means, reported by authors.
o 1975 data.
p 1976 data.

Note: percent moisture data from USDA, 1963. Data for rat tissue approximated from data on other species. Used chicken data for barn owl tissue, and heavy cream data for milk fat.

TABLE D-6. UPTAKE OF CHLORDANE BY ANIMALS

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	Tissue Concentration range (+\-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used In [k]	Footnote references
Cattle	1	Body fat		[i]			1	0.24		20.21	0.30078957	0.025198	Dorough and Hemken, 1973	1,2,3,4,5	i,l
							10	1.40		20.21	1.75460584				
							100	2.65		20.21	3.3212182				
Cattle	1	Body fat		[i]			1	0.47		20.21	0.58904625	0.042096	Dorough and Hemken, 1973	1,2,3,4,5	i,l
							10	1.18		20.21	1.47888207				
							100	3.97		20.21	4.97556085				
Cow		Fat		chlordane			10				13	0.333333	Claborn, 1956	1,2,3,4,5	g
							25				18				
Cattle	1	Milk fat		[i]			1	0.19		57	0.44186047	0.032719	Dorough and Hemken, 1973	6,7	i,l,m
							10	0.87		57	2.02325581				
							100	1.82		57	4.23255814				
Cattle	1	Milk fat		[i]			1	0.32		57	0.74418605	0.052343	Dorough and Hemken, 1973	6,7	i,l,n
							10	1.53		57	3.55813953				
							100	2.98		57	6.93023256				
Cattle	1	Milk fat		[i]			1	0.33		57	0.76744186	0.065298	Dorough and Hemken, 1973	6,7	i,l,o
							10	2.1		57	4.88372093				
							100	3.76		57	8.74418605				
Cattle	1	Milk fat		[i]			1	0.43		57	1	0.07944	Dorough and Hemken, 1973	6,7	i,l,p
							10	2.53		57	5.88372093				
							100	4.58		57	10.6511628				
Cattle	1	Milk fat		[i]			1	0.48		57	1.11627907	0.084189	Dorough and Hemken, 1973	6,7	i,l,q
							10	2.64		57	6.13953488				
							100	4.85		57	11.2790698				
Sheep		Fat		chlordane			10				16	-0.26667	Claborn, 1956		g
							25				12				

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).

TABLE D-6. UPTAKE OF CHLORDANE BY ANIMALS (cont.)

Species	H [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used in [k]	Footnote references

d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.

e Not specified whether tissue concentration is wet or dry weight.

f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)

g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.

h Feed concentration dry weight

i Feed concentration not specified. No conversion performed.

j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).

k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.

l Cattle fed HCS 3260 technical grade chlordane in gelatin capsules

m Tissue samples analyzed after 3 days

n Tissue samples analyzed after 7 days

o Tissue samples analyzed after 15 days

p Tissue samples analyzed after 30 days

q Tissue samples analyzed after 60 days

Note: percent moisture data from USDA, 1963. Used heavy cream data for milk fat.

TABLE D-7. UPTAKE OF DDT/DDD/DDE BY ANIMALS

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [i]	Reference	Used In [k]	Footnote references
Cow		Fat		DDT			10				6.8	2.346667	Claborn, 1956 (p.21)	1,4	g
							25				42				
Cattle	3	Body fat		DDE			0.62	1.37		20.21	1.71700714	3.340422	Fries and Marrow, 1976	1,4	e,i,l
							3.1	7.98		20.21	10.0012533				
Cow		Milk fat		DDE			1.40	6.76		57	15.7209302	11.22924	Fries et al., 1969	4,6	e,h
													as cited in Fries 1982 (p.15)		
Cow		Milk fat		DDT			1.40	1.21		57	2.81395349	2.009967	Fries et al., 1969	4,6	e,h
													as cited in Fries 1982 (p.15)		
Cattle	3	Milk fat		DDE			0.62	2.13		57	4.95348837	7.783196	Fries and Marrow, 1976	4,6	e,i,l
							3.1	10.43		57	24.255814				
Sheep		Fat		DDE			0.068	0.36		22.54	0.464756	6.834647	Harrison et al., 1970	3,4	e,i
													as cited in Fries 1982 (p.15)		
Sheep		Fat		DDT			0.63	1.08		22.54	1.39426801	2.213124	Harrison et al., 1970	3,4	e,i
													as cited in Fries 1982 (p.15)		
Sheep		Fat		DDT			10				3.1	0.793333	Claborn, 1956 (p.21)	3,4	h
							25				15				
Barn owl (male)	2	Carcass					0	0.80		73.83	3.05693542	150.1463	Mendenhall et al., 1983 (p.237)	4,5	g,m,n
	12						2.83	112.0		73.83	427.970959				
Hen		Liver		DDT			0.004	0.17		73.59	0.64369557	4.09426	Cummings et al., 1966 &1967	2,5	e,i,o
							0.05	0.25		73.59	0.94661113		as cited in Bevenue, 1976 (p.87)		
							0.15	0.45		73.59	1.70390004				
							0.45	0.67		73.59	2.53691783				
Hen		Liver		DDT			0.0	5.8		73.59	21.9613783	40.58902	Smith et al., 1970	2,5	e,i,p
							1.0	6.6		73.59	24.9905339		as cited in Bevenue, 1976 (p.87)		
							2.5	9.7		73.59	36.7285119				
							5.0	24.4		73.59	92.3892465				
							7.5	62.7		73.59	237.410072				
							10.0	117.0		73.59	443.01401				
Hen		Egg yolk		DDT			0.0	1.0		51.10	2.04498978	1.081822	Smith et al., 1970	7	e,i,p
							1.0	1.6		51.10	3.27198364		as cited in Bevenue, 1976 (p.87)		
							2.5	2.6		51.10	5.31697342				
							5.0	4.6		51.10	9.40695297				
							7.5	5.7		51.10	11.6564417				
							10.0	5.9		51.10	12.0654397				
Barn owl	2	Eggs		DDE			0	0.25		73.70	0.95057034	15.78686	Mendenhall et al., 1983 (p.238)	7	g,m,q,t
	12						2.83	12		73.70	45.6273764				

TABLE D-7. UPTAKE OF DDT/DDD/DDE BY ANIMALS (cont.)

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	Tissue Concentration range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used In [k]	Footnote references
Barn owl	2	Eggs		DDE			0	0.40		73.70	1.52091255	54.54863	Mendenhall et al., 1983 (p.238)	7	g,r,s,u
	12						2.83	41		73.70	155.893536				

Footnotes:

a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.
l Cows also fed same dose rates of hexachlorobenzene. Authors do not believe an interaction occurred.
m Tissue concentrations are geometric means of 9 samples, reported by authors.
n Feed concentrations are geometric means of 2 samples, reported by authors.
o Feed range 0.004-0.035; used lower value to be conservative.
p Lindane and dieldrin also in feed.
q Feed concentrations are geometric means of 13 samples, reported by authors.
r Tissue concentrations are geometric means of 13 samples, reported by authors.
s Feed concentrations are geometric means of 10 samples, reported by authors.
t 1975 data.
u 1976 data.

Note: percent moisture data from USDA, 1963. Used chicken data for barn owl and hen tissue, and heavy cream data for milk fat.

TABLE D-8. UPTAKE OF HEPTACHLOR BY ANIMALS

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutan quantity (mg/day	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	Tissue Concentration range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used in [k]	Footnote references
Dairy cow	2	Body fat		Heptachlor epoxide			0.5	7.1		20.21	8.89635819	7.139324034	Bruce et al., 1965 (p.64)	1,4,5	e,i
							1.5	14.7		20.21	18.42336132				
							10	83.5		20.21	104.6497055				
							50	293.4		20.21	367.7152525				
Steers	20	Body fat		Heptachlor epoxide			0.19	1.24		20.21	1.554079459	8.179365571	Bovard et al., 1971., (p.131)	1,4,5	e,i,l
Cow		Fat		Heptachlor			2.5				1.4	0.88	Claborn et al., 1960	1,4,5	g
							10				8				
Dairy cow	2	Milk fat		Heptachlor epoxide			0.2	4.25		57	9.88372093	21.06101164	Bruce et al., 1965 (p.64)	2,4,5,6,7	e,i
							0.5	11.25		57	26.1627907				
							1.5	21.7		57	50.46511628				
							10	119.7		57	278.372093				
							50	460		57	1069.767442				
Dairy cow		Milk fat		Heptachlor epoxide			0.5	0.38		57	0.88372093	7.255813953	Bache et al., 1960	2,4,5,6,7	e,i
							1.0	1.94		57	4.511627907		as cited in Bruce et al., 1965 (p.64)		
Sheep		Fat		Heptachlor			2.5				2.1	0.853333333	Claborn et al., 1960	3	g
							10				8.5				

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.
l Cows also fed same dose rates of DDE. Authors do not believe an interaction occurred.

Note: percent moisture data from USDA, 1963. Used heavy cream data for milk fat.

TABLE D-9. UPTAKE OF HEXACHLOROBENZENE BY ANIMALS

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	Tissue Concentration range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used in [k]	Footnote references
Cow	3	Body fat		HCB			0.62	1.91		20.21	2.393783682	3.481922	Fries and Marrow, 1976 (p.477)	1,2,4	e,i,l
							3.1	8.60		20.21	11.028951				
Cow	3	Milk fat		HCB			0.62	2.12		57	4.930232558	6.46099	Fries and Marrow, 1976 (p.477)	2,4,6	e,i,l
							3.1	9.01		57	20.95348837				
Sheep		Body fat		HCB			0.1	0.9		22.54	1.161890006	8.352516	Avrahami and Steele, 1972 as cited in Booth & Mc Dowell, 1975 (p.593)	3,4	e,i
							1	7.5		22.54	9.682416731				
							10	75.0		22.54	96.82416731				
							100	650.0		22.54	839.1427634				
Chicken		Body fat		HCB			0.02	0.7		28.91	0.984667323	5.642786	FAO-WHO, 1969 as cited in Booth & Mc Dowell, 1975 (p.593)	5	e,i
							0.06	0.7		28.91	0.984667323				
							0.7	5		28.91	7.033338022				
							7	29		28.91	40.79336053				
Chicken, broiler		Fat		HCB								13	Dejunckheere et al., as cited in Connor, 1984 (p.48)	5	m
Chicken, hen		Fat		HCB								38	Dejunckheere et al., as cited in Connor, 1984 (p.48)	5	n
Chicken		Body fat		HCB			340	528		28.91	742.7204951	2.184472	FAO-WHO, 1969 as cited in Booth & Mc Dowell, 1975 (p.593)	5	e,i
Chicken		Egg yolks		HCB			0.02	0.2		51.10	0.408997955	4.312415	FAO-WHO, 1969 as cited in Booth & Mc Dowell, 1975 (p.593)	7	e,i
							0.06	0.3		51.10	0.613496933				
							0.7	2.0		51.10	4.08997955				
							7	15		51.10	30.67484663				
Chicken		Egg yolks		HCB			340	167		51.10	341.5132924	1.004451	FAO-WHO, 1969 as cited in Booth & Mc Dowell, 1975 (p.593)	7	e,i
Chicken		Egg		HCB								6.5	Dejunckheere et al., as cited in Connor, 1984 (p.48)	7	o

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.

TABLE D-9. UPTAKE OF HEXACHLOROBENZENE BY ANIMALS (cont.)

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used In [k]	Footnote references

h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.
l Cows also fed same dose rates of DDE. Authors do not believe an interaction occurred.
m Dry weight uptake slope range of 11-13 reported. Used higher to be conservative.
n Dry weight uptake slope range of 21-38 reported. Used higher to be conservative.
o Dry weight uptake slope range of 4.5-6.5 reported. Used higher to be conservative.

Note: percent moisture data from USDA, 1963. Used heavy cream data for milk fat.

TABLE D-10. UPTAKE OF LINDANE BY ANIMALS

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used In [k]	Footnote references
Cow		Fat		Lindane			1				2.0	1.117267	Claborn, 1956 (p.26)	1,2,3,4,5,6,7	g
							10				8.3				
							100				111.0				

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.

Note: percent moisture data from USDA, 1963

TABLE D-11. UPTAKE OF POLYCHLORINATED BIPHENYLS BY ANIMALS

Species	N [a]	Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used In [k]	Footnote references
Cow		Body fat		Arochlor 1254			12.4	41.7		20.21	52.2621882	4.21469	Fries et al., 1973 (p.119)	1,2,3,4,5	e,h,l
Cow		Milk fat		Arochlor 1254			12.4	60.9		57	141.627907	11.4216	Fries et al., 1973 (p.119)	2,3,4,5,6,7	e,h,l
Cattle		Milk fat		Arochlor 1254			0.22	1.0		57	2.3255814	9.71869	Willet, 1975	2,3,4,5,6,7	e,h
							0.43	1.8		57	4.18604651		as cited in Fries, 1982 (p.15)		
							0.87	3.7		57	8.60465116				

Footnotes:

a Number of animals studied.

b Number of samples analyzed.

c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).

d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.

e Not specified whether tissue concentration is wet or dry weight.

f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)

g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.

h Feed concentration dry weight

i Feed concentration not specified. No conversion performed.

j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).

k "Used In" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.

l Tissue concentration is arithmetic mean reported by authors.

Note: percent moisture data from USDA, 1963. Used heavy cream data for milk fat.

TABLE D-12. UPTAKE OF TOXAPHENE BY ANIMALS

Species	N [a]		Tissue Analyzed	N [b]	Chemical Form Fed	Pollutant quantity (mg/day)	Feed quantity (kg DW/day)	Feed Conc. (µg/g) [c]	Tissue Concentration (µg/g WW) [d]	range (+/-)	percent moisture (%)	Tissue Conc. (µg/g DW) [f]	Uptake Slope [j]	Reference	Used in [k]	Footnote references
Cow	2		Milk		[l]			0	0		87.30	0	0.748122294	Bateman et al., 1953 (p.323-4)	1,2,3,4,5,6,7	e,i,l
								63.18	11.6		87.30	91.3385827				
								132.6	13.3		87.30	104.724409				
								288.18	29.2		87.30	229.92126				
Cow	2		Liver		[l]			0	0		68.99	0	0	Bateman et al., 1953 (p.323-4)		e,i,l
								120.7	0		68.99	0				
								252.4	0		68.99	0				
Cow	2		Kidney		[l]			0	0		77.02	0	0	Bateman et al., 1953 (p.323-4)		e,i,l
								120.7	0		77.02	0				
								252.4	0		77.02	0				
Cow	2		Muscle		[l]			0	0		70.62	0	0	Bateman et al., 1953 (p.323-4)		e,i,l
								120.7	0		70.62	0				
								252.4	0		70.62	0				

Footnotes:
a Number of animals studied.
b Number of samples analyzed.
c Where pollutant quantity and feed quantity are given, feed concentration = (pollutant quantity)/(feed quantity).
d If it is not specified if tissue concentration is wet or dry weight, then it is treated conservatively as being reported as wet weight and then converting to dry weight. Referenced as footnote e.
e Not specified whether tissue concentration is wet or dry weight.
f Tissue concentration either reported as dry weight or converted from wet to dry weight using: dry weight concentration = (wet weight concentration)/((100 - percent moisture)/100)
g Feed concentration wet weight. No conversion performed because no feed moisture data available. Not converting results in conservative output.
h Feed concentration dry weight
i Feed concentration not specified. No conversion performed.
j Uptake slope = (dry weight tissue concentration)/(feed concentration). Units are (µg-pollutant/g-tissue DW)/(µg-pollutant/g-diet). Denominator units my be DW, WW or unspecified (see footnotes g,h, & i).
k "Used in" indicates that the study is used for calculating the following food group uptake slope: 1 beef fat; 2 beef liver; 3 lamb fat; 4 pork fat; 5 poultry fat; 6 dairy fat; 7 eggs.
l Cows fed Alfalfa sprayed with toxaphene in the field.

Note: percent moisture data from USDA, 1963

APPENDIX E

Results of the Plant Phytotoxicity Literature Search

TABLE OF CONTENTS

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH	Soil Type
Barley	Hordeum vulgare		leaves			
Cherry	Prunus cerasus		fruit	field		
Corn	Zea mays		leaves,stalks,grain,husks,cobs			
Mushroom	Cantharellus cibarius					
Oak, English	Quercus robur		leaves	field		
Oak	Quercus spp.		leaves	field		
Oats	Avena sativa		leaves	solution		
			leaves,stems	serpentine soil		
Oranges	Citrus sinensis		leaves	greenhouse		
				field		
				pots		
Pear	Pyrus communis		fruit,pericarp,peel	field		
Potato	Solanum tuberosum		tubers			
Tobacco	Nicotiana tabacum		leaves,roots	serpentine soil		
Wheat	Triticum spp.		leaves			
Corn	Zea mays			greenhouse	6.8	Warsaw sandy loam limed
Rye	Seceale cereal			greenhouse	6.8	Warsaw sandy loam limed
Corn	Zea mays			greenhouse	6.5	Warsaw sandy loam
Rye	Seceale cereal			greenhouse	6.5	Warsaw sandy loam
Corn	Zea mays		grain	field	6.3	Sable silty clay loam
					6.8	Cisne silt loam
					6.0-6.3	Ipava silt loam
					6.2-6.3	Drummer silty clay loam
					6	Muscatine silt loam
					6.2	Hartsburg silty clay loam
			tops	greenhouse	5.5	Hartsell fine sandy loam

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

Plant Name	Treatment	Concentration in soil	Loading rate	plant tissue concentration		
				deficiency	normal	toxic
Barley					7.60 ppm	
Cherry					.032ppm	
Corn					.44-2.07	4.0-8.0
Mushroom					.058-.135	
Oak, English					3	
Oak					4	
Oats					0.4-3.0	252
					3.0-11.0	
Oranges					.20-1.00	
					<10	
					.20-<1.00	
Pear					.03-.85	
Potato					0.002	
Tobacco					4-14	18-34
Wheat					4.5-14.8	
Corn	fertilized				<.4	
	plain sludge	58ppm			.7-1.6	
	Cr sludge	404-1444			2.3-7.2	
Rye	fertilized				0.8	
	plain sludge		58		1.3	
	Cr sludge	404-1444			3.2-5.1	
Corn	fertilized				<3	
	sludge		58		<3	
	Cr sludge	358-697			3-8.0	
	inorganic	350-700				46
Rye	fertilized				<3	
	sludge		58		<3	
	Cr sludge	358-697			4.8-9.5	
	inorganic	350-700				25.1-58.1
Corn					.094 ug/g	
					0.11ug/g	
					.059-.193ug/g	
					.059-.118ug/g	
					0.068 ug/g	
					.094 ug/g	
	sludge A		68-1360		1.2-5.4	
	sludge B		3-50		.6-3.5	
	compost		3-50		.7-2.8	
	NaCrO		1-320		1.4-1.6	2.5-29.0

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity deficiency		phytotoxicity		reference
	type	symptoms	type	symptoms	
Barley					35
Cherry					35
Corn	visual	stunted,leaves roll & purple			35
Mushroon					35
Oak, English					35
Oak					35
Oats	visual	stunted,brownish-red leaves			35
					35
Oranges					35
					35
					35
Pear					35
Potato					35
Tobacco			visual	stem retarded,no inflorescence	35
Wheat					35
Corn					44
					44
			yield	reduction was attributed to others	44
Rye					44
					44
			yield	reduction was attributed to others	44
Corn					45
					45
					45
			yield	reduction,lowest yield in crop #1	45
Rye					45
					45
					45
			yield	reduction	45
Corn					187
					187
					187
					187
					187
					187
					169
					169
					169
			yield	reduction from 55 to 1 g/pot	169

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH	Soil Type
		Jubilee	leaves, kernels	field	5.8-7.1	Willamette silt loam
Swiss chard	Beta vulgaris	Fordhook Giant		greenhouse	5.6-5.9	Chalmers silty clay loam and Russel silt loam
Rye grass	Lolium perenne			greenhouse	5.6-5.9	Chalmers silty clay loam and Russel silt loam
Soybean	Glycine max	Corsoy	seedling tissue	pot	5.9	Nicollet loam soil
Sorghum	sorghum bicolor	Moench	leaves,root,grain,stem	field	5.8-7.2	Haynie fine sand loam
					6.9-7.7	Haynie fine sand loam
Winter wheat	Triticum aestivum		roots,grain	field	5.8-7.2	Haynie fine sand loam
					6.9-7.7	Haynie fine sand loam
Oat		Harmon	root,seed,stem	field		
Lucerne	Medicago sativa	Wairau	whole	pot	5	Waitarere sand
					5.1-5.6	Waitarere sand
					6.6	Waitarere sand
					5.2	Levin silt loam
					5.4-6.0	Levin silt loam
					6.8	Levin silt loam
Tomato	Lycopersicon esculentum	Money maker	leaves,fruit,root	pot	4.6-6.9	
Soybean	Glycine max		stem,leaves,seeds,pods	pot		Ritzville silt loam
Grass		timothy,brown top sweet vernal,blue		field	6.05	clay & sandy loam
					6.2	clay & sandy loam
Alfalfa & red clover				field	6.05	clay & sandy loam
					6.2	clay & sandy loam
Various			shoots	field		serpentine soil
Wheat	Triticum aestivum	HDM 1553	stem	field	8	clay
			tops	pot	5.0-5.5	Orentano histosol

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

Plant Name	Treatment	Concentration in soil	Loading rate	plant tissue concentration		
				deficiency	normal	toxic
	CrSO$		5-320		1.3-1.4	2.4-2.8
	control		0		1.3-2.1	
	control	.87-1.0 mmol/kg			.18-.19mmol/kg	
	tannery waste	1.23-13.7mmol/kg			.12-.22mmol/kg	
Swiss chard	control	12 mg/kg			8.9	
	drilling fluid	96-402 mg/kg			8.0-12.2	
Rye grass	control	12 mg/kg			7.5	
	drilling fluid	96-402 mg/kg			8.3-10.9	
Soybean	Na2Cr2O		0-40 mg/kg		.7-1.1	
	sludge		0-432 mg/kg		.7-.9	
Sorghum	fertilized	29.34			0.398	
	sludge	47.7			0.2	
Winter wheat	fertilized	29.34			15.47	
	sludge	47.7			17.26	
Oat	control	.8.1-9.6			43	
	25% sludge	20.3			72	
	50% sludge	27.5			56	
Lucerne	0	15			.75-9.1	
	5-40% sludge	19.25-49			.1-6.5	
	100% sludge	100			.1-2.6	
	0	30			.1-.9	
	5-40% sludge	33.5-58			.1-4.7	
	100% sludge	100			.1-1.0	
Tomato	sludge	470	0-459 kg/ha		15	
Soybean	control	59			0.095	
	Cr solution		2.5 ug/g		0.15	
Grass	control	.18-.78			.13-1.63	
	sludge	.30-.94	1.39-5.84 kg/ha		.11-2.07	
Alfalfa & red clover	control	.18-.78			.47-3.96	
	sludge	.30-.94	1.39-5.84 kg/ha		.38-7.93	
Various	natural	92-737			0-70	
Wheat	control	17	0		7.94	
	50% sludge	41.8			9.52	
	66% sludge	46.6			10.6	
	100% sludge	55			12.16	
	10 ton/ha sludge	27	.45 kg/ha		11.08	
	20 ton/ha sludge	31	.90 kg/ha		20.76	
	control	27.8			5	
	fly ash 2%	25.6			4.1	

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity deficiency		phytotoxicity		reference
	type	symptoms	type	symptoms	
			yield	reduction from 56 to 25 g/pot	169
					169
					226
					226
Swiss chard					176
					176
Rye grass					176
					176
Soybean					57
					57
Sorghum					127
					127
Winter wheat					127
					127
Oat					73
					73
					73
Lucerne					261
					261
					261
					261
					261
					261
Tomato					262
Soybean					27
					27
Grass					147
					147
Alfalfa & red clover					147
					147
Various					5
Wheat					29
					29
					29
					29
					29
					29
					186
					186

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH	Soil Type
					6.1-8.3	Lamporecchio fluvisol
					7.5-8.0	Guardia regosol

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

Plant Name	Treatment	Concentration in soil	Loading rate	plant tissue concentration		
				deficiency	normal	toxic
	fly ash 5%	20.3			4.3	
	control	25.7			3.2	
	fly ash 2%	21.8			3.1	
	fly ash 5%	18.2			2.8	
	control	13.9			4.9	
	fly ash 2%	14.4			3.2	
	fly ash 5%	21.1			4.1	

TABLE E-1. CHROMIUM PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity deficiency		phytotoxicity		reference
	type	symptoms	type	symptoms	
					186
					186
					186
					186
					186
					186
					186

TABLE E-2. COPPER PHYTOTOXICITY DATA

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Alfalfa	Medicago sativa		steams,leaves,tops	field	
			tops	control	
Apple	Malus spp.		leaves	field	
Avocado	Persea americana		leaves	field	
Barley	Hordeum vulgare		grain	field	
Cacao	Theobroma cacao		leaves	field	
Cauliflower	Brassica oleracea botrytis		leaves	field	
Cherry	Prunus cerasus		leaves	field	
Lemon	Citrus limon		leaves	field	
Orange	Citrus sinensis		leaves, Valencia and Navel leaves	field	
				culture	
				control	
Clover,red	Trifolium pratense		tops	field	
Clover,subterranean	Trifolium subterraneum		leaves,tops	field	
Coffee	Coffea spp.		beans		
Currant,black	Ribes nigrum		leaves	field	
Grapes	Vitis spp.		leaves	field	
Oats	Avena sativa		leaves,straw,tops,grain,	field	
				solution	
Peach	Prunus persica		leaves	field	
Pear	Pyrus communis		leaves,wood,bark	field	
Pecan	Carya illinoensis		leaves	field	
Pineapple	Ananas comosus		leaves	field	
Plum	Prunus domestica		apical leaves	field	
Potato	Solanum tuberosum		tubers	field	
Rye	Secale cereale		grain	field	
Timothy	Phleum pratense		tops	field	
Tomato	Lycopersicon esculentum		leaves	greenhouse	
			fruit	control	
			fruit	field	
Tung	Aleurites fordi		leaves	field	
Wheat	Triticum spp.		straw,grain,wheat germ	field	
Corn	Zea mays		earleaf	controled	5.8-6.2
					5.7-6.0
					5.7-6.0
			earleaf,grain,stover	field	6.6
Barley	Hordeum vulgare	Henry	silage	field	6.6
Reed canarygrass	Phalaris arundinacea			field	5.9-6.6
Corn	Zea mays			field	5.9-6.6

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
Alfalfa				
Apple				
Avocado				
Barley				
Cacao				
Cauliflower				
Cherry				
Lemon				
Orange				
Clover,red				
Clover,subterranean				
Coffee				
Currant,black				
Grapes				
Oats				
Peach				
Pear				
Pecan				
Pineapple				
Plum				
Potato				
Rye				
Timothy				
Tomato				
Tung				
Wheat				
Corn	Bojac loamy sand			
	Davidson clay loam			
	Groseclose silt loam			
	Acredale silt loam			304 kg/ha
Barley	Acredale silt loam			304 kg/ha
Reed canarygrass	Hublersburg clay loam			36.6 kg/ha
Corn	Hublersburg ckay loam			7.6 kg/ha

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
Alfalfa		5.10-11.5			
		6-16.4			
Apple	1.0-4.0	3.2-23.0		visual	necrotic spots,shoots die
Avocado		4-11			
Barley		6.2-11.9			
Cacao		11-15			
Cauliflower		4.8-5.4			
Cherry		5-200			
Lemon	3.9	8.4-8.6		visual	multiple budding,gum pockets
Orange	<4.00	5-20	>20.00	visual	dark greeen leaves,bumpy fruit
	<4.00	4-20		visual	dark greeen leaves,bumpy fruit
	.70-1.60	3.20-15		visual	dark greeen leaves,bumpy fruit
Clover,red		7.6-16.4			
Clover,subterranean	<3.00	3-32		visual	become light, no center markings
Coffee		8.0-20.0			
Currant,black	2-4	7.5-10.00		visual	leaves turn pale & mottled
Grapes	1.0-5.4	2.6-30.0		visual	
Oats	<3.0	7-8		visual	leaves roll& yellow-gray spots
	1-2.5	1.1-8.8		visual	leaves roll& yellow-gray spots
Peach		7-16			
Pear	1.2-6.7	5-100		visual	stunted,terminal leaves die,unfruit
Pecan		21-28			
Pineapple		8.6-11.5			
Plum	3.0-4.0	7.0-9.0		visual	terminal buds die,leaves go yellow
Potato		2.5-5.5			
Rye	<.5	<2.0		visual	
Timothy		6.4			
Tomato		3.1-12.3			
		13.0-37.0			
		15.0-25.0			
Tung	2.6-3.1	4.8-5.7		visual	foliage is chlorotic & dwarfed
Wheat	1.5 (grain)	3-16.7 (gr)		visual	Leaves roll,yellow,die,dry to gray
Corn		6.1-9.6mg/kg			
		6.1-9.1mg/kg			
		8.8-10.5mg/k			
		4.9-8.2mg/kg			
Barley		1.0-2.8mg/kg			
Reed canarygrass		8.9-32.3ug/g			
Corn		4.2-6.2ug/g			

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
Alfalfa			35
			35
Apple			35
Avocado			35
Barley			35
Cacao			35
Cauliflower			35
Cherry			35
Lemon			35
Orange	visual	chlorosis of the foliage,yellow	35
			35
			35
Clover,red			35
Clover,subterranean			35
Coffee			35
Currant,black			35
Grapes			35
Oats			35
			35
Peach			35
Pear			35
Pecan			35
Pineapple			35
Plum			35
Potato			35
Rye			35
Timothy			35
Tomato			35
			35
			35
Tung			35
Wheat			35
Corn			197
			197
			197
			196
Barley			196
Reed canarygrass		none reported	213
Corn		none reported	213

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
				greenhouse	6.8
Rye	Seceale cereal			greenhouse	6.8
Corn	Zea mays			greenhouse	6.5
Rye	Seceale cereal			greenhouse	6.5
Bermuda grass	Cynodon dactylon			field	5.7-6.6
					5.4-6.2
					4.2-5.3
Corn	Zea mays		grain	field	6.3
					6.8
					6.0-6.3
					6.2-6.3
					6
					6.2
Tall Fescue	Festuca arundinacea		tops	pots	7.1-7.5
					6.1-7.5
					5.5-6.0
Alfalfa	Medicago sativa		tops	pots	7.1-7.7
					6.1-7.5
					5.5-6.0
Lettuce	Lactuca sativa	longifolia	shoots	greenhouse	7.5
					5.7
Wheat	Triticum aestivum	Inia	leaves,grain	greenhouse	7.5
					5.7

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	limed Warsaw sandy loam	fertilized		
		sludge	46 ppm	
		Cu sludge	120-343 ppm	
Rye	limed Warsaw sandy loam	fertilized		
		sludge	46 ppm	
		Cu sludge	120-343 ppm	
Corn	Warsaw sandy loam	fertilized		
		sludge	46	
		Cu sludge	88-160	
		inorganic	75-150	
Rye	Warsaw sandy loam	fertilized		
		sludge	46	
		Cu sludge	88-160	
		inorganic	75-160	
Bermuda grass	Cecil sandy clay loam	control	1	
	Cecil sandy clay loam	fertilized	1	
	Cecil sandy clay loam	sludge	1-4	
Corn	Sable silty clay loam			
	Cisne silt loam			
	Ipava silt loam			
	Drummer silty clay loam			
	Muscatine silt loam			
	Hartsburg silty clay loam			
Tall Fescue	fine silty		3.9	
	fine silty	sludge	19.2	
	stripped mind	sludge	25.2	
Alfalfa	fine silty		3.9	
	fine silty	sludge	19.2	
	stripped mind	sludge	25.2	
Lettuce	Domino silt loam		0-10	
			20-80	
			160-640	
	Redding fine sandy loam		0-10	
			20-80	
			160-640	
Wheat	Domino silt loam		0-10	
			20-80	
			160-640	
	Redding fine sandy loam		0-10	

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		4.4-10.4			
		6.5-24.3			
			>30		
Rye		7.5			
		12.1			
			>42		
Corn		4.4-10.4			
		6.5-24.3			
			16.7-22.8		
			12.7-41.0		
Rye		7.5			
		12.1			
		14.7-17.4			
			23.9-37.9		
Bermuda grass		12			
		7			
		6-8			
Corn		2.69 ug/g			
		2.68 ug/g			
		2.6-4.41ug/g			
		2.18-3.22ug/g			
		2.49 ug/g			
		1.67 ug/g			
Tall Fescue		9.7			
		9.6-15.0			
		8.6-11.6			
Alfalfa		16			
		19.1-20.5			
		15.1-17.8			
Lettuce		6.2-6.4 ug/g			
		6.6-7.9 ug/g			
			8.2-9.3 ug/g		
		6.8-7.3 ug/g			
		6.1-8.9 ug/g			
		7.6-10.7 ug/g	10.7-18.3ug/g		
Wheat		10.7-11.6ug/g			
		11.9-14.8ug/g			
		13.9-15.4ug/g	15.4-21.0ug/g		
		10.1-10.7ug/g			

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			44
			44
	yield	reduction	44
Rye			44
			44
	yield	reduction	44
Corn			45
			45
	yield	reduction	45
	yield	reduction	45
Rye			45
			45
			45
	yield	reduction	45
Bermuda grass.			240
			240
			240
Corn			187
			187
			187
			187
			187
			187
Tall Fescue			230
			230
			230
Alfalfa			230
			230
			230
Lettuce			167
			167
	yield	significant yield reduction	167
			167
			167
	yield	significant yield reduction	167
Wheat			167
			167
	yield	significant yield reduction	167
			167

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Snap bean	Phaseolus vulgaris	Tendergreen	beans,leaves	field	5.3
			leaves, edible tissue	field	5.3
Carrots	Daucus carota sativa	Scarlet Nantes	tubers	field	5.3
Lettuce	Lactuca sativa	Grand Rapids	leaves	field	5.3
Peas	Pisum sativum	Wando	fruit,vines,pods	field	5.3
Potatoes	Solanum tuberosum	Norland	tubers	field	5.3
Radishes	Raphanus sativus	Sparkler	tubers	field	5.3
Sweet corn	Zea mays	NK-199	grain,leaves	field	5.3
Tomatoes	Lycopersicon esculentum	Fantastic	fruit	field	5.3
Wheat	Triticum aestivum	Centurk	grain	field	
Pearl Millet	Pennisetum americanum		leaves	field	5.3-6.9
Red Oak	Quercus ruba		leaves	field	5.3-6.9
Black Walnut	Juglans nigra		leaves	field	5.3-6.9
Wheat	Triticum aestivum			pots	5.2
					>6.5
			shoots,roots	greenhouse	
Little bluestem	Andropogon scoparius		shoots,roots,whole	greenhouse	4.8
					7.82
Black-eyed Susan	Rudbeckia hirta		shoots,roots,whole	greenhouse	4.8
Corn	Zea mays	Dekalb XL-43	seedlings,grain,stover	field	5.6
					6
					6.3
Oats	Avena sativa	Norline	grain	field	5.6
					6
					6.3
Wheat	Triticum aestivum	Arthur	grain	field	5.6
					6

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
			20-80	
			160-640	
Snap bean	Hubbard coarse sand			
	Hubbard coarse sand	control		0
		single		26.3-105kg/ha
		anual		66.0-263kg/ha
Carrots	Hubbard coarse sand			
Lettuce	Hubbard coarse sand			
Peas	Hubbard coarse sand			
Potatoes	Hubbard coarse sand			
Radishes	Hubbard coarse sand			
Sweet corn	Hubbard coarse sand			
Tomatoes	Hubbard coarse sand			
Wheat	Truckton loamy sand			
Pearl Millet	Downer sand	fertilized		
		unfertilized		
		sludge		517ug/g sludge
Red Oak	Downer sand	fertilized		
		unfertilized		
		sludge		517ug/g sludge
Black Walnut	Downer sand	fertilized		
		unfertilized		
		sludge		517ug/g sludge
Wheat	Redding fine sandy loam			100-200 ug/g
	Redding fine sandy loam			100-200 ug/g
	clay loam	control		
		0-2 cm depth		
		18-20cm depth		
Little bluestem	rural Plainfield sand		37.73-47.11	
	urban Oakville sand		47.25	100 ug/g
Black-eyed Susan	rural Plainfield sand		84.88	200 ug/g
Corn	sandy	no sludge	.6-1.0	
	sandy	56 metric tons	29-35	
	sandy	112metric tons	58-66	
Oats	sandy	no sludge	.6-1.0	
	sandy	56 metric tons	29-35	
	sandy	112metric tons	58-66	
Wheat	sandy	no sludge	.6-1.0	
	sandy	56 metric tons	29-35	

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		10.6-10.9ug/g			
			11.8-42.0ug/g		
Snap bean		11 ug/g			
		8.2-10.0 ug/g			
		11.8-12.2 ug/g			
		10.8-12.0 ug/g			
Carrots		<.3-1.5			
Lettuce		1.6-11.9			
Peas		5.9-22.8			
Potatoes		8.6-19.0			
Radishes		<.3			
Sweet corn		8.5-15.8			
Tomatoes		<.3			
Wheat		3.50-5.96 ug/g			
Pearl Millet		5.8-7.8 ug/g			
		5.2-6.6 ug/g			
		5.4-10.3 ug/g			
Red Oak		5.8 ug/g			
		6.2 ug/g			
		6.0-6.6 ug/g			
Black Walnut		5.6 ug/g			
		5.1 ug/g			
		6.4-7.8 ug/g			
			**		
Wheat			**		
		6.5			
		8.4			
		7.2			
			**		
Little bluestem					
		50.59	209.5		
			**		
Black-eyed Susan					
Corn		3.6-7.2			
		10.5-14.2			
		11.6-16.8			
Oats		1.5			
		2.6			
		2.5			
Wheat		2.1			
		3.2			

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			167
	yield	significant yield reduction	167
Snap bean			58
			138
			138
			138
Carrots			56
Lettuce			56
Peas			56
Potatoes			56
Radishes			56
Sweet corn			56
Tomatoes			56
Wheat			206
Pearl Millet			128
			128
			128
Red Oak			128
			128
			128
Black Walnut			128
			128
			128
Wheat	yield	reduction	15
	yield	reduction	15
			126
			126
			126
Little bluestem	yield	25% yield reduction	164
	yield	reduction of up to 68%	164
Black-eyed Susan	yield	total mortality	164
Corn			212
			212
			212
Oats			212
			212
			212
Wheat			212
			212

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
					6.3
Rye	Secale cereale	Balboa	grain	field	5.6
					6
					6.3
Crimson clover	Trifolium incarnatum	Auburn	whole	field	5.6
					6
					6.3
Arrowleaf clover	Trifolium vesiculosum	Yuchi	whole	field	5.6
					6
					6.3
Carrots	Daucus carota	Danvers	tubers,shoots	field	5.5-5.8
Radishes	Raphanus sativus	Cherry belle	tubers,shoots	field	5.5-5.8
Tomato	Lycopersicon esculentum	New Yorker	fruit	field	5.5-5.8
Lettuce	Lactuca sativa	Salad Bowl	leaves	field	5.5-5.8
Bromegrass	Bromus inermis	Leyess		field	6.7-7.9
Corn	Zea mays		stover	field	6.7-7.9
		Pioneer 3369A	leaves,grain	field	low
Grain sorghum	Sorghum bicolor	Funk G-522	leaves,grain	field	low
Soybeans	Glycine max	Centennial	seedlings leaves seeds	field	low
Winter wheat	Triticum spp.	Anza	straw	field	7.6
Swiss chard	Beta vulgaris	Ford Hook Giant		greenhouse	7.7
					7
					5.5
Sweet corn	Zea mays	Jubilee	plant, seeds	field	
Alfalfa	Medicago sativa	Ranger	leaves,stems	field	
Wheat	Triticum vulgare	Fremont	plant, seeds	field	
Fodder rape	Brassica napus	Kenton		greenhouse	5.6
					6
					7.5
Barley	Hordeum vulgare	Larker		greenhouse	4.0-6.4
Rye Grass	Lolium multiflorum	Westerwool		greenhouse	4.0-6.4
Corn	Zea mays	Pioneer 3517	leaves, grain	field	7.6-8.1

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	sandy	112metric tons	58-66	
Rye	sandy	no sludge	.6-1.0	
	sandy	56 metric tons	29-35	
	sandy	112metric tons	58-66	
Crimson clover	sandy	no sludge	.6-1.0	
	sandy	56 metric tons	29-35	
	sandy	112metric tons	58-66	
Arrowleaf clover	sandy	no sludge	.6-1.0	
	sandy	56 metric tons	29-35	
	sandy	112metric tons	58-66	
Carrots	Bridgehampton silt loam		1.6-13.8	
Radishes	Bridgehampton silt loam		1.6-13.8	
Tomato	Bridgehampton silt loam		1.6-13.8	
Lettuce	Bridgehampton silt loam		1.6-13.8	
Bromegrass	Conestoga loam	NH4NO3		
		sludge low		
		sludge high		
Corn	Conestoga loam	No N		
		NH4NO3		
		Ca sludge		6-13 kg/ha
		Al sludge		9-18 kg/ha
		Fe sludge		13-18 kg/ha
	fine sandy loam			
Grain sorghum	fine sandy loam			
Soybeans	fine sandy loam			
Winter wheat	Omni silty clay		40-62	86.2 kg/ha
Swiss chard	Domino silt loam		.1-.4	6.0-40.0
	Hanford sandy loam		.2-.6	6.0-40.0
	Redding fine sand		.05-.4	6.0-40.0
Sweet corn	fine silt		8-25	
Alfalfa	fine silt		8-25	
Wheat	fine silt		8-25	
Fodder rape	sandy			687 mg/kg
	sandy			
	sandy			
Barley	marginally productive soil	dredged material		
Rye Grass	marginally productive soil	dredged material		
Corn	calcareous strip-mined spoil	control	2.3-6.8 mg/kg	
		sludge	2.7-39.6mg/kg	

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		3.7			
Rye		4.5			
		6.6			
		6.7			
Crimson clover		7.1			
		8.4			
		9.4			
Arrowleaf clover		7.3			
		10.1			
		13.9			
Carrots		3-11			
Radishes		9-22			
Tomato		10-13			
Lettuce		11-17			
Bromegrass		5.9-11			
		7.3-10.1			
		9.3-14.4			
Corn		4.3-8.0			
		6.1-9.4			
		6.0-9.6			
		6.7-11.6			
		6.3-9.6			
		11.3-13.5			
Grain sorghum		8.5-11.0			
Soybeans		10.5-29.5			
Winter wheat		2.0-3.2			
Swiss chard		12-19 mg/kg			
		4-14 mg/kg			
		12-23 mg/kg			
Sweet corn		8.5-9.5			
Alfalfa		8.-12			
Wheat		8.0-9.5			
Fodder rape		6.95-25.75			
		7.02-17.71			
		6.88-14.47			
Barley		6-21			
Rye Grass		9-39			
Corn		9-16			
		10-15			

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			212
Rye			212
			212
			212
Crimson clover			212
			212
			212
Arrowleaf clover			212
			212
			212
Carrots			211
Radishes			211
Tomato			211
Lettuce			211
Bromegrass			224
			224
			224
Corn			224
			224
			224
			224
			224
			143
Grain sorghum			143
Soybeans			143
Winter wheat			32
Swiss chard			242
			242
			242
Sweet corn			24
Alfalfa			24
Wheat			24
Fodder rape			173
			173
			173
Barley			41
Rye Grass			41
Corn			188
			188

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
		Jubilee	leaves, kernels	field	5.8-7.1
Swiss chard	Beta vulgaris	Fordhook Giant		greenhouse	5.6-5.9
Rye Grass	Lolium perenne			greenhouse	5.6-5.9
Upland cotton	Gossypium hirsutum		leaves, seeds	field	8.2
Timothy	Phleum pratense			field	6.3
					6.1
Corn	Zea mays		leaves,grain	field	7
		Pioneer 3192	leaves, grain	field	>6.5
					>6.5
					>6.5
Soybean	Glycine max	Corsoy	seeding tissue	pot	5.9
Sorghum	Sorghum bicolor	Moench	root,leaves,stems,grain	field	6.9-7.2
					5.8-7.2
Winter wheat	Triticum		root, grain	field	6.9-7.7
					5.8-7.2
Splash pine	Pinus elliottii		pine needles	field	4.8-5.1
					4.9-5.3
					4.8-5.2
Wheat	Triticum aestivum	Vergina	whole	field	

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	Willamette silt loam	control	8-11umol/kg	
		tannery waste	8-13 umol/kg	
Swiss chard	Chalmers silt clay loam and	control	13 mg/kg	
	Russel silt loam	drilling fluid	10-163 mg/kg	
Rye Grass	Chalmers silt clay loam and	control	13 mg/kg	
	Russel silt loam	drilling fluid	10-163 mg/kg	
Upland cotton	Pima clay loam	control		
		fertilized		
		sludge		
Timothy	Dalhousie clay loam	control		
		fertilized		
		pig manure		
		sludge		
	St. Bernard sandy loam	control		
		fertilized		
		pig manure		
		sludge		
Corn	Davidson silty clay	CuSO4		334-415 kg/ha
	Guernsey silt loam	control		
		pig manure		
		sludge		
	Bertie fine sandy loam	control		
		pig manure		
		sludge		
	Starr-Dyke clay loam	control		
		pig manure		
		sludge		
Soybean	Nicollet loam soil	CuSO4		0-40 mg/kg
		sludge		0-107 mg/kg
Sorghum	Hynie fine sandy loam	fertilized	0.6	
	Hynie fine sandy loam	sludge	2.9	
Winter wheat	Hynie fine sandy loam	fertilized	0.6	
	Hynie fine sandy loam	sludge	2.9	
Splash pine	Troup fine sandy loam	control	0.5	0
	Troup fine sandy loam	low sludge	1.2-2.4	11-34 kg/ha
	Troup fine sandy loam	high sludge	1.7-2.6	45-56 kg/ha
Wheat		control	50-80 mg/kg	
		low Zn polution	100-300	
		med Zn polution	300-600	

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		.07-.08 mmol/kg			
		.06-.09 mmol/kg			
Swiss chard		7.7 mg/kg			
		7.6-21.4 mg/kg			
Rye Grass		6.1 mg/kg			
		7.7-15.5mg/kg			
Upland cotton		8.1 mg/kg			
		10.7 mg/kg			
		9.2-10.1 mg/kg			
Timothy		3.9-5.1mg/kg			
		4.4-5.8 mg/kg			
		2.7-5.0 mg/kg			
		3.4-5.2 mg/kg			
		3.8-5.2 mg/kg			
		3.6-5.1 mg/kg			
		3.7-5.1 mg/kg			
		3.8-5.9 mg/kg			
Corn		9.7-10.4 mg/kg			
		8.9-9.3 mg/kg			
		10.1-10.7mg/kg			
		9.5-10.7 mg/kg			
		6.5-9.1mg/kg			
		7.6-10.1 mg/kg			
		7.6-10.0 mg/kg			
		8.8-10.5 mg/kg			
		9.2-10.2 mg/kg			
		9.0-11.1 mg/kg			
Soybean		3.2-4.0			
		3.3-9.4			
Sorghum		12.8			
		27.5			
Winter wheat		8			
		13			
Splash pine		3.6			
		4.1-4.5			
		4.1-4.3			
Wheat		**			
			**		
			**		

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			226
			226
Swiss chard			176
			176
Rye Grass			176
			176
Upland cotton			259
			259
			259
Timothy			257
			257
			257
			257
			257
			257
			257
			257
Corn			183
			184
			184
			184
			184
			184
			184
			184
			184
			184
Soybean			57
			57
Sorghum			127
			127
Winter wheat			127
			127
Splash pine			144
			144
			144
Wheat			61
	visual	reduced growth	61
	visual	reduced growth,chlorotic,stunted	61

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Oat		Harmon	root,seed,stem	field	
Sudangrass	Sorghum bicolor	Piper	whole	field	5.23 5.18 5.77-6.38
Corn	Zea mays		leaves,roots,stems,husks	field	6.2
Perennial ryegrass	Loluim perenne			pot	4.3-5.26
					4.76-5.72
					6.16-7.11
Wheat			straw,kernels	greenhouse	8.1
					6.5
				field	8.1
Brome-alfalfa			whole	greenhouse	8.1
					6.5
Soybean	Glycine max	Bragg	seed,pod wall, stem	greenhouse	6.2
		Ransom	seed,pod wall,stem	greenhouse	6.2
Maize	Zea mays		whole	pot	

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
		high Zn polution	800-1200	
Oat		control	5.2-8.7	
		25 % sludge	16.6	
		50% sludge	10.3	
Sudangrass	Wahiawa silty clay	control		
	Wahiawa silty clay	fertilized		
	Wahiawa silty clay	sludge		
Corn	Warsaw silt loam	control	51	
		sludge	843	1075 tons/ha
Perennial ryegrass	acid clay loam	Control	0	
		sludge	4-8%	
		sludge	0.12	
	acid clay loam	Control	0	
		sludge	4-8%	
		sludge	0.12	
	acid clay loam	Control	0	
		sludge	4-8%	
		sludge	0.12	
Wheat	Lakeland calcareous fine	control		0
		sludge		12.15-121.5 kg/ha
	Red River noncalcareous fine	control		0
		sludge		12.15-121.5 kg/ha
	Lakeland calcareous fine	control		0
		sludge		198-396 kg/ha
Brome-alfalfa	Lakeland calcareous fine	control		0
		sludge		12.15-121.5 kg/ha
	Red River noncalcareous fine	control		0
		sludge		12.15-121.5 kg/ha
Soybean	Enon sandy loam	control		0
		low sludge		10-20 kg/ha
		high sludge		30 kg/ha
	Enon sandy loam	control		0
		low sludge		10-20 kg/ha
		high sludge		30 kg/ha
Maize	sand	control	2.5	
		low saturatrion sludge	5.1-10.2	
		low saturatrion sludge	20.3-40.7	
		high saturation sludge	5.1-10.2	
		high saturation sludge	20.3-40.7	

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
			**		
Oat		8			
		27			
		22			
Sudangrass		24			
		20			
		17-20			
Corn		10			
		40			
Perennial ryegrass		15			
		20-30			
		30			
		10			
		20-30			
		35			
		10			
		15-20			
		30			
Wheat		1.78			
		1.83-3.13			
		2.4			
		1.68-3.38			
		1.7-2.7			
		2.5-8.3			
Brome-alfalfa		7.9			
		7.9-15.0			
		5.2			
		5.9-12.9			
Soybean		5.66			
		7.93-8.96			
		10.66			
		3.8			
		5.73-6.33			
		7.16			
Maize		6-9.0			
		7-9.0			
		8-13.0			
		9-13.0			
			15-36.0		

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
	visual	1/6natural size,few reach maturity	61
Oat			73
			73
			73
Sudangrass			104
			104
			104
Corn			125
			125
Perennial ryegrass			19
			19
			19
			19
			19
			19
			19
			19
			19
Wheat			270
			270
			270
			270
			270
			270
Brome-alfalfa			270
			270
			270
			270
Soybean			202
			202
			202
			202
			202
			202
Maize			79
			79
			79
			79
	yield	significant reduction	79

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Lettuce		Imperial 847	tops	pot	
Onions		Early flat Baretta	bulbs	pot	
				field	
Lettuce		Imperial 847	tops	greenhouse	
Lucerne	Medicago satuva	Wairau	whole	pot	5
					5.1-5.6
					6.6
					5.2
					5.4-6.0
					6.8
Tomato	Lycopersicon esculentum	Money maker	Leaves,fruit,root	pot	4.6-6.9
			fruit	pot	4.6-6.6
					6.6-6.9
					6.6-6.7
Sweet corn	Zea mays	Jubilee	leaves,kernels	field	5.4
					4.7-5.1
					5.1-5.2
					5.1-5.3
					5.1
Soybean	Glycine max		stem,leaves,seeds,pods	pot	
Barley	Hordeum vulgare	Julia	tops	sand	
Ryegrass	Lolium perenne	S24	tops	greenhouse	6
					7.6
Lettuce	Lactuca sativa	Grand rapids	leaves	pots	6.7

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
Lettuce	loamy, fine sand	control		0
		low sludge		1.31-6.55 kg/ha
		high sludge		6.55-11.79 kg/ha
Onions	loamy, fine sand	control		0
		low sludge		1.31-6.55 kg/ha
		high sludge		6.55-11.79 kg/ha
	loamy fine sand	control		0
		sludge		1.31-23.58kg/ha
Lettuce	sandy loam	control		0
		sludge		1.31-106.11 kg/ha
		heated sludge		3.93-11.79 kg/ha
Lucerne	Waitarere sand	0	12	
	Waitarere sand	5-40% sludge	26.9-131.2	
	Waitarere sand	100% sludge	310	
	Levin silt loam	0	28	
	Levin silt loam	5-40% sludge	42.1-140.8	
	Levin silt loam	100% sludge	310	
Tomato		sludge	380	0-388.8 kg/ha
		0		0
		25-75% sludge		97.2-291.6 kg/ha
		100% sludge		388.8 kg/ha
Sweet corn	Willamette silt loam	control		
	Willamette silt loam	fertilized		
	Willamette silt loam	Portland sudge		28-55 lb/acre
	Willamette silt loam	Rock Creek sludge		27-54 lb/acre
	Willamette silt loam	Salem sludge		11-21 lb/acre
Soybean	Ritzville silt loam	control	31	
		Cu solution		2.5 ug/g
Barley	washed silver sand	CuSO4	3.1-13.6	
		CuSO4	34-100	
Ryegrass	sandy soil	control		0
		salt		13.7-110 mg/kg
		sludge		13.7-110 mg/kg
	heavy clay soil	control		0
		salt		13.7-110 mg/kg
		sludge		13.7-110 mg/kg
Lettuce	very fine non-calcareous	control	31	0
		low sludge		43.45-86.9 kg/ha
		high sludge		173.8 kg/ha

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
Lettuce		6			
		9-12.5			
		12.5-14			
Onions		4.5			
		6-6.5			
		6.5-7			
		4.5			
		4.25-4.5			
Lettuce		6.9			
		8.7-18.7			
		8.1-10.8			
Lucerne		15			
		16-22			
		15			
		9-24.0			
		8.5-35			
		12-20.0			
Tomato		28			
		13			
		18-20			
		22			
Sweet corn		9			
		6-7.0			
		12-13.0			
		11-12.0			
		10-11.0			
Soybean		3.9			
		1.7			
Barley		18.2-20.3			
			36-100		
Ryegrass		12.4			
		14.2-20.9			
		14.8-19.9			
		9.2			
		12.6-21.3			
		9.3-18.0			
Lettuce		5.6			
		7.8-8.7			
		12.8			

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
Lettuce			54
			54
			54
Onions			54
			54
			54
			54
			54
Lettuce			53
			53
			53
Lucerne			261
			261
			261
			261
			261
			261
Tomato			262
			262
			262
			262
Sweet corn			121
			121
			121
			121
			121
Soybean			27
			27
Barley			6
	visual'	death	6
Ryegrass			43
			43
			43
			43
			43
			43
Lettuce			271
			271
			271

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Carrots	Daucus carota	Amstel	tubers	pots	6.7
Peas	Pisum sativum	Thomas Laxton	fruit	pots	6.7
Tomato	Lycopersicon esculentum		shoots	greenhouse	5.33
					7.96-8.09
					8.01-8.11
Grass		timothy,brown top		field	6.05
		sweet vernal,blue			6.2
Alfalfa & red clover				field	6.05
					6.2
Duckweed			whole	solution	4
					4.5
					5
Various			shoots	field	
Oats	Avena sativa	Selma	leaves	pot	6.6
					6.2
					7.5
Highbush blueberry	Vaccinium corymbosum	Blueray		pot	3.9-7.1
Subterranean clover	Trifolium subterraneum		tops	field	
	Arctotheca calendula		tops	field	
	Holcus lanatus		tops	field	
	Lolium perenne		tops	field	
	Plantago lanceolata		tops	field	
Subterranean clover	Trifolium subterraneum	Mt. Barker	tops	greenhouse	5.6-6.3
Silver beat	Beat vulgaris	Fordhook Giant	tops	greenhouse	5.6-6.3

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
Carrots	very fine non-calcareous	control	31	0
		low sludge		43.45-86.9 kg/ha
		high sludge		173.8 kg/ha
Peas	very fine non-calcareous	control	31	0
		low sludge		43.45-86.9 kg/ha
		high sludge		173.8 kg/ha
Tomato	Elkton silt loam	control	72.4	
	Elkton silt loam	low 2-6% sludge	73.46-75.58	
	Elkton silt loam	high 8-10% sludge	76.64-77.70	
Grass	clay and sandy loam	control	.81-8.39	
	clay and sandy loam	sludge	.66-11.06	17.87-30.44 kg/ha
Alfalfa & red clover	clay and sandy loam	control	.81-8.39	
	clay and sandy loam	sludge	.66-11.06	17.87-30.44 kg/ha
Duckweed	Huther's medium		1.0-10	
	Huther's medium		1.0-10	
	Huther's medium		1.0-10	
Various	serpentine soil	natural	37-144	
Oats	sandy loam	control	10.6	
		nitrate compound	28.7	
	sandy soil	control	21.5	
		nitrate compound	30.1	
	organic soil	control	28	
		nitrate compound	49.5	
Highbush blueberry	peat	control		
		low CuSO4		2 g/pot
		high CuSO4		4 g/pot
Subterranean clover	orchard soil		155 mg/kg	
	orchard soil		155 mg/kg	
	orchard soil		155 mg/kg	
	orchard soil		155 mg/kg	
	orchard soil		155 mg/kg	
Subterranean clover	orchard	12 degrees	195 mg/kg	
		22 degrees	195 mg/kg	
	ore mineralized	12 degrees	9 mg/kg	
		22 degrees	9 mg/kg	
Silver beat	orchard	12 degrees	195 mg/kg	
		22 degrees	195 mg/kg	
	ore mineralized	12 degrees	9 mg/kg	
		22 degrees	9 mg/kg	

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
Carrots		3.6			
		5.5-6.7			
		7.5			
Peas		5.3			
		8.4-8.9			
		9.5			
Tomato		41			
		24.6-27.1			
		30.9-33.8			
Grass		5.2-17.4			
		6.7-19.2			
Alfalfa & red clover		7.2-14.2			
		8.6-15.2			
Duckweed		31.8 prop. metal uptak	34.6-42.2 PMUT		
		18.2 PMUT	32.5-37.1 PMUT		
		5.5 PMUT	30.4-33.2 PMUT		
Various		2.0-30			
Oats		4.04-5.93			
		3.15-6.36			
		1.83-8.58			
		3.05-10.48			
		2.97-9.24			
		4.82-12.87			
Highbush blueberry		1.0-7			
		4-8.9			
		5.5-9.9			
Subterranean clover			22-30		
			27-36		
			35-40		
			12.0-43		
			12.0-34		
Subterranean clover		21			
		30			
		9.5			
		13.7			
Silver beat		77			
		134			
		6.9			
		9.2			

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
Carrots			271
			271
			271
Peas			271
			271
			271
Tomato			62
			62
			62
Grass			147
			147
Alfalfa & red clover			147
			147
Duckweed	visual	became pale and dark green	168
	visual	became pale and dark green	168
	visual	became pale and dark green	168
Various			5
Oats			17
			17
			17
			17
			17
			17
Highbush blueberry			87
			87
			87
Subterranean clover	yield	probable yield reduction	161
	yield	probable yield reduction	161
	yield	probable yield reduction	161
	yield	probable yield reduction	161
	yield	probable yield reduction	161
Subterranean clover			161
			161
			161
			161
Silver beat			161
			161
			161
			161

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Radishes	Rhaphanus sativus	Long Scarlet	tops	greenhouse	5.6-6.3
					4.77-6.57
					3.6-4.83
					5.6-8.00
					4.9-6.9
Silver beat	Beta vulgaris	Fordhook Giant	tops	greenhouse	4.8-6.75
					3.6-5.05
					4.3-5.95
					5.35-7.75
					4.8-6.65
Radishes	Rhaphanus sativus	Long scarlet	tops	greenhouse	
Corn	Zea mays	Asgrow UH7	whole	greenhouse	6.3
					5.9
					6.5
Lettuce	Lactuca sativa	Grand Rapids Forcing	whole	greenhouse	6.3
					5.9
					6.5
Oats	Avena sativa	Garry	straw	field	5.09
					5.84
					6
Soybean	Glycine max	Clark	shoots	field	6.9
					6.6
					6.4
					5.9-7.4
					7.0-7.7
					6.9-7.6
					5.8-7.1
					5.7-6.0
					5.1-5.3
					6.4-6.6
					5.7-5.9
Sunflower	Helianthus annuus	894A	whole	field	7.2-7.4

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
Radishes	orchard	12 degrees	195 mg/kg	
		22 degrees	195 mg/kg	
	ore mineralized	12 degrees	9 mg/kg	
		22 degrees	9 mg/kg	
	various	control	43-295	
	various	sulfure	43-295	
	various	CaCO3	43-295	
	various	waterlogging	43-295	
Silver beat	various	control	43-295	
	various	Sulfure	43-295	
	various	Gypsum	43-295	
	various	CaCO3	43-295	
	various	waterlogging	43-295	
	Dystric Xeropsamment	sulfate		250 mg/kg
Radishes	Dystric Xeropsamment	sulfate		250 mg/kg
Corn	Grenville loam	control		0-480
		fertilized		0-480
		sludge		0-480+12
	Rideau clay	sludge		0-480+12
	Rideau clay	sludge+lime		0-480+12
Lettuce	Grenville loam	sludge		0-480+12
	Rideau clay	sludge		0-480+12
	Rideau clay	sludge + lime		0-480+12
Oats	peat	CuSO4	22-1177	13-1659 ug/g
	muck	CuSO4	152-1187	135-1745 ug/g
	mucky peat	CuSO4	158-583	81-1063 ug/g
Soybean	Sassafras fine sandy loam	control		0
	Sassafras fine sandy loam	sludge		123.2 kg/ha
	Sassafras fine sandy loam	sludge		246.4 kg/ha
	Christiana fine sandy loam	control		0
	Christiana fine sandy loam	limed-digested		14.5-116 kg/ha
	Christiana fine sandy loam	limed-raw		15.5-62.0 kg/ha
	Christiana fine sandy loam	limed-composted		15.3-184.1 kg/ha
	Christiana fine sandy loam	heated		22.6-90.5 kg/ha
	Christiana fine sandy loam	heated		22.6-90.5 kg/ha
	Christiana fine sandy loam	Nu-earth		58-116 kg/ha
	Christiana fine sandy loam	Nu-earth		58-116 kg/ha
Sunflower	irrigated loamy fine sand	control		0
		Cu Sulfate		3.0 kg/ha

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
Radishes		19			
		26			
		6.5			
		6.8			
		16			
		39			
		13			
		20			
Silver beat		63			
		63			
		68			
		35			
		74			
			**		
Radishes			**		
Corn		4.5	5.7-8.6		
		2.4-3.1	4.9-5.5		
		4.3-5.0			
		4.6-5.5			
		3.1-5.4			
Lettuce		12.8	13.8-22.0		
		11.3-15.7			
		11.0-12.9			
Oats		8.0-9.6			
		4.8-5.4			
		6.0-7.4			
Soybean		8.1-8.7			
		8.6-8.9			
		9.0-9.5			
		7.4-8.1			
		7.9-8.5			
		7.4-8.0			
		7.0-7.6			
		7.0-7.9			
		6.6-8.3			
		7.6-8.2			
		7.1-7.5			
Sunflower		9.8			
		10.5			

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
Radishes			161
			161
			161
			161
			162
			162
			162
			162
Silver beat			162
			162
			162
			162
			162
	yield	death of all plants	162
Radishes	yield	death of all plants	162
Corn	yield	23-50% reduction in yield	146
	yield	25-49.6% reduction in yield	146
			146
			146
			146
Lettuce	yield	20.7-58.6% reduction in yield	146
			146
			146
Oats			7
			7
			7
Soybean			89
			89
			89
			89
			89
			89
			89
			89
			89
			89
			89
Sunflower			93
			93

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
					6.0-6.3
					8.4
					6.0-6.2
Barley	Hordeum vulgare	M ariout	grain	field	5.3
					4.7-4.9
					4.4-4.5
					5.3
					6.4-6.5
					6.5-6.6
Oats	Avena sativa	Clintford	stover	field	5
					6.5
					6.7
					5.4
					6.7
Wheat	Triticum aestivum	Potomac	stover	field	5
					6.5
					6.7
					5.4
					6.7
Chard	Beta vulgaris	Fordhook Giant Swiss	whole	field	5
					6.5
					6.7
					5.4
					6.7
Carrots	Daucus carota	Gold Pak 128	leaves	field	5.11
					5.08
					5.11
					5.05
					5.89
					5.79
					5.89
					5.79
Beans	Phaleolus vulgaris	Tender crop	fruit	pot	5
					5.3
Cabbage	Brassica oleracea	Golden Acre	leaves	pot	5
					5.3

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	dry loamy fine sand	control		0
		Cu Sulfate		3.0 kg/ha
	dry fine sandy loam	control		0
		Cu Sulfate		3.0 kg/ha
	irrigated fine sandy loam	control		0
		Cu Sulfate		3.0 kg/ha
Barley	Dublin loam	Oakland sludge control		0
	Dublin loam	low sludge		27-54 kg/ha
	Dublin loam	high sludge		81-108 kg/ha
	Dublin loam	Pacheo sludge control		0
	Dublin loam	low sludge		8.1-16.2 kg/ha
	Dublin loam	high sludge		24.3-40.5 kg/ha
Oats	Galestown Evesboro loamy sand	control	DTPA: 3.1	
	Galestown Evesboro loamy sand	control+lime	1.9	
	Galestown Evesboro loamy sand	lime raw	3.4	
	Galestown Evesboro loamy sand	digested	6.3	
	Galestown Evesboro loamy sand	limed + digested	7.4	
Wheat	Galestown Evesboro loamy sand	control	DTPA: 3.1	
	Galestown Evesboro loamy sand	control+lime	1.9	
	Galestown Evesboro loamy sand	lime raw	3.4	
	Galestown Evesboro loamy sand	digested	6.3	
	Galestown Evesboro loamy sand	limed + digested	7.4	
Chard	Galestown Evesboro loamy sand	control	DTPA: 3.1	
	Galestown Evesboro loamy sand	control+lime	1.9	
	Galestown Evesboro loamy sand	lime raw	3.4	
	Galestown Evesboro loamy sand	digested	6.3	
	Galestown Evesboro loamy sand	limed + digested	7.4	
Carrots	peat	control	12.6-30.8	
	peat	low CuSO4	83.0-209.5	
	peat	med CuSO4	113.4-669.0	
	peat	high CuSO4	338.0-1659	
	muck	control	135.4-170.7	
	muck	low CuSO4	244.1-292.7	
	muck	med CuSO4	311.8-610.3	
	muck	high CuSO4	746.4-1745.0	
Beans	Arkport fine sandy loam	peat	42.35	
	Arkport fine sandy loam	sludge	107	
Cabbage	Arkport fine sandy loam	peat	42.35	
	Arkport fine sandy loam	sludge	107	

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		8.8			
		8.8			
		18.2			
		17.9			
		8.8			
		8			
Barley		10			
		11.0-12			
		10.0-13.0			
		10			
		12.0-13.0			
		13.0-14.0			
Oats		2.6			
		3.1			
		2.7			
		3.5			
		3.3			
Wheat		2.1			
		2.1			
		2.4			
		3.2			
		2.8			
Chard		14			
		19.2			
		23			
		27.2			
		25.8			
Carrots		3.77			
		4.95			
		5.74			
		6.82			
		17.26			
		16.08			
		11.55			
		7.62			
Beans		3.2			
		3.6			
Cabbage		.6-3.0			
		1.8-2.9			

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			93
			93
			93
			93
			93
			93
Barley			246
			246
			246
			246
			246
			246
Oats			214
			214
			214
			214
			214
Wheat			214
			214
			214
			214
			214
Chard			214
			214
			214
			214
			214
Carrots			157
			157
			157
			157
			157
			157
			157
			157
Beans			68
			68
Cabbage			68
			68

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Carrots	Daucus carota	Scarlet Nantes	tubers	pot	5 5.3
Millet	Echinochloa crusgalli	Japanese	edilbe tissue	pot	5 5.3
Onions	Allium cepa	Downing Yellow Sweet Spanish	fruit	pot	5 5.3
Potatoes	Solanum tuberosum	Katahidin	tubers	pot	5 5.3
Tomatoes	Lycopersicon esculentum	Vendor	fruit	pot	5 5.3
Celery	Apium graveolens	Utah 52-70	leaves	field	6.88 5.68 6.91
Ryegrass Timothy Meadow grass	lolium perenne Phleum pratense Poa annua		whole	field	5.4 5.9
Perennial ryegrass	Lolium perenne	Melle	leaves	pot	7
Wheat	Triticum aestivum	HDM 1553	stem	field	8
Cabbage	Brassica Parachinensis	Flowering Chinese	leaves	pot	6.35 5.8-6.32 5.82-6.27 6.55-7.32 6.18-7.33
Tomatoes	Lycopersicon esculentum	Fireball	leaves	sand	
Wheat	Triticum aestivum		tops	pot	5.0-5.5

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
Carrots	Arkport fine sandy loam	peat	42.35	
	Arkport fine sandy loam	sludge	107	
Millet	Arkport fine sandy loam	peat	42.35	
	Arkport fine sandy loam	sludge	107	
Onions	Arkport fine sandy loam	peat	42.35	
	Arkport fine sandy loam	sludge	107	
Potatoes	Arkport fine sandy loam	peat	42.35	
	Arkport fine sandy loam	sludge	107	
Tomatoes	Arkport fine sandy loam	peat	42.35	
	Arkport fine sandy loam	sludge	107	
Celery	muck soil	control	46	
	muck soil	high metal soil	657	
	muck soil	limed high metal soil	575	
Ryegrass	Devon sandy clay	control		0
Timothy		pig slurry low		50-100 m3/ha
Meadow grass		pig slurry high		200 m3/ha
	Devon clay	control		0
		pig slurry low		50-100 m3/ha
		pig slurry high		200 m3/ha
Perennial ryegrass	Sutton sandy loam	control	39	0
		low sludg	229	
		medium sludge	409	132 kg/ha
		high sludge	715	
Wheat	clay	control	23.4	0
		50% sludge	38.2	
		66% sludge	63.8	
		100% sludge	77.2	
		10 tons/ha sludge	40.1	4.28 kg/ha
		20 tons/ha sludge	72.8	8.56 kg/ha
Cabbage	redyellow podzol soil	control	22.33	
	redyellow podzol soil	activated sludge	32.5-50.0	
	redyellow podzol soil	digested sludge	14.25-86.75	
	redyellow podzol soil	chicken manure	18.5-37.5	
	redyellow podzol soil	pig manure	52.5-75.0	
Tomatoes	Hoagland solution	control		0
		CuSO4		3
		CuSO4		6
Wheat	Orentano histosol	control	44.5	
		fly ash 2%	46.2	

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
Carrots		2			
		2			
Millet		2.4			
		2.6			
Onions		3.4			
		1.2			
Potatoes		3.1			
		4.6			
Tomatoes		2.2			
		1.7			
Celery		15			
		12			
		15			
Ryegrass		3.5			
Timothy		6.0-8.1			
Meadow grass		16.7			
		6.6			
		8.1-9.7			
		21.7			
Perennial ryegrass		19.8			
		22	32.4		
			34.9		
			39.6		
Wheat		6.14			
		6.84			
		7.78			
		10.94			
		8.12			
		9.96			
Cabbage					
			100-250		
		30	100-150		
		25-30			
		10.0-30			
Tomatoes		**			
			**		
			**		
Wheat		19.4			
		18.6			

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
Carrots			68
			68
Millet			68
			68
Onions			68
			68
Potatoes			68
			68
Tomatoes			68
			68
Celery			16
			16
			16
Ryegrass			182
Timothy			182
Meadow grass			182
			182
			182
			182
Perennial ryegrass			50
	yield	28% reduciton	50
	yield	43% reduction	50
	yield	57% reduciton	50
Wheat			29
			29
			29
			29
			29
			29
Cabbage			36
	visual	small,short,young budding stage	36
	visual	opaque granulate deposits	36
			36
			36
Tomatoes			193
	yield	33% reduced dry weight	193
	yield	62% reduced dry weight	193
Wheat			186
			186

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
					6.1-8.3
					7.5-8.0
Bush bean	Phaseolus vulgaris	improved Tendergreen	trifoliate leaves	solution	4
					8
					4
					8
Soybean	Glycine max	Coker 237	leaves	field	6
Spinach	Spinacia oleracea	Symphony	leaves	field	6
					5.09
Bush bean	Phaseolus vulgaris	Bulgarian	leaves	field	6.33
Corn	Zea mays	Pioneer 3369A	whole	pot	6.4 6.3 6.2
Highbush blueberry	Vaccinium corymbosium	Blueray	whole	pot	3.8-4.0 4.6-5.0 5.4-6.4

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
		fly ash 5%	47.9	
	Lamporecchio fluvisol	control	55.3	
		fly ash 2%	46.9	
		fly ash 5%	42.4	
	Guardia regosol	control	28.2	
		fly ash 2%	34.4	
		fly ash 5%	42	
Bush bean	solution	control		0
		CuSO4		0.0001
		CuSO4		0.00025
	solution	control		0
		CuSO4		0.0001
		CuSO4		0.00025
	N-deficient solution	control		0
		CuSO4		0.0001
		CuSO4		0.00025
	N-deficient solution	control		0
		CuSO4		0.0001
		CuSO4		0.00025
Soybean	loamy sand	control		0
		CuSO4		5.6 kg/ha
		Cu-EDTA		.4-.7 kg/ha
		Cu-heptogluconate		.2-.5 kg/ha
Spinach	muck peat	control	158.1	0
		Cu solution	212.6	81 ug/g
		Cu solution	316.9	
		Cu solution	582.5	1063 ug/g
	peat	control	22.4	0
		Cu solution	125.7	13 ug/g
		Cu solution	359.8	
		Cu solution	1177.1	1659 ug/g
Bush bean	sand,loam,clay	control	.69 umol/kg	
		sewage sludge	22.4 umol/kg	
Corn	various	control		0
	various	CuSO4		169-183 kg/ha
	various	sludge		169-183 kg/ha
Highbush blueberry	Tempelton silt loam	control		
	Tempelton silt loam	control		
	Tempelton silt loam	control		

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		17.8			
		17.5			
		13.5			
		11.9			
		21.5			
		16.4			
		16.2			
Bush bean		5.9			
			17.9		
			49.8		
		3.2			
		14.2			
		16.7			
		6.5			
			45.4		
			26		
		6.2			
		9.7			
		13.9			
Soybean		10			
		12			
		11			
		10.0-15			
Spinach		16.03			
		14.73			
		15.32			
		15.9			
		9.85			
		11.58			
		15.76			
		19.3			
Bush bean					
			495.0 nmol/g		
Corn		4.0-6.0			
		6.0-14.0			
		5.0-9.0			
Highbush blueberry		7.5-8.0			
		7.0-9.0			
		3.0-6.0			

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			186
			186
			186
			186
			186
			186
			186
Bush bean			253
	yield	17% reduced by dry weight of leaf	253
	yield	73% reduced dry weight of leaf	253
			253
			253
			253
			253
	yield	21% reduced dry weight of leaves	253
	yield	84% reduced dry weight of leaves	253
			253
			253
			253
Soybean			114
			114
			114
			114
Spinach			165
			165
			165
			165
			165
			165
			165
			165
Bush bean			82
		possible yield reduction	82
Corn			129
			129
			129
Highbush blueberry			86
			86
			86

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
					3.8-4.0
					4.6-5.0
					5.4-6.4
					3.8-4.0
					4.6-5.0
					5.4-6.4
Barley	Hordeum vulgare	Conquest		greenhouse	6.1
Oats	Avena sativa	Hudson		greenhouse	6.1
Wheat	Triticum aestivum	Neepawa		greenhouse	6.1
Flax	Linum usitatissimum	Dufferin		greenhouse	6.1
Canola	Brassica campestris	Torch		greenhouse	6.1

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	Tempelton silt loam	CuSO4		2 g/m3
	Tempelton silt loam	CuSO4		2 g/m3
	Tempelton silt loam	CuSO4		2 g/m3
	Tempelton silt loam	CuSO4		4 g/m3
	Tempelton silt loam	CuSO4		4 g/m3
	Tempelton silt loam	CuSO4		4 g/m3
Barley	Cu deficient soil	CuSO4		0-5.8 ug/g
Oats	Cu deficient soil	CuSO4		0-5.8 ug/g
Wheat	Cu deficient soil	CuSO4		0-11.5 ug/g
Flax	Cu deficient soil	CuSO4		0-64 ug/g
Canola	Cu deficient soil	CuSO4		0-16 ug/g

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		10.0-11.0			
		9.0-10.0			
		3.5-7.5			
		12.5-13.5			
		10.0-12.0			
		4.0-9.0			
Barley	1.3-2.3	2.3-3.7		visual	bending,gray leaf margins,necrotic
Oats	1.1-1.7	1.7-2.5		visual	bending,whitish margins,necrotic
Wheat	1.4-3.0	3.0-4.9		visual	bending,grayish margins,necrotic
Flax	1.0-2.4	2.4-3.5		visual	interveinal chlorosis,obtuse stem
Canola	1.2-1.7	1.7-2.7		visual	interveinal chlorosis,large leaves

TABLE E-2. COPPER PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			86
			86
			86
			86
			86
			86
Barley			159
Oats			159
Wheat			159
Flax			159
Canola			159

TABLE E-3. NICKEL PHYTOTOXICITY DATA

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH	Soil Type
Alfalfa	Medicago sativa		tops	field		
Alyssum	Alyssum berthollnii		leaves,seeds	field		
Apricot	Prunus armeniaca		fruit	field		
Barley	Hordeum vulgare		leaves	field		
Bean	Phaseolus spp.		seeds	field		
Bog asphodel	Narthecium spp.		leaves,stems	field		
Buckwheat	Fagopyrum spp.		seeds	field		
Bulrush	Scirpus caespitosus		leaves,stems	field		
Cabbage	Brassica oleracea capitala		tops	field		
Carrot	Daucus carota sativa		roots,leaves	field		
Cherry	Prunus cerasus		fruit	field		
Citrus fruits	citrus spp.		leaves	greenhouse		
				field		
				pots		
Clover,bur	Medicago hispida		tops	field		
Clover,red	Trifolium pratense		tops	field		
Coffee	Coffea spp.		beans	field		
Corn	Zea mays		grain	field		
Cress,water	Rorippa nasturtium-aquaticum		tops,leaves	field		
Fig	Ficus carica		fruit	field		
Grasses	Anthoxanthum odoratum	sweet vernal	tops	field		
		various spp.	tops	field		
Heather Heath	Calluna vulgaris		tops	field		
	Erica cinerea		tops	field		
	Erica tetralix		tops	field		
Mushroom	Cantharellus cibarius		buttons	field		
Oats	Avena sativa		leaves,grain,tops	field		
				pots		
Onion	Allium cepa		bulbs	field		
Pea	Pisum sativum		seeds	field		
Pear	Pyrus communis		fruit	field		
Potato	Solanum tuberosum		tubers	field		
Rice	Oryza sativa		grain	field		
Sedge	Carex spp.		tops	field		
Soybean	Glycine soja		seeds	field		
Spinach	Spinacia oleracea		tops	field		
Squash	Cucurbita spp.		fruit	field		
Tea	Camillia sinensis		leaves	field		
Timothy	Phleum pratense		tops	field		

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Treatment	Concentration in soil	Loading rate	plant tissue concentration		
				deficiency	normal	toxic
Alfalfa					1-4	
Alyssum					4000	
Apricot					0.65	
Barley					4-6	
Bean					0.59	
Bog asphodel					.4-5.3	
Buckwheat					1.34	
Bulrush					.3-3.0	
Cabbage					3.3	
Carrot					1.8	
Cherry					0.5	
Citrus fruits					.4-1.0	55-140
					.4-4.0	
					.7-1.8	
Clover,bur					1.0-2.0	
Clover,red					1.9	
Coffee					0.4	
Corn					0.14	
Cress,water					0.13	
Fig					1.2	
Grasses					.7-1.7	
					.2-56.0	
Heather Heath					.6-2.6	
					1.5-1.7	
					1.1-1.5	
Mushroom					3.5	
Oats					7-134	
					84-340	
Onion					0.16	
Pea					2	
Pear					1.3	
Potato					.08-.37	
Rice					0.02	
Sedge					.20-3.2	
Soybean					3.9	
Spinach					2.4	
Squash					4.6	
Tea					3.0-5.0	
Timothy					0.46	

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity deficiency		phytotoxicity		reference
	type	symptoms	type	symptoms	
Alfalfa					35
Alyssum					35
Apricot					35
Barley					35
Bean					35
Bog asphodel					35
Buckwheat					35
Bulrush					35
Cabbage					35
Carrot					35
Cherry					35
Citrus fruits			Visual	Chlorosis,necrosis,death	35
					35
					35
Clover,bur					35
Clover,red					35
Coffee					35
Corn					35
Cress,water					35
Fig					35
Grasses					35
					35
Heather Heath					35
					35
					35
Mushroom					35
Oats					35
					35
Onion					35
Pea					35
Pear					35
Potato					35
Rice					35
Sedge					35
Soybean					35
Spinach					35
Squash					35
Tea					35
Timothy					35

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH	Soil Type
Tomato	Lycopersicon esculentum		fruit	field		
Walnut	Juglans regia		leaves,meats	field		
Wheat	Triticum spp.		grain	field		
Corn	Zea mays		earleafs,grain	field	5.8-6.2	Bojac loamy sand
					5.7-6.0	Davidson clay loam
					5.7-6.0	Groseclose silt loam
			earleafs,grain,stover	field	6.6	Acredale silt loam
Barley	Hordeum vulgare	Henry	silage	field	6.6	Acredale silt loam
Corn	Zea mays			greenhouse	6.8	limed Warsaw sandy loam
Rye	Seceale cereal			greenhouse	6.8	limed Warsaw sandy loam
Corn	Zea mays			greenhouse	6.5	Warsaw sandy loam
Rye	Seceale cereal			greenhouse	6.5	Warsaw sandy loam
Tall fescue	Festuca arundinacea		tops	pots	7.1-7.7	fine silty
					6.1-7.5	fine silty
					5.5-6.0	stripped mined
Alfalfa	Medicago sativa		tops	pots	7.1-7.7	fine silty
					6.1-7.5	fine silty
					5.5-6.0	stripped mined
Lettuce	Lactuca sativa	longifolia	shoots	greenhouse	7.5	Domino silt loam
					5.7	Redding fine sandy loam
Wheat	Triticum aestivum	Inia	leaves grain	greenhouse	7.5	Domino silt loam
					5.7	Redding fine sandy loam

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Treatment	Concentration in soil	Loading rate	plant tissue concentration		
				deficiency	normal	toxic
Tomato					.01-.15	
Walnut					.9-5.0	
Wheat					.35-35.0	
Corn					.54-1.0mg/kg	
					.2-.41mg/kg	
					.28-.46mg/kg	
			17.2 kg/ha		.23-1.3mg/kg	
Barley			17.2 kg/ha		.51-.92mg/kg	
Corn	fertilized				<4.5	
	sludge	22 ppm			<4.5	
	Ni sludged	37-81ppm			5.7-15.5	
Rye	fertilized				<4.5	
	sludge	22 ppm			5	
	Ni sludge	37-81 ppm			15.4-34.1	
Corn	fertilized				<4.5	
	sludge	22			<4.5	
	Ni sludge	22-36			4.6-6.5	
	inorganic	15-30			4.5-5.5	
Rye	fertilized				4.5	
	sludge	22			5	
	Ni sludge	22-36			10.1-15.3	>20.9
	inorganic	15-30			5.5-14.1	
Tall fescue		1.3			4.1	
	sludge	7.9			2.8-3.8	
	sludge	12.2			4.2-9.0	
Alfalfa		1.3			5.7	
	sludge	7.9			5.5-6.1	
	sludge	12.2			5.6-14.8	
Lettuce		0-10			4.5-6.8 ug/g	
		20-80			9.5-23 ug/g	
		160-640			29-61 ug/g	61-166ug/g
		0-10			3.5-9.9 ug/g	
		20-80			19-41 ug/g	41-241 ug/g
		160-640				345-1150ug/g
Wheat		0-10			3.2-3.4 ug/g	
		20-80			3.6-4.3 ug/g	
		160-640			6.8-18 ug/g	18-41 ug/g
		0-10			2.3-4.3 ug/g	
		20-80			5.7-46 ug/g	>46 ug/g

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity deficiency		phytotoxicity		reference
	type	symptoms	type	symptoms	
Tomato					35
Walnut					35
Wheat					35
Corn					197
					197
					197
					196
Barley					196
Corn					44
					44
			yield	reduction attributed to other	44
Rye					44
					44
			yield	reduction attributed to other	44
Corn					45
					45
					45
					45
Rye					45
					45
			yield	reduction	45
					45
Tall fescue					230
					230
					230
Alfalfa					230
					230
					230
Lettuce					167
					167
			yield	significant yield reduction	167
					167
			yield	significant yield reduction	167
			yield	significant yield reduction	167
Wheat					167
					167
			yield	significant yield reduction	167
					167
			yield	significant yield reduction	167

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH	Soil Type
Corn	Zea mays		grain	field	6.3	Sable silty clay loam
					6.8	Cisne silt loam
					6.0-6.3	Ipava silt loam
					6.2-6.3	Drummer silty clay loam
					6	Muscatine silt loam
					6.2	Hartsburg silty clay loam
			Forage,grain	field	5.4	Sango sil
Bush Bean	Phaseolus vulgaris		vines,pods	field	5.4	Sango sil
Pearl Millet	Pennisetum americanum		leaves	field	5.3-6.9	Downer sand
Red Oak	Queracus ruba		leaves	field	5.3-6.9	Downer sand
Black Walnut	Juglans nigra		leaves	field	5.3-6.9	Downer sand
Wheat	Triticum aestivum			pots	5.2	Redding fine sandy loam
					<6.5	Redding fine sandy loam
Corn	Zea mays	Dekalb XL-43	seedlings,grain,stover	field	5.6	sandy
					6	sandy
					6.3	sandy
Oats	Avena sativa	Norline	grain	field	5.6	sandy
					6	sandy
					6.3	sandy
Rye	Secale cereale	Balboa	grain	field	5.6	sandy
					6	sandy
					6.3	sandy
Wheat	Triticum aestivum	Arthur	grain	field	5.6	sandy
					6	sandy
					6.3	sandy
Crimson clover	Trifolium incarnatum	Auburn	whole	field	5.6	sandy

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Treatment	Concentration in soil	Loading rate	plant tissue concentration		
				deficiency	normal	toxic
		160-640				125-294 ug/g
Corn					0.91ug/g	
					0.78 ug/g	
					.49-.58ug/g	
					.79-1.43ug/g	
					0.78 ug/g	
					1.03 ug/g	
	control	1.1			4.4	
	ZnSO4	1.3-1.9			3.0-3.6	
	compost	1.3-2.1			2.4-4.6	
	sludge	1.4-2.1			2.6-4.5	
Bush Bean	control	1.1			5	
	ZnSO4	1.3-1.9			4.1-4.6	
	compost	1.3-2.1			3.7-4.8	
	sludge	1.4-2.1			.9-5.8	
Pearl Millet	fertilized				.4-4.9	
	unfertilized				.2-7.5	
	sludge		69 ug/g sludge		.9-5.9	
Red Oak	fertilized				1.1	
	unfertilized				1.5	
	sludge		69 ug/g sludge		1.3-2.0	
Black Walnut	fertilized				1.3	
	unfertilized				1.1	
	sludge		69 ug/g sludge		1.2-1.8	
Wheat			20-80 ug/g			**
			20-80 ug/g		**	
Corn	no sludge	.2-.4			1.2	
	56 metric tons	1.3-1.7			1.6	
	112metric tons	2.5-2.8			2.1	
Oats	no sludge	.2-.4			0.7	
	56 metric tons	1.3-1.7			5.3	
	112metric tons	2.5-2.8			6.9	
Rye	no sludge	.2-.4			0.4	
	56 metric tons	1.3-1.7			1.1	
	112metric tons	2.5-2.8			1.9	
Wheat	no sludge	.2-.4			0.4	
	56 metric tons	1.3-1.7			1.3	
	112metric tons	2.5-2.8			2.2	
Crimson clover	no sludge	.2-.4			1.4	

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity deficiency		phytotoxicity		reference
	type	symptoms	type	symptoms	
			yield	significant yield reduction	167
Corn					187
					187
					187
					187
					187
					187
					74
					74
					74
					74
Bush Bean					74
					74
					74
					74
Pearl Millet					128
					128
					128
Red Oak					128
					128
					128
Black Walnut					128
					128
					128
Wheat			yield	reduction	15
					15
Corn					212
					212
					212
Oats					212
					212
					212
Rye					212
					212
					212
Wheat					212
					212
					212
Crimson clover					212

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH	Soil Type
					6	sandy
					6.3	sandy
Arrowleaf clover	Trifolium vesiculosum	Yuchi	whole	field	5.6	sandy
					6	sandy
					6.3	sandy
Carrots	Daucus carota	Danvers	tubers,shoots	field	5.5-5.8	Bridgehampton silt loam
Radishes	Raphanus sativus	Cherry belle	tubers,shoots	field	5.5-5.8	Bridgehampton silt loam
Tomato	Lycopersicon esculentum	New Yorker	fruit	field	5.5-5.8	Bridgehampton silt loam
Lettuce	Lactuca sativa	Salad Bowl	leaves	field	5.5-5.8	Bridgehampton silt loam
Bromegrass	Bromus inermis	Leyess		field	6.7-7.9	Conestoga loam
Corn	Zea mays		stover	field	6.7-7.9	Conestoga loam
Fescue grass	Fertuca arundinacea			pot	6.5	Norfolk fine loamy
						Cecil sandy clay loam
						Norfolk fine loamy
						Norfolk fine loamy
Winter wheat	Triticum spp.	Anza	straw	field	7.6	Omni silty clay
Swiss chard	Beta vulgaris	Fordhook Giant		greenhouse	7.7	Domino silt loam
					7	Hanford sandy loam
					5.5	Redding fine sandy loam
Fodder rape	Brassica napus	Kenton		greenhouse	5.6	sandy
					6	sandy
					7.5	sandy
Barley	Hordeum vulgare	Larker		greenhouse	4.0-6.4	marginally productive soil
Rye grass	Lolium multiflorum	Westerwool		greenhouse	4.0-6.4	marginally productive soil
Corn	Zea mays	Pioneer 3517	leaves, grain	field	7.6-8.1	calcareous strip-mined spoil
Fodder rape	Brassica napus	Kenton		greenhouse	5.6	sandy
					6	sandy
					7.5	sandy
Swiss chard	Beta vulgaris	Fordhook Giant		greenhouse	5.6-5.9	Chalmers silty clay loam and Russel silt loam
Rye grass	Lolium perenne			greenhouse	5.6-5.9	Chalmers silty clay loam and

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Treatment	Concentration in soil	Loading rate	plant tissue concentration		
				deficiency	normal	toxic
	56 metric tons	1.3-1.7			2.9	
	112metric tons	2.5-2.8			3.5	
Arrowleaf clover	no sludge	.2-.4			2.3	
	56 metric tons	1.3-1.7			6.5	
	112metric tons	2.5-2.8			10.7	
Carrots		.3-3.2			5-11	
Radishes		.3-3.2			4-22	
Tomato		.3-3.2			1.6-6.9	
Lettuce		.3-3.2			5.2-9.6	
Bromegrass	NH4NO3	.7-1.3			.7-.8	
	Ca sludge	.6-44.5			2.6-6.0	
	Al sludge	4.5-5.2			.8-1.7	
	Fe sludge	1.2-3.0			.6-1.1	
Corn	no N				0.8	
	Ca sludge	.6-27.8			2.3	
Fescue grass					6.5-18	
					5-10	
	surface				11.2-31.6	
	incorporated				5.4-8.2	
Winter wheat		93-106	20.6 kg/ha		<5.0	
Swiss chard		.6-6.6	.4-200.0		5-39 mg/kg	
		1.4-32.0	.4-200.0			100-410mg/kg
		.6-43.0	.4-200.0			100-340 mg/kg
Fodder rape			46 mg/kg		.46-3.75	
					.24-1.30	
					.11-.49	
Barley	dredged material				.37-2.9	
Rye grass	dredged material				1.4-10.8	
Corn	control	4.4-5.7			.4-2.6	
	sludge	3.9-11.3			.5-2.6	
Fodder rape	control		20.4 mg/pot		39.6 ug/pot	
	sludge		26.2-31.9mg/pot		35.2-51.4ug/pot	
	control		20.4 mg/pot		24.9 ug/pot	
	sludge		26.2-31.9mg/pot		18.1-24.0ug/pot	
	control		20.4 mg/pot		9.2 ug/pot	
	sludge		26.2-31.9mg/pot		12.8-18.3 ug/pot	
Swiss chard	control	15 mg/kg			4.4 mg/kg	
	drilling fluids	9-18 mg/kg			4.4-13.0 mg/kg	
Rye grass	control	15 mg/kg			4.4 mg/kg	

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity deficiency		phytotoxicity		reference
	type	symptoms	type	symptoms	
					212
					212
Arrowleaf clover					212
					212
					212
Carrots					211
Radishes					211
Tomato					211
Lettuce					211
Bromegrass					224
					224
					224
					224
Corn					224
					224
Fescue grass					123
					123
					123
					123
Winter wheat					32
Swiss chard					242
			yield	reduction	242
			yield	reduction	242
Fodder rape					173
					173
					173
Barley					41
Rye grass					41
Corn					188
					188
Fodder rape					215
					215
					215
					215
					215
					215
Swiss chard					176
					176
Rye grass					176

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH	Soil Type
						Russel silt loam
Upland cotton	Gossypium hirsutum		seeds	field	8.2	Pima clay loam
Soybean	Glycine max	Corsoy	seedling tissue	pot	5.9	Nicollet loam soil
Sorghum	Sorghum bicolor	Moench	root,leaves,stem,grain	field	6.9-7.7	Haynie fine sand loam
					5.8-7.2	Haynie fine sand loam
Winter wheat	Triticum aestivum		root,grain	field	6.9-7.7	Haynie fine sand loam
					5.8-7.2	Haynie fine sand loam
Oat		Harmon	root,seed,stem	field		
Corn	Zea mays		leaves,roots,stems,husks	field	6.2	Warsaw silt loam
Perennial ryegrass	Loluim perenne			pot	4.3-5.26	acid clay loam
					4.76-5.72	acid clay loam
					6.16-7.11	acid clay loam
Soybean	Glycine max	Bragg	seed,pod wall,stem	greenhouse	6.2	Enon sandy loam
		Ransom	seed,pod walls,stem	greenhouse	6.2	Enon sandy loam
Oat	Avena sativa	Victory	roots	greenhouse	5.2-7.0	solution
Lettuce		Imperial 847	tops	pot		laomy fine sand
Onions		Early flat Baretta	bulbs	pot		loamy fine sand
Lettuce		Imperial 847	tops	field		loamy fine sand

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Treatment	Concentration in soil	Loading rate	plant tissue concentration		
				deficiency	normal	toxic
	drilling fluids	9-18 mg/kg			4.1-6.3 mg/kg	
Upland cotton	control				1.05 mg/kg	
	fertilized				1.38 mg/kg	
	sludge				.70-1.08mg/kg	
Soybean	NiCl2		0-40 mg/kg		2.8-10.6	
Sorghum	fertilized	12.31-15.96			0.053	
	sludge	11.90-18.58			0.059	
Winter wheat	fertilized	12.31-15.96			3.18	
	sludge	11.90-18.58			4.53	
Oat	control	5.7-10.4			14	
	25% sludge	7.5			21	
	50% sludge	8.6			17	
Corn	control	71.5			2	
	sludge	147	1990 ton /ha		2	
Perennial ryegrass	control	0			20	
	sludge	4-8%				225-300
	sludge	0.12				350
	control	0			15	
	sludge	4-8%				200-280
	sludge	0.12				300
	control	0			10	
	sludge	4-8%			115-200	
	sludge	0.12				250
Soybean	control		0		8.1	
	low sludge		2.8-5.6 kg/ha		11.83-13.83	
	high sludge		8.4 kg/ha		15.93	
	control		0		3.3	
	low sludge		2.8-5.6 kg/ha		9.30-14.5	
	high sludge		8.4 kg/ha		20.26	
Oat		0uM			.2-.4umol/gDWh	
		5-15 uM			.7-1.3 umol/gDWh	
		20-30 uM			1.8 umol	
Lettuce	control		0		1.5	
	low sludge		.34-1.7		2.0-4	
	high sludge		1.7-3.06		4.0-6	
Onions	control		0		4.5	
	low sludge		.34-1.7		5.5-7.5	
	high sludge		1.07-3.06		7.5-10	
Lettuce	control		0		1	

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity deficiency		phytotoxicity		reference
	type	symptoms	type	symptoms	
					176
Upland cotton					259
					259
					259
Soybean					57
Sorghum					127
					127
Winter wheat					127
					127
Oat					73
					73
					73
Corn					125
					125
Perennial ryegrass					19
			yield	decreases yield	19
			yield	reduction in yield	19
					19
			yield	decreases yield	19
			yield	reduction in yield	19
					19
					19
			yield	reduction in yield	19
Soybean					202
					202
					202
					202
					202
					202
Oat					4
					4
					4
Lettuce					54
					54
					54
Onions					54
					54
					54
Lettuce					54

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH	Soil Type
Onion		Early flat Baretta	bulbs	field		loamy fine sand
Lettuce		Imperial 847	tops	greenhouse		sandy loam
Lucerne	Medicago sativa	Wairau	whole	pot	5	Waitarere sand
					5.1-5.6	Waitarere sand
					6.6	Waitarere sand
					5.2	Levin silt loam
					5.4-6.0	Levin silt loam
					6.8	Levin silt loam
Tomato	Lycopersicon escuientum	Money maker	leaves,fruit,root	pot	4.6-6.9	
			fruit	pot	4.6-6.6	
					6.6-6.9	
					6.6-6.7	
Soybean	Glycine max		stem,leaves,seeds,pods	pot		Ritzville silt loam
Barley	Hordeum vulgare	Julia	tops	sand		washed Silver sand
Ryegrass	Lolium perenne	S24	tops	pot	6	sandy soil
					7.6	heavy clay soil
Tomato	Lycopersicon esculentum		shoots	greenhouse	5.33	Elkton silt loam
					7.96-8.09	Elkton silt loam
					8.01-8.11	Elkton silt loam
Grass		timothy,brown top		field	6.05	clay & sandy loams
		sweet vernal,blue			6.2	clay & sandy loams
Alfalfa & red clover				field	6.05	clay & sandy loams
					6.2	clay & sandy loams
Barley	Hordeum vulgare	Onda	shoots	solution		solution
	Alyssum murale		leaves	field		serpentine soil
	Rumex scutatus		leaves	field		serpentine soil
Corn	Zea mays	Asgrow UH7	whole	greenhouse	6.3	Grenville loam

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Treatment	Concentration in soil	Loading rate	plant tissue concentration		
				deficiency	normal	toxic
	sludge		.34-6.12		1.0-2	
Onion	control		0		0.5	
	sludge		.34-6.12		0.75	
Lettuce	control		0		1.46	
	sludge		.34-27.54 kg/ha		1.78-44.8	
	heated		1.02-3.06 kg/ha		1.79-2.69	
Lucerne	0	7			3.5	
	5-40% sludge	8.25-17.0			2.1-3.5	
	100% sludge	32			1.8	
	0	12			.5-2	
	5-40% sludge	13.0-20			.5-3.25	
	100% sludge	32			.1-2	
Tomato	sludge	210	0-189 kg/ha		3.4	
	0		0		0.7	
	25-75% sludge		47.25-141.75 kg/ha		.95-1.9	
	100% sludge		189 kg/ha		2.4	
Soybean	Control	28			0.62	
	Ni solution		2.5 ug/g		14.3	
Barley	NiCl2	2-8.9			10.8-13.0	
	NiCl2	24-90				250-850
Ryegrass	control		0		2.47	
	salt		2.5-20 mg/kg		4.65-54.4	
	sludge		2.5-20 mg/kg		4.17-11.3	
	control		0		2.3	
	salt		2.5-20 mg/kg		2.7-13.9	
	sludge		2.5-20 mg/kg		2.8-4.9	
Tomato	control	154.6			14.91	
	low 2-6% sludge	157.6-163.7			8.81-8.84	
	high 8-10% sludge	166.8-169.8			9.82-10.68	
Grass	control	.26-2.5			.64-4.10	
	sludge	.49-3.05	1.26-2.51 kg/ha		.57-5.89	
Alfalfa & red clover	control	.26-2.5			2.24-5.71	
	sludge	.49-3.05	1.26-2.51 kg/ha		2.55-5.92	
Barley		0 Ni		0-100 ppb		
		1.0 uM Ni			100-400 ppb	
	natural	728-2093				10317
	natural	728-2093			<252 ppm	
Corn	control		0-480		0.6	1.6-78.1
	fertilized		0-480		0.6	1.5-166.1

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity deficiency		phytotoxicity		reference
	type	symptoms	type	symptoms	
					54
Onion					54
					54
Lettuce					53
					53
					53
Lucerne					261
					261
					261
					261
					261
					261
Tomato					262
					262
					262
					262
Soybean					27
					27
Barley					6
			visual	death	6
Ryegrass					43
					43
					43
					43
					43
					43
Tomato					62
					62
					62
Grass					147
					147
Alfalfa & red clover					147
					147
Barley	yield/visual	30% less/less green,smaller			21
					21
				none mentioned	5
					5
Corn			yield	32-91% reduction in yield	146
			yield	22-97.6% reduction in yield	146

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH	Soil Type
					5.9	Rideau clay
					6.5	Rideau clay
Lettuce	Lactuca sativa	Grand Rapilds	whole	greenhouse	6.3	Grenville loam
		Forcing			5.9	Rideau clay
					6.5	Rideau clay
Soybean	Glycine max	Clark	shoots	field	6.9	Sassafras sandy loam
					6.6	Sassafras sandy loam
					6.4	Sassafras sandy loam
					5.9-7.4	Christiana fine sandy loam
					7.0-7.7	Christiana fine sandy loam
					6.9-7.6	Christiana fine sandy loam
					5.8-7.1	Christiana fine sandy loam
					5.7-6.0	Christiana fine sandy loam
					5.1-5.3	Christiana fine sandy loam
					6.4-6.6	Christiana fine sandy loam
					5.7-5.9	Christiana fine sandy loam
Beans	Phaleolus vulgaris	Tender crop	fruit	pots	5	Arkport fine sandy loam
					5.3	Arkport fine sandy loam
Cabbage	Brassica oleracea	Golden Acre	leaves	pots	5	Arkport fine sandy loam
					5.3	Arkport fine sandy loam
Carrots	Daucus carota	Scarlet Nantes	tubers	pots	5	Arkport fine sandy loam
					5.3	Arkport fine sandy loam
Millet	Echinochloa crusgalli	Japanese	edible tissue	pots	5	Arkport fine sandy loam
					5.3	Arkport fine sandy loam
Onions	Allium cepa	Downing Yellow Sweet	fruit	pots	5	Arkport fine sandy loam
		Spanish			5.3	Arkport fine sandy loam
Potatoes	Solanum tuberosum	Katahdin	tubers	pots	5	Arkport fine sandy loam
					5.3	Arkport fine sandy loam
Tomatoes	Lycopersicon esculentum	Vendor	fruit	pots	5	Arkport fine sandy loam
					5.3	Arkport fine sandy loam
Celery	Apium graveolens	Utah 52-70	leaves	field	6.88	muck soil
					5.68	muck soil
					6.91	muck soil
Perennial ryegrass	Lolium perenne	Melle	leaves	pot	7	Sutton sandy loam
Lettuce	Lactuca sativa	Climax		solution	6.2	Hoagland solution

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Treatment	Concentration in soil	Loading rate	plant tissue concentration		
				deficiency	normal	toxic
	sludge		0-480+1		0.5	1.5-19.1
	sludge		0-480+1		.6-1.4	21.9-637.8
	sludge+lime		0-480+1		0.4	1.2-6.8
Lettuce	sludge		0-480+1		1.3	6.1-133.1
	sludge		0-480+1		1.3-51.0	3619
	sludge+lime		0-480+1		1.6-31.8	
Soybean	control		0		2.5-2.8	
	sludge		9.52 kg/ha		3.8-4.6	
	sludge		19.04 kg/ha		5.1-6.1	
	control		0		5.8-8.2	
	limed-digested		.84-6.72 kg/ha		3.7-6.9	
	limed-raw		.95-3.81 kg/ha		3.2-4.4	
	limed-compost		11.26-135 kg/ha		2.5-7.8	
	heated sludge		2.07-8.29 kg/ha		4.4-7.7	
	heated sludge		2.07-8.29 kg/ha		7.9-12.6	
	Nu-Earth		15.1-30.2 kg/ha		7.6-7.7	
	Nu-Earth		15.1-30.2 kg/ha		9.6-11.3	
Beans	peat	15.31			3.9	
	sludge	28.9			11.3	
Cabbage	peat	15.31			1.9-2.1	
	sludge	28.9			3.3-10.0	
Carrots	peat	15.31			2.7	
	sludge	28.9			3.8	
Millet	peat	15.31			1.4	
	sludge	28.9			1.9	
Onions	peat	15.31			2.2	
	sludge	28.9			3	
Potatoes	peat	15.31			0.6	
	sludge	28.9			1.6	
Tomatoes	peat	15.31			0.5	
	sludge	28.9			1.3	
Celery	control	54			5	
	high metal soil	6000				78
	limed high metal soil	5550			66	
Perennial ryegrass	control	43	0		11	
	low sludge	86-129			46-79	
	medium sludge	210-372	356 kg/ha		90	126-222
	high sludge	537				305
Lettuce					20 ueg/l	20-45 ueg/l

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity deficiency		phytotoxicity		reference
	type	symptoms	type	symptoms	
			yield	19.6-88% reduction in yield	146
			yield	71.4-88.9% reduction in yield	146
			yield	15.3-42% reduction in yield	146
Lettuce			yield	31-41% reduction in yield	146
			yield	20.9% reduction in yield	146
					146
Soybean					89
					89
					89
					89
					89
					89
					89
					89
					89
					89
					89
Beans					68
					68
Cabbage					68
					68
Carrots					68
					68
Millet					68
					68
Onions					68
					68
Potatoes					68
					68
Tomatoes					68
					68
Celery					16
			visual	stunting,cupping,& foliar necrosis	16
					16
Perennial ryegrass					50
					50
			yield	28% reduction	50
			yield	57% reduction	50
Lettuce			yield	70% reduced root length	10

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH	Soil Type
Tomato	Lycopersicon esculentum	Fireball	leaves	sand		Hoagland solution
Soybean	Glycine max	Harcor	leaves	sand		Hoagland solution
Wheat	Triticum aestivum		tops	pot	5.0-5.5	Orentano histosol
					6.1-8.3	Lamporecchio fluvisol
					7.5-8.0	Guardia regosol
Peas	Pisum sativum	Dark Skin Prefection		perlite		Hoaglands solutions
		Laxton's Progress		perlite		Hoaglands solution
Corn	Zea mays	Pioneer 3369A	whole	pot	6.4	various
					6.3	various
					6.2	various
				pot	7.3-8.1	various

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	Treatment	Concentration in soil	Loading rate	plant tissue concentration		
				deficiency	normal	toxic
Tomato	control		0		**	
	NiSO4		1.5			**
	NiSO4		7.5			**
	NiSO4		37.5			**
Soybean	control		0		**	
	NiSO4		0.3		**	
	NiSO4		0.9		**	
	NiSO4		1.5		**	
Wheat	control	24.1			6.7	
	fly ash 2%	29			7.7	
	fly ash 5%	30.2			6.8	
	control	53.8			11.7	
	fly ash 2%	42.7			9.6	
	fly ash 5%	38.4			7.7	
	control	23.1			16.4	
	fly ash 2%	26.6			12.2	
	fly ash 5%	28.8			9.1	
Peas	control		0		0	
	NiSO4		10-100 umol		8.5-40.1	
	NiSO4		1000 umol			**
	control		0		0	
	NiSO4		10-100 umol		9.9-53.7	
	NiSO4		1000 umol			**
Corn	control		0		<.1-2.7	
	NiSO4		14.5-16.4 kg/ha		<.1-2.7	
	sludge		14.5-16.4 kg/ha		<.1-2.7	
	Ni(NO3)2	20.0-44.0			3.0-5.5	
	Ni(NO3)2	53.0-54.0			4.2-6.4	
	Ni(NO3)2	74.0-90.0			4.5-7.1	

TABLE E-3. NICKEL PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity deficiency		phytotoxicity		reference
	type	symptoms	type	symptoms	
Tomato					193
			visual	44.3% leaf area injury--necrosis	193
			visual	57.9% leaf area injury--necrosis	193
			visual	death 91% yield reduction	193
Soybean					193
					193
					193
					193
Wheat					186
					186
					186
					186
					186
					186
					186
					186
					186
Peas					179
					179
			visual	extreme leaf necrosis & abscission	179
					179
					179
			visual	extreme leaf necrosis & abscission	179
Corn					129
					129
					129
					207
					207
					207

TABLE E-4. ZINC PHYTOTOXICITY DATA

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Alfalfa	Medicago sativa		tops,top half of shoots	field	
				control	
Apple	Malus spp.		leaves,stems	field	
Apricot	Prunus armeniaca		leaves,stems	field	
Avocado	Persea americana		leaves	field	
Clover,Subter.	Trifolium subterraneum		leaves	field	
			tops	solution	
Corn	Zea mays		leaves	field	
Flax	Linum usitatissimum		tops	pots	
Oats	Avena sativa		leaves,plant	sand	
Orange	Citrus sinensis		leaves	field	
Peach	Prunus persica		leaves,stems	field	
Pear	Pyrus communis		leaves	field	
Pecan	Carya illinoensis		leaves,leaflets,petioles,shoots	field	
Pineapple	Ananas comosus		leaves,stems	field	
Potato	Solanum tuberosum		leaves	field	
Tomato	Lycopersicon esculentum		leaves	field	
				sand	
				solution	
Tung	Aleurites fordi		leaves,petioles	field	
				sand	
Walnut	Juglans regia		leaves,stems	field	
Corn	Zea mays		earleaf,grain	controled	5.8-6.2
					5.7-6.0
					5.7-6.0
			earleaf,grain,stover	field	6.6
Barley	Hordeum vulgare	Henry	silage	field	6.6
Reed canarygrass	Phalaris arundinacea			field	5.9-6.6
Corn	Zea mays			field	5.9-6.6
Radish	Raphanus sativus	Cherry Belle	leaf,tuber	field	
Swiss Chard	Beta vulgare	Fordhook		field	
Corn	Zea mays		stover,grain	field	6.2
				greenhouse	6.8
Rye	Seceale cereal			greenhouse	6.8
Corn	Zea mays			greenhouse	6.5

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
Alfalfa				
Apple				
Apricot				
Avocado				
Clover,Subter.				
Corn				
Flax				
Oats				
Orange				
Peach				
Pear				
Pecan				
Pineapple				
Potato				
Tomato				
Turg				
Walnut				
Corn	Bojac loamy sand			
	Davidson clay loam			
	Groseclose silt loam			
	Acredale silt loam			248 kg/ha
Barley	Acredale silt loam			248 kg/ha
Reed canarygrass	Hublersburg clay loam			73.0 kg/ha
Corn	Hublersburg clay loam			30.6 kg/ha
Radish	Ramona sandy loam		950 mg/kg	
Swiss Chard	Ramona sandy loam		950 mg/kg	
Corn	Waukegan fine silty over loam			106-384 kg/ha
	limed Warsaw sandy loam	fertilized		
		sludge	113	
		Zn sludge	410-1302	
Rye	limed Warsaw sandy loam	fertilized		
		sludge	113	
		Zn sludge	410-1302	
Corn	Warsaw sandy loam	fertilized		

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
Alfalfa	8	13.8		visual	
	13	39-48		visual	
Apple	1.2-54	4-80		visual	small stiff and mottled leaves
Apricot	24-30	19-31		visual	
Avocado	4-15	50		visual	
Clover,Subter.	<15			visual	
	24-25	76-90		visual	
Corn	9-15.1	15-36		visual	light yellow streaks,chlorotic strip
Flax	18	32-83		visual	grayish-brown spots,turns white
Oats	<20	20	1700-7500	visual	turn pale green,collapsed areas,gray
Orange	3.8-26	7.8-200	200-300	visual	leaves become chlorotic,mottled
Peach	3.5-25.4	66.0-140		visual	mottling,narrow crinkled leaves
Pear	9.9	16		visual	
Pecan	trace-7.0	66-202		visual	yellow mottling,rosettes
Pineapple	4-26	4-44		visual	
Potato		30-87			
Tomato	6.0-8.7	13		visual	slow growth,brownish chlorosis,curl
	14.4	26.9		visual	slow growth,brownish chlorosis,curl
	9-15	65-198	526-1489	visual	slow growth,brownish chlorosis,curl
Tung	3.6-26	15.7-229		visual	leaf bronzing,necrosis,spotting
			485		
Walnut	11-22	16-30		visual	
Corn	56-71mg/kg				
	21-28mg/kg				
	22-48mg/kg				
	10-53mg/kg				
Barley	12-35mg/kg				
Reed canarygrass		41.14-90.19ug/g			
Corn		18.32-45.15ug/g			
Radish		425 mg/kg			
Swiss Chard		610 mg/kg			
Corn		18.5-154 mg/kg			
		26-42 ppm			
		164-225 ppm			
			296-959 ppm		
Rye		45			
		125			
			396-948ppm		
Corn		26-42			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
Alfalfa			35
			35
Apple			35
Apricot			35
Avocado			35
Clover,Subter.			35
			35
Corn			35
Flax			35
Oats	visual	leaves show iron chlorosis	35
Orange	visual	leaves show iron chlorosis	35
Peach			35
Pear			35
Pecan			35
Pineapple			35
Potato			35
Tomato			35
			35
	visual		35
Tung			35
	visual		35
Walnut			35
Corn			197
			197
			197
			196
Barley			196
Reed canarygrass		none reported	213
Corn		none reported	213
Radish		none reported	34
Swiss Chard		none reported	34
Corn		no significant differences	12
			44
			44
	yield	up to 78% reduction	44
Rye			44
			44
	yield	up to 57% reduction	44
Corn			45

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Rye	Seceale cereal			greenhouse	6.5
Corn	Zea mays		leaf,grain	field	5.0-5.9
					6.8-7.7
					6.7-7.6
Bermuda grass	Cynodon dactylon			field	5.7-6.0
					5.4-6.0
					4.2-5.3
					6.1-6.6
					5.8-6.2
					4.8-5.2
Tall fescue	Festuca arundinacea		tops	pots	7.1-7.7
					6.1-7.5
					5.5-6.0
Alfalfa	Medicago sativa		tops	pots	7.1-7.7
					6.1-7.5
					5.5-6.0
Corn	Zea mays		grain	field	6.3
					6.8
					6.0-6.3
					6.2-6.3
					6
					6.2
Lettuce	Lactuca sativa	longifolia	shoots	greenhouse	7.5
					5.7
Wheat	Triticum aestivum	Inia	leaves, grain	greenhouse	7.5
					5.7

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
		sludge	113	
		Zn sludge	327-618	
		inorganic	300-600	
Rye	Warsaw sandy loam	fertilized		
		sludge	113	
		Zn sludge	327-618	
		inorganic	300-600	
Corn	Blount silt loam		12.1-277.2	
	Blount silt loam		5.99-227	
	Blount silt loam		4.82-140	
Bermuda grass	nonlimed Cecil sandy clay loam	control	1-4	
	nonlimed Cecil sandy clay loam	fertilized	1-4	
	nonlimed Cecil sandy clay loam	sludge	34-54	
	limed Cecil sandy clay loam	control	1-6	
	limed Cecil sandy clay loam	fertilized	1-8	
	limed Cecil sandy clay loam	sludge	26-43	
Tall fescue	fine silty		7.5	
	fine silty	sludge	506.7	
	stripped mined	sludge	543.4	
Alfalfa	fine silty		7.5	
	fine silty	sludge	506.7	
	stripped mined	sludge	543.4	
Corn	Sable silty clay loam			
	Cisne silt loam			
	Ipava silt loam			
	Drummer silty clay loam			
	Muscatine silt loam			
	Hartsburg silty clay loam			
Lettuce	Domino silt loam		0-10	
			20-80	
			160-640	
	Redding fine sandy loam		0-10	
			20-80	
			160-640	
Wheat	Domino silt loam		0-10	
			20-80	
			160-640	
	Redding fine sandy loam		0-10	
			20-80	

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		164-225			
			280-520		
			273-591		
Rye		45			
		125			
			317-833		
			564-1031		
Corn		28.3-381			
		23-145			
		18.3-115			
Bermuda grass		33			
		19			
		34-285			
		27			
		19			
		34-192			
Tall fescue		50.3			
		52.4-54.2			
		51.6-62.7			
Alfalfa		103.5			
		92.6-108.3			
		141.8-237.9			
Corn		16.4 ug/g			
		18.8 ug/g			
		15.7-20.1 ug/g			
		18.6-20.7 ug/g			
		16.9 ug/g			
		17.1 ug/g			
Lettuce		78-98ug/g			
		105-146ug/g			
		190-380ug/g	380-1265ug/g		
		139-172ug/g			
		195-520ug/g			
			1058-1973ug/g		
Wheat		63-67 ug/g			
		68-87 ug/g			
		108-189 ug/g	189-412 ug/g		
		58-70 ug/g			
		76-131 ug/g			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			45
	yield	reduction	45
	yield	reduction	45
Rye			45
			45
	yield	reduction	45
	yield	reduction	45
Corn		no significant differences	111
		no significant differences	111
		no significant differences	111
Bermuda grass			240
			240
			240
			240
			240
			240
Tall fescue			230
			230
			230
Alfalfa			230
			230
			230
Corn			187
			187
			187
			187
			187
			187
Lettuce			167
			167
	yield	significant yield reduction	167
			167
			167
	yield	significant yield reduction	167
Wheat			167
			167
	yield	significant yield reduction	167
			167
			167

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Snap bean	Phaseolus vulgaria	Tendergreen	beans,leaves	field	5.3
			leaves,edible tissue	field	5.3
Barley	Hordeum vulgare	Liberty		greenhouse	7.2
Corn	Zea mays		forage,grain	field	5.4
Bush beans	Phaseolus vulgaris		vines,pods	field	5.4
Corn	Zea mays		forage,grain	field	5.4
Bush beans	Phaseolus vulgaris		vines, pods	field	5.4
Carrots	Daucus carota sotiva	Scarlet Nantes	tubers	field	5.3
Lettuce	Lactuca sativa	Grand Rapids	leaves	field	5.3
Peas	Pisum sativum	Wando	fruit,vines,pods	field	5.3
Potatoes	Solanum tuberosum	Norland	tubers	field	5.3
Radishes	Raphanus sativus	Sparkler	tubers	field	5.3
Sweet corn	Zea mays	NK-199	grain,leaves	field	5.3
Tomatoes	Lycopersicon esculentum	Fantastic	fruit	field	5.3
Wheat	Triticum aestivum	Centurk	grain	field	5.3
Corn	Zea mays		tops	greenhouse	5.5
			leaves,grain	field	nuetral
Pearl millet	Pennisetum Americanum		leaves	field	5.3-6.9

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
			160-640	
Snap bean	Hubbard coarse sand			1520 kg/ha
	Hubbard coarse sand	control		0
		single		149-597 kg/ha
		anual		379-1518kg/ha
Barley	Humus loam coarse sand			
Corn	Sango sil	control	4	0
		ZnSo4	28-106	40-160 ppm
		Compost	32-80	40-160
		Sludge	29-93	40-160
Bush beans	Sango sil	control	4	0
		ZnSO4	28-106	40-160
		Compost	32-80	40-160
		Sludge	29-93	40-160
Corn	Sango sil	control	6	0
		ZnSo4	53-164	80-320
		Compost	70-156	80-320
		Sludge	68-206	80-320
Bush beans	Sango sil	control	6	0
		ZnSO4	53-164	80-320
		Compost	70-156	80-320
		Sludge	68-206	80-320
Carrots	Hubbard coarse sand			
Lettuce	Hubbard coarse sand			
Peas	Hubbard coarse sand			
Potatoes	Hubbard coarse sand			
Radishes	Hubbard coarse sand			
Sweet corn	Hubbard coarse sand			
Tomatoes	Hubbard coarse sand			
Wheat	Truckton loamy sand			
Corn	Hartsell fine sandy loam	Sludge A		70-1400
		Sludge B		11-210
		Compost		6-120
		ZnSO4		12-1400
		control		0
	Blount silt loam	none	72-83	
		middle	124-270	
		maximum	257-451	
Pearl millet	Downer sand	fertilized		

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		224-655ug/g	>655 ug/g		
Snap bean		112-115 ug/g			
		29.5-32.3 ug/g			
		57.2-60.4 ug/g			
		58.5-117.4ug/g			
Barley		106-295			
Corn		41			
		227-475			
		77-100			
		94-97			
Bush beans		60			
		184-328	328-499		
		52-84			
		158	164-189		
Corn		53			
			509-1025		
		126-184			
		202-241			
Bush beans		48			
			305-634		
		55-61			
		211-225			
Carrots		23-103			
Lettuce		21-225			
Peas		49-327			
Potatoes		24-53			
Radishes		37-98			
Sweet corn		22-293			
Tomatoes		9-31			
Wheat		34.8-54.2			
Corn		196-508			
		60-186	313		
		31-92			
		104	1604-10178		
		14-18			
		21-42			
		23-112			
		45-145			
Pearl millet		56 ug/g			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
	yield	significant yield reduction	167
Snap bean			58
		none mentioned	138
		none mentioned	138
		none mentioned	138
Barley			124
Corn			74
			74
			74
			74
Bush beans			74
	yield	vine & pod yield reduction	74
			74
	yield	pod yield reduction	74
Corn			74
	yield	up to 59% yield reduciton	74
			74
			74
Bush beans			74
	yield	up to 99% yield reduction	74
			74
			74
Carrots			56
Lettuce			56
Peas			56
Potatoes			56
Radishes			56
Sweet corn			56
Tomatoes			56
Wheat			206
Corn			169
	yield	reduciton attributed elsewhere	169
			169
	yield	reduction of 10-96%	169
			169
			96
			96
			96
Pearl millet			128

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Red oak	Quercus ruba		leaves	field	5.3-6.9
Black Walnut	Juglans nigra		leaves	field	5.3-6.9
Wheat	Triticum aestivum			pots	5.2 >6.5
Lettuce	Lactuca sativa	Bibb	leaves	field	
					6.5
		Romaine	leaves	field	
					6.5
		Boston	leaves	field	
					6.5
Cabbage	Brassica oleracea	capitata	edible parts	field	
					6.5

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
		unfertilized		
		sludge		2154ug/g sludge
Red oak	Downer sand	fertilized		
		unfertilized		
		sludge		2154ug/g sludge
Black Walnut	Downer sand	fertilized		
		unfertilized		
		sludge		2154ug/g sludge
Wheat	Redding fine sandy loam			100-200 ug/g
				100-200 ug/g
Lettuce	Sango sil	no lime:no heat		
		heat		
		sludge		
		sludge,heat		
	Sango sil	limed : no heat		
		heat		
		sludge		
		sludge,heat		
	Sango sil	no lime:no heat		
		heat		
		sludge		
		sludge,heat		
	Sango sil	limed : no heat		
		heat		
		sludge		
		sludge,heat		
	Sango sil	no lime:no heat		
		heat		
		sludge		
		sludge,heat		
	Sango sil	limed : no heat		
		heat		
		sludge		
		sludge,heat		
Cabbage	Sango sil	no lime:no heat		
		heat		
		sludge		
		sludge,heat		
	Sango sil	limed : no heat		

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		47-61 ug/g			
		51-81 ug/g			
Red oak		20			
		25			
		22-24			
Black Walnut		29 ug/g			
		43 ug/g			
		37-47 ug/g			
Wheat			**		
		**			
Lettuce		46			
		74			
		103			
		121			
		43			
		40			
		68			
		93			
		35			
		43			
		53			
		128			
		31			
		49			
		51			
		79			
		29			
		88			
		116			
		125			
		31			
		50			
		63			
		64			
Cabbage		29			
		34			
		46			
		41			
		48			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			128
			128
Red oak			128
			128
			128
Black Walnut			128
			128
			128
Wheat	yield	reduction	15
			15
Lettuce			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
			75
Cabbage			75
			75
			75
			75
			75

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Carrot	Daucus carota sotiva		edible parts	field	6.5
Canteloupe	Cucumis melo	Hal's Best	edible parts	field	6.5
Pepper	Capsicum spp.	California Wonder	edible parts	field	6.5
Lettuce	Lactuca sativa	Great lakes	leaves	field	
Corn	Zea mays	Silver Queen	edible tissue,foliage	field	
Squash	Cucurbita pepo	Yellow Crookneck	edible tissue ,foliage	field	

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
		heat		
		sludge		
		sludge,heat		
Carrot	Sango sil	no lime:no heat		
		heat		
		sludge		
		sludge,heat		
	Sango sil	limed : no heat		
		heat		
		sludge		
		sludge,heat		
Cantaloupe	Sango sil	no lime:no heat		
		heat		
		sludge		
		sludge,heat		
	Sango sil	limed : no heat		
		heat		
		sludge		
		sludge,heat		
Pepper	Sango sil	no lime:no heat		
		heat		
		sludge		
		sludge,heat		
	Sango sil	limed : no heat		
		heat		
		sludge		
		sludge,heat		
Lettuce	Sango sil	no heat		
		heat		
		sludge		
		sludge,heat		
Corn	Sango sil	no heat		
		heat		
		sludge		
		sludge,heat		
Squash	Sango sil	no heat		
		heat		
		sludge		
		sludge,heat		

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		64			
		59			
		53			
Carrot		22			
		20			
		29			
		25			
		39			
		34			
		30			
		40			
Cantaloupe		18			
		15			
		20			
		24			
		18			
		12			
		25			
		30			
Pepper		24			
		33			
		29			
		29			
		29			
		26			
		33			
		37			
Lettuce		48-54			
		41-44			
		74-131			
		70-142			
Corn		52			
		54			
		142			
		178			
Squash		48			
		88			
		120			
		121			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			75
			75
			75
Carrot			75
			75
			75
			75
			75
			75
			75
			75
Cantaloupe			75
			75
			75
			75
			75
			75
			75
			75
Pepper			75
			75
			75
			75
			75
			75
			75
			75
Lettuce			75
			75
			75
			75
Corn			75
			75
			75
			75
Squash			75
			75
			75
			75

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Pepper	Capsicum spp.	California Wonder	edible tissue,foliage	field	
Beans	Phaseolus vulgaris	Contender	edible tissue,foliage	field	
Broccoli	Brassica oleracea		edible tissue	field	
Eggplant	Solanum melongena	Black Beauty	edible tissue,foliage	field	
Tomatoes	Lycopersicon esculentum	Better Boy	edible tissue,foliage	field	
Potatoes	Solanum tuberosum	red Irish	edible tissue,foliage	field	
Little bluestem	Andropogen scoparius		whole	greenhouse	4.8 7.82
Black-eyed Susan	Rudbeckia hirta		whole	greenhouse	4.8 7.82
Wheat	Triticum aestivum		shoots,roots	greenhouse	
Corn	Zea mays	Dekald XL-43	seedlings,grain,stovers	field	5.6 6 6.3
Oats	Avena sativa	Norline	grain	field	5.6 6 6.3
Wheat	Triticum aestivum	Arthur	grain	field	5.6 6

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
Pepper	Sango sil	no heat		
		heat		
		sludge		
		sludge,heat		
Beans	Sango sil	no heat		
		heat		
		sludge		
		sludge,heat		
Broccoli	Sango sil	no heat		
		heat		
		sludge		
		sludge,heat		
Eggplant	Sango sil	no heat		
		heat		
		sludge		
		sludge,heat		
Tomatoes	Sango sil	no heat		
		heat		
		sludge		
		sludge,heat		
Potatoes	Sango sil	no heat		
		heat		
		sludge		
		sludge,heat		
Little bluestem	rural Plainfield sand	ZnCl2		2000-4000ug/g
	urban Oakville sand	ZnCl2		2000-4000ug/g
Black-eyed Susan	rural Plainfield sand	ZnCl2		2000-4000ug/g
	urban Oakville sand	ZnCl2		2000-4000ug/g
Wheat	clay loam	control		
		0-2 cm depth		
		18-20cm depth		
Corn	sandy	no sludge	1.0-1.6	
	sandy	56 metric tons	42.0-52.0	
	sandy	112 metric tons	84.0-99.0	
Oats	sandy	no sludge	1.0-1.6	
	sandy	56 metric tons	42.0-52.0	
	sandy	112 metric tons	84.0-99.0	
Wheat	sandy	no sludge	1.0-1.6	
	sandy	56 metric tons	42.0-52.0	

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
Pepper		71			
		64			
		96			
		109			
Beans		37			
		46			
		71			
		62			
Broccoli		87			
		93			
		99			
		130			
Eggplant		21			
		19			
		22			
		25			
Tomatoes		38			
		41			
		32			
		47			
Potatoes		27			
		39			
		33			
		65			
Little bluestem			**		
			**		
Black-eyed Susan			**		
			**		
Wheat		52			
		81.1			
		87.5			
Corn		42-86			
		289-405			
		331-411			
Oats		13			
		39			
		42			
Wheat		19			
		61			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
Pepper			75
			75
			75
			75
Beans			75
			75
			75
			75
Broccoli			75
			75
			75
			75
Eggplant			75
			75
			75
			75
Tomatoes			75
			75
			75
			75
Potatoes			75
			75
			75
			75
Little bluestem	yield	lack of germination	164
	yield	lack of germination	164
Black-eyed Susan	yield	lack of germination	164
	yield	lack of germination	164
Wheat			126
			126
			126
Corn			212
			212
			212
Oats			212
			212
			212
Wheat			212
			212

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Rye	Secale cereale	Balboa	grain	field	6.3 5.6 6
Crimson clover	Trifolium incarnatum	Auburn	whole	field	6.3 5.6 6
Arrowleaf clover	Trifolium vesiculosum	Yuchi	whole	field	6.3 5.6 6
					6.3
Carrots	Daucus carota	Danvers	tubers,shoots	field	5.5-5.8
Radishes	Raphanus sativus	Cherry belle	tubers,shoots	field	5.5-5.8
Tomatoes	Lycopersicon esculentum	New Yorker	fruit	field	5.5-5.8
Lettuce	Lactuca sativa	Salad bowl	leaves	field	5.5-5.8
Brome grass	Bromus inermis	Leyes		field	6.7-7.9
Corn	Zea mays		grain	field	6.7-7.9
			leaves, kernels	field	5.7
Fescue grass	Festuca arundinacea			pot	6.5 6.5 6.5 6.5
Corn	Zea mays	Pioneer 3369A	leaves	field	low
Grain Sorghum	Sorghum bicolor	Funk G-522	leaves	field	low
Soybeans	Glycine max	Centennial	seedlings	field	low
Barley	Hordeum vulgare	Barsoy	leaves,straw, grain	pot	6
		Briggs	leaves, straw,grain	pot	6

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	sandy	112 metric tons	84.0-99.0	
Rye	sandy	no sludge	1.0-1.6	
	sandy	56 metric tons	42.0-52.0	
	sandy	112 metric tons	84.0-99.0	
Crimson clover	sandy	no sludge	1.0-1.6	
	sandy	56 metric tons	42.0-52.0	
	sandy	112 metric tons	84.0-99.0	
Arrowleaf clover	sandy	no sludge	1.0-1.6	
	sandy	56 metric tons	42.0-52.0	
	sandy	112 metric tons	84.0-99.0	
Carrots	Bridgehampton silt loam		2.3-11.7	
Radishes	Bridgehampton silt loam		2.3-11.7	
Tomatoes	Bridgehampton silt loam		2.3-11.7	
Lettuce	Bridgehampton silt loam		2.3-11.7	
Brome grass	Conestoga loam	NH4NO3	4-7	
		sludge low		
		sludge high	45-249	
Corn	Conestoga loam	NH4NO3	6-9	
		Ca sludge	32-89	27-59
		Al sludge	66-156	38-87
		Fe sludge	63-92	23-38
	Willamette silt loam	control		
		NHSO		
		Portland sludge		2800mg/kg
		Rock Creek sludge		2200mg/kg
		Salum sludge		1670mg/kg
Fescue grass	Norfolk fine loamy			
	Cecil sandy clay loam			
	Norfolk fine loamy	swine sludge		76 kg/ha
	Norfolk fine loamy	municipal sludge		88 kg/ha
Corn	fine sandy loam			
Grain Sorghum	fine sandy loam			
Soybeans	fine sandy loam			
Barley	Ramona sandy loam	control		
		sludge low		
		sludge high		
	Ramona sandy loam	control		
		sludge low		
		sludge high		

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		72			
Rye		21			
		91			
		94			
Crimson clover		50			
		102			
		112			
Arrowleaf clover		51			
		187			
		312			
Carrots		23-79			
Radishes		62-164			
Tomatoes		35-49			
Lettuce		46-133			
Brome grass		17-25			
		19-27			
		26-31			
Corn		21			
		22-24			
		20-27			
		25-30			
		26-41			
		33-62			
		53-84			
		41-70			
		29-66			
Fescue grass		15-43			
		22-50			
		18-46			
		20-47			
Corn		37-200	400-707		
Grain Sorghum		50-200			
Soybeans		45-223	778-1188		
Barley		30			
		41			
		52			
		24			
		31			
		61			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			212
Rye			212
			212
			212
Crimson clover			212
			212
			212
Arrowleaf clover			212
			212
			212
Carrots			211
Radishes			211
Tomatoes			211
Lettuce			211
Brome grass			224
			224
			224
Corn			224
			224
			224
			224
			92
			92
			92
			92
			92
Fescue grass			123
			123
			123
			123
Corn	yield	reduction in certain years	143
Grain Sorghum			143
Soybeans	yield/visual	to 48% reduciton/ chlorosis/death	143
Barley			31
			31
			31
			31
			31
			31

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
		Florida 103	leaves,straw,grain	pot	6
		Larker	leaves,straw,grain	pot	6
		Briggs	leaves,straw,grains	pot	7.1
					7.8
Winter wheat	Triticum spp.	Anza	straw,grain	field	7.6
Swiss chard	Beta vulgaris	Fordhook Giant		greenhouse	7.7
					7
					5.5
Sweet corn	Zea mays	Jubilee	plant,seeds	field	
Alfalfa	Medicago sativa	Ranger	leaves,stems	field	
Wheat	Triticum vulgare	Fremont	plant,seeds	field	
Corn	Zea mays	Pride 110	leaves,kernels	field	6.5
					6.5
Fodder rape	Brassica napus	Kenton		greenhouse	5.6
					6
					7.5
Barley	Hordeum vulgare	Larker		greenhouse	4.0-6.4
Rye grass	Lolium multiflorum	Westerwool		greenhouse	4.0-6.4
Barley	Hordeum vulgare		leaves	field	5.5-7.0
Corn	Zea mays	Pioneer 3517	leaves,grain	field	7.6-8.1
		Jubilee	leaves,kernels	field	5.8-7.1
Fodder rape	Brassica napus	Kenton		greenhouse	5.6

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	Ramona sandy loam	control		
		sludge low		
		sludge high		
	Ramona sandy loam	control		
		sludge low		
		sludge high		
	Greenfield sandy loam	control		
		sludge low		
		sludge high		
	Domino loam soil	control		
		sludge low		
		sludge high		
Winter wheat	Omni silty clay		98-177	567 kg/ha
Swiss chard	Domino silt loam			20-160
	Hanford sandy loam			20-160
	Redding fine sand			20-160
Sweet corn	fine silty		25-74	
Alfalfa	fine silty		25-74	
Wheat	fine silty		25-74	
Corn	Sulton silt loam	limed		0-448 kg/ha
		unlimed		0-448 kg/ha
	Puyallup fine sandy loam	limed		0-448 kg/ha
		unlimed		0-448 kg/ha
Fodder rape	sandy			417mg/kg sludge
	sandy			417mg/kg sludge
	sandy			417mg/kg sludge
Barley	Marginally productive soil	dredged material		
Rye grass	Marginally productive soil	dredged material		
Barley	Domino loam soil	compost		2000 kg/ha
		liquid		2000 kg/ha
	Greenfield sandy loam	compost		2000 kg/ha
		liquid		2000 kg/ha
Corn	calcareous strip-mined spoil	control	3.4-9.5mg/kg	
		sludge	3.6-114mg/kg	
	Willamette silt loam	control	11-14umol/kg	
		NH4NO3n	9 umol/kg	
		tannery waste	9-26umol/kg	
Fodder rape	sandy	control	125 mg/pot	
		sludge	240-354mg/pot	

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		29			
		51			
		121			
		26			
		35			
		67			
		16			
		26			
		57			
		16			
		23			
		32			
Winter wheat		22-45			
Swiss chard		80-170			
		75-250	250-360		
			300-600		
Sweet corn		31-67			
Alfalfa		21-38			
Wheat		23-75			
Corn		26.8-342.6			
		28.0-587.7			
		27.3-508.7			
		28.7-677.3			
Fodder rape		34.8-70.5			
		21.8-41.2			
		17.6-27.8			
Barley		24-200	200-291		
Rye grass		41-258			
Barley		14.2-51.0			
		16.1-51.4			
		12.5-57.3			
		18.4-81.9			
Corn		13-33			
		34-200			
		.44-.46mmol/kg			
		.43-.46mmol/kg			
		.55-.67mmol/kg			
Fodder rape		1318 ug/pot			
		1698-2545ug/pot			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			31
			31
			31
			31
			31
			31
			31
			31
			31
			31
			31
			31
Winter wheat			32
Swiss chard			242
	yield	reduction	242
	yield	reduction	242
Sweet corn			24
Alfalfa			24
Wheat			24
Corn			185
			185
			185
			185
Fodder rape			173
			173
			173
Barley			41
Rye grass	visual	chlorosis	41
Barley			33
			33
			33
			33
Corn			188
			188
			226
			226
			226
Fodder rape			215
			215

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
					6
					7.5
Swiss chard	Beta vulgaris	Fordhook Giant		greenhouse	5.6-5.9
Rye grass	Lolium perenne			greenhouse	5.6-5.9
Upland cotton	Gossypium hirsutum		leaves,seeds	field	8.2
Timothy	Phleum pratense			field	6.3
					6.1
Tomato	Lycopersicon lycopersium	Tropic	leaves, fruit	greenhouse	7.9
					7.8
					7.6
					6.9
					7
					6.5
Bell pepper	Capsicum annuum	California Wonder	leaves,fruit	greenhouse	7.9
					7.8
					7.6
					6.9
					7
					6.5
Cos lettuce	Lactuca sativa	Cos Paris White	leaves	greenhouse	7.9
					7.8
					7.6
					6.9
					7
					6.5
Head lettuce	Lactuca sativa	Great Lakes 118	leaves	greenhouse	7.9
					7.8

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	sandy	control	125 mg/pot	
		sludge	240-354mg/pot	
	sandy	control	125 mg/pot	
		sludge	240-354mg/pot	
Swiss chard	Chalmers silty clay loam and Russel silt loam	control	62 mg/kg	
		drilling fluid	35-6170mg/kg	
Rye grass	Chalmers silty clay loam and Russel silt loam	control	62 mg/kg	
		drilling fluid	35-6170mg/kg	
Upland cotton	Pima clay loam	control		
		fertilized		
		sludge		
Timothy	Dalhousie clay loam	control		
		fertilized		
		pig manure		
		sludge		
	St. Bernard sandy loam	control		
		fertilized		
		pig manure		
		sludge		
Tomato	Las Virgines I fine loamy			
	Las Virgines II fine loamy			
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			
	Greenfield II coarse-loamy			
Bell.pepper	Las Virgines I fine loamy			
	Las Virgines II fine loamy			
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			
	Greenfield II coarse-loamy			
Cos lettuce	Las Virgines I fine loamy			
	Las Virgines II fine loamy			
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			
	Greenfield II coarse-loamy			
Head lettuce	Las Virgines I fine loamy			
	Las Virgines II fine loamy			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		1177 ug/pot			
		1025-1322ug/pot			
		641 ug/pot			
		749-1157ug/pot			
Swiss chard		72 mg/kg			
		72-2072 mg/kg			
Rye grass		43 mg/kg			
		43-995mg/kg			
Upland cotton		42.8 mg/kg			
		39.5 mg/kg			
		41.1-49.1 mg/kg			
Timothy		19-30 mg/kg			
		19-25 mg/kg			
		20-27 mg/kg			
		19-29 mg/kg			
		22-29 mg/kg			
		21-28 mg/kg			
		23-34 mg/kg			
		24-33 mg/kg			
Tomato		22			
		20			
		68			
		99.5			
		92.3			
		121			
Bell pepper		178.8			
		108			
		242.8			
		205			
		195.3			
		195.8			
Cos lettuce		52.5			
		58			
		75.8			
		137			
		116.3			
		354			
Head lettuce		53.5			
		57.3			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			215
			215
			215
			215
Swiss chard			176
			176
Rye grass			176
			176
Upland cotton			259
			259
			259
Timothy			257
			257
			257
			257
			257
			257
			257
			257
Tomato			122
			122
			122
			122
			122
			122
Bell pepper			122
			122
			122
			122
			122
			122
Cos lettuce			122
			122
			122
			122
			122
			122
Head lettuce			122
			122

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
					7.6
					6.9
					7
					6.5
Radishes	Raphanus sativus	Cherry Belle	leaves,tubers	greenhouse	7.9
					7.8
					7.6
					6.9
					7
					6.5
Potato	Solanum tuberosum	Gold Russet	leaves,tuber	greenhouse	7.9
					7.8
					7.6
					6.9
					7
					6.5
Corn	Zea mays	Golden	leaves	greenhouse	7.9
		Bantam			7.8
					7.6
					6.9
					7
					6.5
Wheat	Triticum aestivum	Anza	leaves,seeds	greenhouse	7.9
					7.8
					7.6
					6.9
					7
					6.5
Swiss chard	Beta vulgaris	Large White	leaves	greenhouse	7.9
					7.8
					7.6
					6.9
					7
					6.5
Broccoli	Brassica oleracea	Green Comet	leaves,fruit	greenhouse	7.9
					7.8
					7.6
					6.9
					7

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			
	Greenfield II coarse-loamy			
Radishes	Las Virgines I fine loamy			
	Las Virgines II fine loamy			
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			
	Greenfield II coarse-loamy			
Potato	Las Virgines I fine loamy			
	Las Virgines II fine loamy			
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			
	Greenfield II coarse-loamy			
Corn	Las Virgines I fine loamy			
	Las Virgines II fine loamy			
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			
	Greenfield II coarse-loamy			
Wheat	Las Virgines I fine loamy			
	Las Virgines II fine loamy			
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			
	Greenfield II coarse-loamy			
Swiss chard	Las Virgines I fine loamy			
	Las Virgines II fine loamy			
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			
	Greenfield II coarse-loamy			
Broccoli	Las Virgines I fine loamy			
	Las Virgines II fine loamy			
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		83.5			
		143.8			
		177			
		281			
Radishes		56.5			
		48.8			
		168			
		246.8			
		200.8			
		332.8			
Potato		21.5			
		26.5			
		23.3			
		27.5			
		31			
		50.5			
Corn		63.3			
		47			
		129.3			
		154.8			
		125.5			
		239.5			
Wheat		34.5			
		42.5			
		89.5			
		130.5			
		102.3			
		210			
Swiss chard		39.5			
		33.5			
		250.8			
		349.8			
		412.3			
		884			
Broccoli		14.3			
		19			
		75.5			
		167.8			
		91			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			122
			122
			122
			122
Radishes			122
			122
			122
			122
			122
			122
Potato			122
			122
			122
			122
			122
			122
Corn			122
			122
			122
			122
			122
			122
Wheat			122
			122
			122
			122
			122
			122
Swiss chard			122
			122
			122
			122
			122
			122
Broccoli			122
			122
			122
			122
			122

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Carrot	Daucus carota	Imperator	leaves, tubers	greenhouse	6.5
					7.9
					7.8
					7.6
					6.9
					7
Beet	Beta vulgaris	Red Detroit	leaves,tubers	greenhouse	6.5
					7.9
					7.8
					7.6
					6.9
					7
Corn	Zea mays		leaves,grain	field	6.5
					7
		Pioneer 3192	leaves,grain	field	>6.5
					>6.5
					>6.5
Soybean	Glycine max	Corsoy	Seedling tissue	pot	5.9
Corn	Zea mays		leaves,grain	field	
Sorghum	Sorghum bicolor	Moench	roots,leaves,stem,grain	field	6.9-7.7
					5.8-7.2
Winter wheat	Triticum aestivum		grain, roots	field	6.9-7.7
					5.8-7.2
Corn	Zea mays			field	6.5
					5.1-5.5
Lettuce	Lactuca sativa		whole	field	7.56
					7.06
					8.53

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	Greenfield II coarse-loamy			
Carrot	Las Virgines I fine loamy			
	Las Virgines II fine loamy			
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			
	Greenfield II coarse-loamy			
Beet	Las Virgines I fine loamy			
	Las Virgines II fine loamy			
	Domino I fine loamy			
	Domino II fine loamy			
	Greenfield I coarse-loamy			
	Greenfield II coarse-loamy			
Corn	Davidson silty clay	control		
		ZnSO4		695-897kg/ha
	Guernsey silt loam	control		
		pig manure		
		CuSO4		
	Bertie fine sandy loam	control		
		pig manure		
		CuSO4		
	Starr-Dyke clay loam	control		
		pig manure		
		CuSO4		
Soybean	Nicollet loam soil	ZnSO4		0-72 mg/kg
		sludge		0-92 mg/kg
Corn	Blount silt loam	control	68	
		1/4 max sludge	188	
		1/2 max sludge	326	
		maximum	454	
Sorghum	Haynie fine sandy loam	fertilized	0.8	
	Haynie fine sandy loam	sludge	10.2	
Winter wheat	Haynie fine sandy loam	fertilized	0.8	
	Haynie fine sandy loam	sludge	10.2	
Corn	Bount silt loam	control		0
	Bount silt loam	sludge		0-2358 kg/ha
Lettuce	land fill	control	2169	
	land fill	sludge	1824	
	clay	control	117	

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		288			
Carrot		51			
		47.8			
		91			
		109.5			
		98.5			
		155.5			
Beet		51.8			
		48.3			
		286.3			
		446.5			
		363.5			
		1023.3			
Corn		19.2-19.6 mg/kg			
		21.1-54.3mg/kg			
		45			
		41			
		38-39			
		45			
		37			
		44-48			
		25			
		17			
		25-26			
Soybean		32-55			
		32-112			
Corn		14.5-28.3			
		32.0-84.4			
		43.7-156.1			
		61.8-281.8	188.8-217.2		
Sorghum		50			
		101			
Winter wheat		28			
		56			
Corn		28-60			
		85-381			
Lettuce		26.93			
		39.21			
		11.3			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			122
Carrot			122
			122
			122
			122
			122
			122
Beet			122
			122
			122
			122
			122
			122
Corn			183
			183
			184
			184
			184
			184
			184
			184
			184
			184
			184
Soybean			57
			57
Corn			95
			95
			95
	yield/visual	yield reduction/delayed flowering	95
Sorghum			127
			127
Winter wheat			127
			127
Corn			94
			94
Lettuce			72
			72
			72

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
					8.06
					6.8
					6.86
					6.74
					7.32
Tomato	Lycopersicon esculentum		fruit	field	7.56
					7.06
					8.53
					8.06
					6.8
					6.86
					6.74
					7.32
Wheat	Triticum aestivum		grain,whole	field	7.56
					7.06
					8.53
					8.06
					6.8
					6.86
					6.74
					7.32
Onion	Allium cepa		root, whole	field	7.56
					7.06
					8.53
					8.06
					6.8
					6.86
					6.74
					7.32
Radish	Raphanus sativa		root,whole	field	7.56
					7.06
					8.53
					8.06
					6.8
					6.86
					6.74
					7.32
Splash pine	Pinus elliotttii		pine needles	field	4.8-5.1
					4.9-5.3

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	clay	sludge	150	
	brown loam	control	176	
	brown loam	sludge	335	
	black top soil	control	97	
	black top soil	sludge	200	
Tomato	land fill	control	2169	
	land fill	sludge	1824	
	clay	control	117	
	clay	sludge	150	
	brown loam	control	176	
	brown loam	sludge	335	
	black top soil	control	97	
	black top soil	sludge	200	
Wheat	land fill	control	2169	
	land fill	sludge	1824	
	clay	control	117	
	clay	sludge	150	
	brown loam	control	176	
	brown loam	sludge	335	
	black top soil	control	97	
	black top soil	sludge	200	
Onion	land fill	control	2169	
	land fill	sludge	1824	
	clay	control	117	
	clay	sludge	150	
	brown loam	control	176	
	brown loam	sludge	335	
	black top soil	control	97	
	black top soil	sludge	200	
Radish	land fill	control	2169	
	land fill	sludge	1824	
	clay	control	117	
	clay	sludge	150	
	brown loam	control	176	
	brown loam	sludge	335	
	black top soil	control	97	
	black top soil	sludge	200	
Splash pine	Troup fine sandy loam	control	0.9	0
	Troup fine sandy loam	low sludge	7.7-12.6	49-146 kg/ha

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		10.14			
		25.4			
		14.07			
		8.76			
		6.75			
Tomato		2.99			
		3.45			
		2.14			
		2.68			
		2.87			
		2.74			
		2.04			
		2.65			
Wheat		233.3			
		148.4			
		50.3			
		78			
		77.9			
		67.6			
		50.9			
		59.6			
Onion		10.19			
		11.38			
		4.29			
		6.06			
		12.91			
		6.52			
		6.09			
		7.17			
Radish		6.67			
		6.07			
		7.58			
		11.05			
		6.89			
		9.42			
		4.44			
		7.01			
Splash pine		36			
		41-74			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			72
			72
			72
			72
			72
Tomato			72
			72
			72
			72
			72
			72
			72
			72
Wheat			72
			72
			72
			72
			72
			72
			72
			72
Onion			72
			72
			72
			72
			72
			72
			72
			72
Radish			72
			72
			72
			72
			72
			72
			72
			72
Splash pine			144
			144

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
					4.8-5.2
Oats		Harmon	root,seed,stem	field	
Sudangrass	Sorghum bicolor	Piper	whole	field	5.32
					5.18
					5.77-6.38
Corn	Zea mays		stems,roots,leaves,husks,grain	field	6.2
Perennial ryegrass	Loluim perenne			pot	4.3-5.26
					4.76-5.72
					6.16-7.11
Swiss chard	Beta vulgaris		leaves	pot	4.9-5.5
					5.2-6.2
					5.2-5.8
					5.2-5.7
					5.1-5.7
Tobacco	Nicotiana tabacum	Virginia 115 and Island gold	leaves	field	5.9-6.2
Wheat			kernels,straw	greenhouse	8.1
					6.5
				field	8.1
Brome alfalfa			whole	greenhouse	8.1
					6.5
perennial ryegrass				pot	5.5

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	Troup fine sandy loam	high sludge	8.3-13.3	195-244 kg/ha
Oats		control	25-31.1	
		25 % sludge	42.8	
		50% sludge	81.4	
Sudangrass	Wahiawa silty clay	control		
	Wahiawa silty clay	fertilized		
	Wahiawa silty clay	sludge		
Corn	Warsaw silt loam	control	158	
		sludge	2065	1010 tons/ha
Perennial ryegrass	Acid clay loam	Control	0	
		sludge	4-8%	
		sludge	0.12	
	Acid clay loam	Control	0	
		sludge	4-8%	
		sludge	0.12	
	Acid clay loam	Control	0	
		sludge	4-8%	
		sludge	0.12	
Swiss chard	Puyallup sandy loam	sludge	40-145	0-246 kg/ha
	Sultan silt loam	sludge	50-150	0-246 kg/ha
	Schalcar muck	sludge	95-185	0-246 kg/ha
	Chehalis clay loam	sludge	75-195	0-246 kg/ha
	Olympic clay loam	sludge	70-225	0-246 kg/ha
Tobacco	fine sandy loam	control		0
		Zn sulfate		6.7-20.1 kg/ha
		Zn sulfate		26.8-40.2 kg/ha
Wheat	Lakeland calcareous fine	control		0
		sludge		87.75-877.5 kg/ha
	Red River noncalcareous fine	control		0
		sludge		87.75-877.5 kg/ha
	Lakeland calcareous fine	control		0
		sludge		824-1648 kg/ha
Brome alfalfa	Lakeland calcareous fine	control		0
		sludge		87.75-877.5 kg/ha
	Red River noncalcareous fine	control		0
		sludge		87.75-877.5 kg/ha
perennial ryegrass	sandy soil	control	89 mg/pot	
		sludge	712 mg/pot	126 g/pot
		sulfate	712 mg/pot	

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		73-85			
Oats		42			
		68			
		99			
Sudangrass		129			
		176			
		115-172			
Corn		165			
		320			
Perennial ryegrass		80			
		250-365			
			500		
		60-75			
		200-300			
			400-450		
		40			
		100-150			
		250			
Swiss chard		.10-.86 mg/g			
		.10-.86 mg/g			
		.60-1.3 mg/g			
		.10-.60 mg/g			
		.10-.40 mg/g			
Tobacco		16.8-27.0			
		22.1-53.8			
		43.2-114.6			
Wheat		15.9			
		23.0-52.0			
		30.3			
		30.9-64.5			
		32-44			
		45-96			
Brome alfalfa		14			
		22.0-61.0			
		21			
		33-66			
perennial ryegrass		35 mg/pot			
		68 mg/pot			
		150 mg/pot			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			144
Oats			73
			73
			73
Sudangrass			104
			104
			104
Corn			125
			125
Perennial ryegrass			19
			19
	yield	yield reduces again	19
			19
			19
	yield	yield reduces again	19
			19
			19
			19
Swiss chard			134
			134
			134
			134
			134
Tobacco			80
			80
			80
Wheat			270
			270
			270
			270
			270
			270
Brome alfalfa			270
			270
			270
			270
perennial ryegrass			55
			55
			55

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Soybean	Glycine max	Bragg	seed, pod wall, stem	greenhouse	6.2
		Ransom	seed, pod wall, stem	greenhouse	6.2
White pine	Pinus strobus		leaves, roots	greenhouse	
Red maple	Acer rubrum		leaves, roots	greenhouse	
Norway spruce	Picea abies		leaves,roots	greenhouse	
Lettuce		Imperial 847	tops	pot	
Onions		Early flat Baretta	bulbs	pot	
Lettuce		Imperial 847	tops	field	
Onions		Early flat Baretta	bulbs	field	
Lettuce		Imperial 847	tops	greenhouse	
Lucerne	Medicago sativa	Wairau	whole	pot	5
					5.1-5.6
					6.6
					5.2
					5.4-6.0
					6.8
Tomato	Lycopersicon esculentum	Money maker	leaves,fruit,root	pot	4.6-6.9
			fruit	pot	4.6-6.6
					6.6-6.9
					6.6-6.7

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
		combination	712 mg/pot	
Soybean	Enon sandy loam	control		0
		low sludge		12.2-24.4 kg/ha
		high sludge		36.6 kg/ha
	Enon sandy loam	control		0
		low sludge		12.2-24.4 kg/ha
		high sludge		36.6 kg/ha
White pine	sand	Zn solution		0
				6.25-50 ug/l
				100-400 ug/l
Red maple	sand	Zn solution		0
				6.25-50 ug/l
				100-400 ug/l
Norway spruce	sand	Zn solution		0
				6.25-50 ug/l
				100-400 ug/l
Lettuce	loamy fine sand	Control		0
		low sludge		3.68-18.4 kg/ha
		high sludge		18.4-33.12 kg/ha
Onions	loamy fine sand	control		0
		low sludge		3.68-18.4 kg/ha
		high sludge		18.4-33.12 kg/ha
Lettuce	loamy fine sand	control		0
		sludge		3.68-66.24 kg/ha
Onions	loamy fine sand	control		0
		sludge		3.68-66.24 kg/ha
Lettuce	sand loam	control		0
		sludge		3.68-289.08
		heated sludge		11.04-33.12
Lucerne	Waitarere sand	0	37	
	Waitarere sand	5-40% sludge	95.15-502.2	
	Waitarere sand	100% sludge	1200	
	Levin silt loam	0	65	
	Levin silt loam	5-40% sludge	121.75-519	
	Levin silt loam	100% sludge	1200	
Tomato		sludge	380	0-378 kg/ha
		0		0
		25-75% sludge		94.5-283.5 kg/ha
		100% sludge		378 kg/ha

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		17 mg/pot			
Soybean		53.33			
		60.66-62.33			
		61.3			
		52			
		57.33-57.66			
		63.33			
White pine		98.8			
		128.3-433.8			
		647.1-1005.5	1005.5-2650		
Red maple		49.3			
		147.5-381.3	421.3		
		260.8-385.8			
Norway spruce		133.8			
		165.0-242.5	621.3		
		0	496.3-1625.0		
Lettuce		50			
		87-220			
		220-300			
Onions		35			
		60-120			
		120-180			
Lettuce		40			
		40			
Onions		17			
		14-18			
Lettuce		55			
		85-698			
		117-169			
Lucerne		80-180			
		130-880			
		150-350			
		84			
		110-280			
		170			
Tomato		62			
		46			
		42-51			
		56			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			55
Soybean			202
			202
			202
			202
			202
			202
White pine			166
			166
	visual	foliar toxicity/interveinal chlorosis	166
Red maple			166
	visual	foliar toxicity/interveinal chlorosis	166
			166
Norway spruce			166
	visual	foliar toxicity/ stunted growth	166
	visual	foliar toxicity/stunted growth	166
Lettuce			54
			54
			54
Onions			54
			54
			54
Lettuce			54
			54
Onions			54
			54
Lettuce			53
			53
			53
Lucerne			261
			261
			261
			261
			261
			261
Tomato			262
			262
			262
			262

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Sweet corn	Zea mays	Jubilee	leaves,kernels	field	5.4 4.7-5.1 5.1-5.2 5.1-5.3 5.1
Soybean	Glycine max		stem,leaves,seeds,pods	pot	
	Picea abies		needles	field	
Endive	Chicorium endivia	Florida Deepheart	leaves	greenhouse	4.5-4.9
Barley	Hordeum vulgare	Julia	tops	sand	
Rye grass	Lolium perenne	S24	tops	greenhouse	6
					7.6
Lettuce	Lactuca sativa	Grand rapids	leaves	pots	6.7
Carrots	Daucus carota	Amstel	tubers	pots	6.7
Peas	Pisum sativum	Thomas Laxton	fruit	pots	6.7
Tomato	Lycopersicon esculentum		shoots	greenhouse	5.33 7.96-8.09 8.01-8.11
Lettuce			tops		4.9
					7.7

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
Sweet corn	Willamette silt loam	control		
	Willamette silt loam	fertilized		
	Willamette silt loam	Portland sludge		88-177 lb/acre
	Willamette silt loam	Rock Creek sludge		40-80 lb/acre
	Willamette silt loam	Salem sludge		26-52 lb/acre
Soybean	Rizville silt loam	control	74	
		Zn solution		2.5 ug/g
		control		
		polluted		
Endive	Merrimac loamy sand and	control		0
	Suffield loam and	ZnSO4		100-400 mg/kg
	Hadley silt loam	ZnSO4		800 mg/kg
		sludge		16 mg/kg
		sludge + ZnSO4		100-400 + 16 mg/kg
		sludge + ZnSO4		800 + 16 mg/kg
Barley	washed silver sand	ZnSO4	3.5-12.6	
		ZnSO4	430-1500	
Rye grass	sandy soil	control		0
		salt		51-410 mg/kg
		sludge		51-410 mg/kg
	heavy clay soil	control		0
		salt		51-410 mg/kg
		sludge		51-410 mg/kg
Lettuce	very fine non-calcareous	control	99	0
		low sludge		160.6-321.2 kg/ha
		high sludge		642.4 kg/ha
Carrots	very fine non-calcareous	control	99	0
		low sludge		160.6-321.2 kg/ha
		high sludge		642.4 kg/ha
Peas	very fine non-calcareous	control	99	0
		low sludge		160.6-321.2 kg/ha
		high sludge		642.4 kg/ha
Tomato	Elkton silt loam	control	82.2	
	Elkton silt loam	low 2-6% sludge	88.7-101.8	
	Elkton silt loam	high 8-10% sludge	108.3-114.9	
Lettuce	Steinhof sandy loam	NaNO3	0-60	
			60-144	
	Erlach soil	NaNO3	60-144	
			144-475	

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
Sweet corn		47			
		54-59			
		130-164			
		108-118			
		79-95			
Soybean		12.1			
		10.4			
		65			
		30-70			
Endive		250			
			500-900		
			115-1500		
		290			
			600-1000		
			1500		
Barley		124-220			
			2000-19000		
Rye grass		69			
		117-1001			
		99-232			
		32.4			
		62.4-163			
		55.4-100.7			
Lettuce		35			
		135-181			
		320			
Carrots		11			
		35-43			
		53			
Peas		83			
		52-61			
		67			
Tomato		334.6			
		87.5-101.4			
		114-119.2			
Lettuce		50-200			
			200-800		
		75-200			
			200-1000		

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
Sweet corn			121
			121
			121
			121
			121
Soybean			27
			27
			112
			112
Endive			165
	yield	6-57.5% reduction	165
	yield	54% reduction/death	165
			165
	yield	23.5-41% reduction	165
	yield	64% reduction	165
Barley			6
	visual	death	6
Rye grass			43
			43
			43
			43
			43
			43
Lettuce			271
			271
			271
Carrots			271
			271
			271
Peas			271
			271
			271
Tomato			62
			62
			62
Lettuce			78
	visual	phytotoxic	78
			78
	visual	phytotoxic	78

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
					6.9
Red clover			tops		5.7
					7.3
Grass		timothy,brown top sweet vernal,blue		field	6.05 6.2
Alfalfa & Red clover				field	6.05 6.2
Wheat	Triticum aestivum	Gamenya	seedlings	solution	3.5-6.0
Dwarf beans	Phaseolus vulgaris	Limburgse vroege	leaves	solution	
Various			shoots	field	
Oats	Avena sativa	Selma	leaves	pot	6.6
					6.2
					7.5
Eucalyptus	Eucalyptus maculata	Hook	leaves	greenhouse	6.5-7.5
	Eucalyptus marginata	Donn	leaves	greenhouse	6.5-7.5
	Eucalyptus patens	Benth	leaves	greenhouse	6.5-7.5
Wheat	Triticum eastivum	Gamenya	leaves	greenhouse	6.5-7.5
Highbush blueberry	Vaccinium corymbosum	Blueray		pot	3.9-7.1

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	La Chatange soil	NaNO3	144-210	
			210-350	
Red clover	Gansemoos soil	control	68	
		low NaNO3	77-106	
		high NaNO3	219	
	Erlach soil	control	61	
		low NaNO3	70-96	
		high NaNO3	202	
Grass	clay and sandy loams	control	.4-4.5	
	clay and sandy loams	sludge	.6-5.94	27.39-62.77 kg/ha
Alfalfa & Red clover	clay and sandy loams	control	.4-4.5	
	clay and sandy loams	sludge	.6-5.94	27.39-62.77 kg/ha
Wheat	solution	control		0
		sulfate		.05-1.0 uM half plant
		sulfate		1.0 uM whole plant
Dwarf beans	Hoaglands ZnSO4 solution		0-1.9	
			3.8-15.3	
			19.1-30.6	
Various	serpentine soil	natural	30-79	
Oats	sandy loam	control	36.9	
		nitrate compound	67.4	
	sandy aoil	control	20.8	
		nitrate compound	46.4	
	organic soil	control	72.9	
		nitrate compound	122.2	
Eucalyptus	sand	control	0	
		sulfate	50-200 ug/3kg	
		sulfate	600-1200 ug/3 kg	
	sand	control	0	
		sulfate	50-200 ug/3kg	
		sulfate	600-1200 ug/3 kg	
	sand	control	0	
		sulfate	50-200 ug/3kg	
		sulfate	600-1200 ug/3 kg	
Wheat	sand	control	0	
		sulfate	50-200 ug/3kg	
		sulfate	600-1200 ug/3 kg	
Highbush blueberry	peat	control		
		low MnCl2		4 g/pot

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		75-200			
			200-425		
Red clover		132			
		235-428			
			1364		
		57			
		61-70			
		94			
Grass		15.8-31.7			
		14.9-29.5			
Alfalfa & Red clover		19.9-39.3			
		15.8-50.1			
Wheat		11.0-15			
		18-47			
		62-72			
Dwarf beans		25-35			
		50-226	226-300		
			226-500		
Various		18-75			
Oats		13.5-27.3			
		62.3-126.9			
		10.3-23.7			
		90.0-330.9			
		20.5-37.3			
		38.0-56.7			
Eucalyptus	9.1			visual/yield	necrotic,purple/2% shoot weight
	5.5-7.5			visual/yield	necrotic,purple/4% shoot weight
		12.4-29.9			
	2.6			visual/yield	necrotic,purple/26% shoot weight
	2.0-2.4			visual/yield	necrotic,purple/29% shoot weight
		15.2-36.6			
	5.2			visual/yield	necrotic,purple/3% shoot weight
	3.8-6.8			visual/yield	necrotic,purple/16% shoot weight
		13.8-28.4			
Wheat	4.8			visual/yield	necrotic,purple/5% shoot weight
	4.4-5.8			visual/yield	necrotic,purple/8% shoot weight
		17.4-25.4			
Highbush blueberry		25-37			
		32-49			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			78
	visual	phytotoxic	78
Red clover			78
			78
	yield	71.4% yield reduction	78
			78
			78
			78
Grass			147
			147
Alfalfa & Red clover			147
			147
Wheat			142
			142
			142
Dwarf beans			243
	yield	20-30% reduction in shoot length	243
	yield	20-55% reduction in shoot length	243
Various			5
Oats			17
			17
			17
			17
			17
			17
Eucalyptus			51
			51
			51
			51
			51
			51
			51
			51
			51
Wheat			51
			51
			51
Highbush blueberry			87
			87

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Corn	Zea mays	Asgrow UH7	whole	greenhouse	6.3
					5.9
					6.5
Lettuce	Lactuca sativa	Grand Rapids Forcing	whole	greenhouse	6.3
					5.9
					6.5
Barley	Hordeum vulgare		straw	field	6.0-7.4
					4.5-5.5
Oats	Avena sativa	Garry	straw	field	5.09
					5.84
					6
Soybean	Glycine max	Clark	shoots	field	6.9
					6.6
					6.4
					5.9-7.4
					7.0-7.7
					6.9-7.6
					5.8-7.1
					5.7-6.0
					5.1-5.3
					6.4-6.6
					5.7-5.9
Sunflower	Helianthus annuus	894A	whole	field	7.2-7.4
					6.0-6.3
					8.4
					6.0-6.2
Barley	Hordeum vulgare	Mariout	grain	field	5.3
					4.7-4.9

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
		high MnCl2		8 g/pot
Corn	Grenville loam	control		0-480 ppm
		fertilized		0-480 ppm
		sludge		0-480 +18 ppm
	Rideau clay	sludge		0-480 +18 ppm
	Rideau clay	sludge + lime		0-480 +18 ppm
Lettuce	Grenville loam	sludge		0-480 +18 ppm
	Rideau clay	sludge		0-480 +18 ppm
	Rideau clay	sludge + lime		0-480 +18 ppm
Barley	Dublin loam	Pacheco sludge control		0
		low sludge		21.6-64.8 kg/ha
		high sludge		86.4-108 kg/ha
	Dublin loam	Oakland sludge control		0
		low sludge		172.8-518.4 kg/ha
		high sludge		691.2 kg/ha
Oats	peat	CuSO4	54	0
	muck	CuSO4	85	0
	mucky peat	CuSO4	46	0
Soybean	Sassafras sandy loam	control		0
	Sassafras sandy loam	sludge		246.4 kg/ha
	Sassafras sandy loam	sludge		492.8 kg/ha
	Christiana fine sandy loam	control		0
	Christiana fine sandy loam	limed-digested		35.8-286.3 kg/ha
	Christiana fine sandy loam	limed-raw		33.5-134.2 kg/ha
	Christiana fine sandy loam	limed-compost		40.9-491.2 kg/ha
	Christiana fine sandy loam	heated sludge		74.5-297.9 kg/ha
	Christiana fine sandy loam	heated sludge		74.5-297.9 kg/ha
	Christiana fine sandy loam	Nu-Earth		207-414 kg/ha
	Christiana fine sandy loam	Nu-Earth		207-414 kg/ha
Sunflower	irrigated loamy fine sand	control		0
		Zn sulfate		5 kg/ha
	dry loamy fine sand	control		0
		Zn sulfate		5 kg/ha
	dry fine sandy loam	control		0
		Zn sulfate		5 kg/ha
	irrigated fine sand	control		0
		Zn sulfate		5 kg/ha
Barley	Dublin loam	Oakland sludge control		0
	Dublin loam	low sludge		176-352 kg/ha

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		40-54			
Corn		48-709			
		28-292	436		
		28-260			
		37-190	469		
		21-107			
Lettuce		75-159	259-578		
		87-241	417-1821		
		61-217			
Barley		30.5-97.6			
		43.7-92.7			
		41.5-89.3			
		37.1-116.0			
		76.2-461.6			
		113.0-820.1			
Oats		54.9-66.5			
		43.1-53.7			
		65.4-76.2			
Soybean		24-26			
		80-103			
		134-165			
		29-70			
		35-46			
		31-37			
		40-54			
		57-62			
		85-153			
		70-74			
		81-95			
Sunflower		42			
		54			
		39			
		48			
		22			
		24			
		56			
		67			
Barley		38			
		46-47			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			87
Corn			146
	yield	20% yield reduction	146
			146
	yield	12% yield reduction	146
			146
Lettuce	yield	32-81% yield reduction	146
	yield	54.7-95% yield reduction	146
			146
Barley			245
			245
			245
			245
			245
			245
Oats			7
			7
			7
Soybean			89
			89
			89
			89
			89
			89
			89
			89
			89
			89
			89
Sunflower			93
			93
			93
			93
			93
			93
			93
			93
Barley			246
			246

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
					4.4-4.5
					5.3
					6.4-6.5
					6.5-6.6
Oats	Avena sativa	Clintford	stover	field	5
					6.5
					6.7
					5.4
					6.7
Wheat	Triticum aestivum	Potomac	stover	field	5
					6.5
					6.7
					5.4
					6.7
Chard	Beta vulgaris	Fordhook Giant Swiss	whole	field	5
					6.5
					6.7
					5.4
					6.7
Snapbeans		Bush Blue Lake 47		field	6.6
					6.7
					6.7
Bush bean	Phaseolus vulgaris	Tender crops	beans	pots	5
					5.3
Cabbage	Brassica oleracea	Golden Acre	leaves	pots	5
					5.3
Carrots	Daucus carota	Scarlet Nantes	tubers	pots	5

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	Dublin loam	high sludge		528-704 kg/ha
	Dublin loam	Pacheco sludge control		0
	Dublin loam	low sludge		19.8-39.6 kg/ha
	Dublin loam	high sludge		59.4-9[illegible] kg/ha
Oats	Galestown Evesboro loamy sand	control	DTPA: 3.7	
	Galestown Evesboro loamy sand	control + lime	3.4	
	Galestown Evesboro loamy sand	limed-raw	4.2	
	Galestown Evesboro loamy sand	digested	10.2	
	Galestown Evesboro loamy sand	limed-digested	14.5	
Wheat	Galestown Evesboro loamy sand	control	DTPA: 3.7	
	Galestown Evesboro loamy sand	control + lime	3.4	
	Galestown Evesboro loamy sand	limed-raw	4.2	
	Galestown Evesboro loamy sand	digested	10.2	
	Galestown Evesboro loamy sand	limed-digested	14.5	
Chard	Galestown Evesboro loamy sand	control	DTPA: 3.7	
	Galestown Evesboro loamy sand	control + lime	3.4	
	Galestown Evesboro loamy sand	limed-raw	4.2	
	Galestown Evesboro loamy sand	digested	10.2	
	Galestown Evesboro loamy sand	limed-digested	14.5	
Snapbeans	Pope silt loam	control		0
		$ZnSO_4$		5.6-11.2 kg/ha
		$ZnCl_2$		11.2 kg/ha
		ZnO		11.2 kg/ha
		Zn chelate		11.2 kg/ha
	Chenango silt loam	control		0
		$ZnSO_4$		5.6-11.2 kg/ha
		$ZnCl_2$		11.2 kg/ha
		ZnO		11.2 kg/ha
		Zn chelate		11.2 kg/ha
	Leek Kill Channery silt loam	control		0
		$ZnSO_4$		5.6-11.2 kg/ha
		$ZnCl_2$		11.2 kg/ha
		ZnO		11.2 kg/ha
		Zn chelate		11.2 kg/ha
Bush bean	Arkport fine sand loam	peat	162	
	Arkport fine sand loam	sludge	357	
Cabbage	Arkport fine sand loam	peat	162	
	Arkport fine sand loam	sludge	357	
Carrots	Arkport fine sand loam	peat	162	

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		65-70			
		31			
		31-32			
		35-39			
Oats		35.3			
		20.5			
		5.3			
		171.2			
		71.4			
Wheat		42.8			
		42.2			
		5.3			
		76.4			
		69.7			
Chard		142			
		158			
		53			
		322			
		254			
Snapbeans		32			
		44.0-62.4			
		51.6			
		45.8			
		34.6			
		21.2			
		19.8-24.4			
		23			
		22.2			
		20.6			
		22			
		22.4-24.2			
		24.8			
		23.2			
		23.2			
Bush bean		44			
		79			
Cabbage		68-204			
		1086-1640			
Carrots		122			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			246
			246
			246
			246
Oats			214
			214
			214
			214
			214
Wheat			214
			214
			214
			214
			214
Chard			214
			214
			214
			214
			214
Snapbeans			20
			20
			20
			20
			20
			20
			20
			20
			20
			20
			20
			20
			20
			20
			20
Bush bean			68
			68
Cabbage			68
			68
Carrots			68

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Millet	Echinochloa crusigalli	Japanese	edible tissue	pots	5.3 5
Onions	Allium cepa	Downing Yellow Sweet Spanish	fruit	pots	5.3 5
Potatoes	Solanum tuberosum	Katahdin	tubers	pots	5.3 5
Tomatoes	Lycopersicon esculentum	Vendor	fruit	pots	5.3 5 5.3
Cocoa	Theobroma cacao	Amazon	seedlings	pot	6.4
		Amelonado	seedlings	pot	6.4
Bush beans	Phaseolus vulgaris	Contender	leaves	solution	5
Celery	Apium graveolens	Utah 52-70	leaves	field	6.88 5.68
Perennial ryegrass	Lolium perenne	Melle	leaves	pot	6.91 7
Wheat	Triticum aestivum	HDM 1553	stem	field	8
Lettuce	Lactuca sativa	Climax		solution	6.2
Cabbage	Brassica Parachinensis	flowering Chinese	leaves	pot	6.35 5.8-6.32 5.82-6.27 6.55-7.32 6.18-7.33

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	Arkport fine sand loam	sludge	357	
Millet	Arkport fine sand loam	peat	162	
	Arkport fine sand loam	sludge	357	
Onions	Arkport fine sand loam	peat	162	
	Arkport fine sand loam	sludge	357	
Potatoes	Arkport fine sand loam	peat	162	
	Arkport fine sand loam	sludge	357	
Tomatoes	Arkport fine sand loam	peat	162	
	Arkport fine sand loam	sludge	357	
Cocoa	sandy loam	control	0	
		ZnSO4	5.0-10.0	
		ZnSO4	20-50	
	sandy loam	control	0	
		ZnSO4	5.0-10.0	
		ZnSO4	20-50	
Bush beans	Hoaglands solution	control		2 uM/14 l
		low ZnSO4		6.6 uM/14 l
		medium ZnSO4		9.6 uM/14 l
		high ZnSO4		13.5 uM/14 l
Celery	muck soil	control	190	
	muck soil	high metal soil	287	
	muck soil	limed high metal soil	265	
Perennial ryegrass	Sutton sandy loam	control	148	
		low sludge	309-446	342 kg/ha
		medium sludge	707-1307	
		high sludge	1979	
Wheat	clay	control	22.2	0
		50% sludge	34.6	
		66% sludge	80	
		100% sludge	85.2	
		10 ton/ha sludge	47	5.62 kg/ha
		20 ton/ha sludge	81.8	11.24 kg/ha
Lettuce	Hoagland solution			
Cabbage	redyellow podzol soil	control	68	
	redyellow podzol soil	activated sludge	51.0-82.0	
	redyellow podzol soil	digested sludge	81.0-204.5	
	redyellow podzol soil	chicken manure	8.33-55.5	
	redyellow podzol soil	pig manure	55.75-70.25	

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		56			
Millet		290			
		491			
Onions		288			
		174			
Potatoes		34			
		35			
Tomatoes		18.1			
		17.4			
Cocoa	30			visual	sickle shapes leaves
	20-24			visual	sickle shapes leaves
		46-54			
	20			visual	sickle shapes leaves
	16-18			visual	sickle shapes leaves
		36-76			
Bush beans		70			
		115			
			150		
			160		
Celery		77			
		92			
		86			
Perennial ryegrass		89			
		140	143-186		
			247-390		
			425		
Wheat		76.38			
		84.86			
		94.86			
		117.61			
		91.1			
		104.54			
Lettuce		<63 ueg/l	>63 ueg/l		
		450-500	500-525		
Cabbage					
		300	480-1470		
		250-400	500		
		125-300			
		100-125			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			68
Millet			68
			68
Onions			68
			68
Potatoes			68
			68
Tomatoes			68
			68
Cocoa			39
			39
			39
			39
			39
			39
Bush beans			205
			205
	yield	21% growth reduction in leaves	205
	yield	21% growth reduction in leaves	205
Celery			16
			16
			16
Perennial ryegrass			50
	yield	0-10% reduction	50
	yield	10-40% reduction	50
	yield	40-60% reduction	50
Wheat			29
			29
			29
			29
			29
			29
Lettuce	yield	60% reduced root length	10
	yield	10% yield reduction	9
Cabbage			36
	visual	small,short,young budding stage	36
	visual	opaque graniuate deposits	36
			36
			36

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
Wheat	Triticum aestivum	WH-147	whole	pots	7.9
Corn	Zea mays		shoot	greenhouse	
Barley	Hordeum vulgare	UC 566	tops	greenhouse	7.9
					5
Brittlebush	Encelia farinosa		leaves	greenhouse	7.9
					5
Wheat	Triticum aestivum		tops	pots	5.0-5.5
					6.1-8.3
					7.5-8.0
Corn	Zea mays	Early American	shoots	pot	

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
Wheat	loamy sand soil	control		0-.01 kg/ha
		farm yard manure		.25-1.2 kg/ha
		dhaincha		.1-.6 kg/ha
		wheat straw		.04-.36 kg/ha
Corn	Chalmers Indiana	control		0
		sludge		340 kg/ha
	Celina Michigan	control		0
		sludge		340 kg/ha
	Celina Ohio	control		0
		sludge		340 kg/ha
	Plano Wisconsin	control		0
		sludge		340 kg/ha
Barley	Arizo sandy loam	control		
		fly ash 2-8%		
	Redding loam	control		
		fly ash 2-8%		
Brittlebush	Arizo sandy loam	control		
		fly ash 2-8%		
	Redding loam	control		
		fly ash 2-8%		
Wheat	Orentano histosol	control	208.8	
		fly ash 2%	181	
		fly ash 5%	183	
	Lamporecchio fluvisol	control	169.1	
		fly ash 2%	143	
		fly ash 5%	143.1	
	Guardia regosol	control	64.6	
		fly ash 2%	88.8	
		fly ash 5%	110	
Corn	Low carbonate clay loam	control		0
		low ZnSO4		2.5 mg/kg
		medium ZnSO4		5 mg/kg
		high ZnSO4		10 mg/kg
	medium carbonate sandly loam	control		0
		low ZnSO4		2.5 mg/kg
		medium ZnSO4		5 mg/kg
		high ZnSO4		10 mg/kg
	high carbonate clay loam	control		0
		low ZnSO4		2.5 mg/kg

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
Wheat		14.30-61.97			
		18.11-70.07			
		17.64-72.93			
		13.82-51.92			
Corn		1.33 umol/g			
		6.10 umol/g			
		1.24 umol/g			
		2.91 umol/g			
		1.44 umol/g			
		2.15 umol/g			
		2.38 umol/g			
		5.46 umol/g			
Barley		280-325			
		50-110			
		125-140			
		80-85			
Brittlebush		290-320			
		100-150			
		200-270			
		120-170			
Wheat		51.9			
		51.2			
		47.8			
		34.4			
		33.2			
		32.9			
		36.3			
		35.4			
		33.4			
Corn		183			
		224			
		333			
		460			
		118			
		171			
		238			
		293			
		53			
		84			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
Wheat			195
			195
			195
			195
Corn			171
			171
			171
			171
			171
			171
			171
			171
Barley			63
			63
			63
			63
Brittlebush			63
			63
			63
			63
Wheat			186
			186
			186
			186
			186
			186
			186
			186
			186
Corn			178
			178
			178
			178
			178
			178
			178
			178
			178
			178

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
		Mol 17 x H98	leaves	field	7.4
		Oh545 x B73	leaves	field	7.4
		Pioneer 3369A	whole	pot	6.6-6.7
					6.2-6.6
					5.8-6.4
					6.2-6.4
					6.1-6.3
					6.5-6.6
					6.2-6.3
					6.2-6.4
					6.3-6.5
					6.3-6.4
					6.4-6.5
					5.7-6.2
					6.4
					6.3
					6.1-6.5
					6.2-6.4
					6.2-6.3
					6.0-6.6
Highbush blueberry	Vaccinium corymbosium	Blueray	whole	pot	3.8-4.0
					4.6-5.0
					5.4-6.4
					3.8-4.0
					4.6-5.0
					5.4-6.4
					3.8-4.0
					4.6-5.0
					5.4-6.4
Corn	Zea mays	FRM017 x H98	shoots	greenhouse	5.5-7.1
					7.0-7.4

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
		medium ZnSO4		5 mg/kg
		high ZnSO4		10 mg/kg
	Blount silt loam	control	73-79	0
		1/4 sludge	200-268	634-723 kg/ha
		1/2 sludge	321-390	1269-1446 kg/ha
		max sludge	537-606	2537-2891 kg/ha
	Blount silt loam	control	73-79	0
		1/4 sludge	200-268	634-723 kg/ha
		1/2 sludge	321-390	1269-1446 kg/ha
		max sludge	537-606	2537-2891 kg/ha
	Rutledge	control		0
	Rutledge	ZnSO4		~ 457-470 kg/ha
	Rutledge	sludge		457-470 kg/ha
	Evesboro	control		0
	Evesboro	ZnSO4		~ 457-470 kg/ha
	Evesboro	sludge		457-470 kg/ha
	Downer	control		0
	Downer	ZnSO4		~ 457-470 kg/ha
	Downer	sludge		457-470 kg/ha
	Collington	control		0
	Collington	ZnSO4		~ 457-470 kg/ha
	Collington	sludge		457-470 kg/ha
	Manor	control		0
	Manor	ZnSO4		~ 457-470 kg/ha
	Manor	sludge		457-470 kg/ha
	Myersville	control		0
	Myersville	ZnSO4		~ 457-470 kg/ha
	Myersville	sludge		457-470 kg/ha
Highbush blueberry	Tempelton silt loam	control		
	Tempelton silt loam	control		
	Tempelton silt loam	control		
	Tempelton silt loam	ZnSO4		4 g/m3
	Tempelton silt loam	ZnSO4		4 g/m3
	Tempelton silt loam	ZnSO4		4 g/m3
	Tempelton silt loam	ZnSO4		8 g/m3
	Tempelton silt loam	ZnSO4		8 g/m3
	Tempelton silt loam	ZnSO4		8 g/m3
Corn	various	control	36-120	
	various	control + lime		

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		98			
		123			
		15.9-19.3			
		51.6-56.5			
		77.6-89.3			
		138-173			
		13.7-14.8			
		39.9-49.2			
		61.3-76.0			
		118-139			
		17-23			
		81	166		
		71-122			
		18-19			
		152			
		46-60	350		
		17-19			
		123-145			
		65-72			
		14-17			
		131-175			
		80-107			
		15-18			
		113-144			
		70-85			
		15-17			
		86-100			
		76-95			
Highbush blueberry		32-36			
		42-47			
		26-39			
		45-47			
		50-55			
		30-47			
		57-59			
		56-62			
		34-51			
Corn		22-108			
		28-74			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
			178
			178
			98
			98
			98
			98
			98
			98
			98
			98
			129
	yield	40% reduction	129
			129
			129
			129
	yield	53% reduction	129
			129
			129
			129
			129
			129
			129
			129
			129
			129
			129
			129
			129
Highbush blueberry			86
			86
			86
			86
			86
			86
			86
			86
			86
Corn			151
			151

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Scientific Name	Variety	Parts	Cultivation	PH
					3.6-7.5
					5.8-7.3
Swiss chard	Beta vulgaris	Fordhook Giant		greenhouse	5.5-7.1
					7.0-7.4
					3.6-7.5
					5.8-7.3
Ryegrass		S24		pots	4.7-5.8
					6.0-7.8
					4.9-5.7
					5.9-7.3
					4.7-5.8
					6.1-7.2
					4.6-5.6
					6.0-7.4
					5.3-6.0
					6.2-7.3
					4.9-5.2
					6.0-7.4
					4.9-5.5
					5.8-7.2
					5.5-5.6
					6.2-7.0
					4.9-5.5
					5.9-7.3
					5.3-5.7
					6.3-7.2

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	Soil Type	Treatment	Concentration in soil	Loading rate
	various	sludge	90-500	
	various	sludge + lime		
Swiss chard	various	control	36-120	
	various	control + lime		
	various	sludge	90-500	
	various	sludge + lime		
Ryegrass	silty clay loam	no sludge	57	
	silty clay loam	no sludge	57	
	silty clay loam	low metal sludge	86	
	silty clay loam	low metal sludge	86	
	silty clay loam	Zn sludge	470	
	silty clay loam	Zn sludge	470	
	silty clay loam	Cu sludge	70	
	silty clay loam	Cu sludge	70	
	silty clay loam	Ni sludge	86	
	silty clay loam	Ni sludge	86	
	sandy loam	no sludge	42	
	sandy loam	no sludge	42	
	sandy loam	low metal sludge	64	
	sandy loam	low metal sludge	64	
	sandy loam	Zn sludge	360	
	sandy loam	Zn sludge	360	
	sandy loam	Cu sludge	57	
	sandy loam	Cu sludge	57	
	sandy loam	Ni sludge	80	
	sandy loam	Ni sludge	80	

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	plant tissue concentration			phytotoxicity deficiency	
	deficiency	normal	toxic	type	symptoms
		68-726			
		68-232			
Swiss chard		53-159			
		32-46			
		78-1810			
		51-142			
Ryegrass		47-49			
		31-43			
		152-204			
		57-111			
		1190	2840		
		389-945			
		156-170			
		63-120			
		124-150			
		60-91			
		30-34			
		25-42			
		120-143			
		61-137			
		1240-1525			
		443-1140			
		188-210			
		63-142			
		110-183			
		51-92			

TABLE E-4. ZINC PHYTOTOXICITY DATA (con't)

Plant Name	phytotoxicity		reference
	type	symptoms	
		none mentioned	151
			151
Swiss chard			151
		none mentioned	151
			151
			151
Ryegrass			210
			210
			210
			210
	yield	50-100% yield reduction	210
			210
			210
			210
			210
			210
			210
			210
			210
			210
			210
			210
			210
			210
			210
			210

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APPENDIX F

Phytotoxicity Data from Field Experiments with Sludge

TABLE OF CONTENTS

TABLE F-1. CHROMIUM DATA

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
1	HINESLY 1985	CORN					3.4	263
2	HINESLY 1985	CORN					3.4	263
3	HINESLY 1985	CORN					3.4	263
4	HINESLY 1985	CORN					3.4	263
5	HINESLY 1985	CORN					3.4	263
6	HINESLY 1985	CORN					3.4	263
7	HINESLY 1985	CORN					3.4	263
8	HINESLY 1985	CORN					3.4	263
9	HINESLY 1985	CORN					3.4	263
10	HINESLY 1985	CORN					3.4	263
11	HINESLY 1985	CORN					3.4	263
12	HINESLY 1985	CORN					3.4	263
13	HINESLY 1985	CORN					3.4	263
14	HINESLY 1985	CORN					3.4	263
15	HINESLY 1985	CORN					3.4	263
16	HINESLY 1985	CORN					3.4	263
17	HINESLY 1985	CORN					3.4	263
18	HINESLY 1985	CORN					3.4	263
19	HINESLY 1985	CORN					3.4	263
20	HINESLY 1985	CORN					3.4	263
21	HINESLY 1985	CORN					3.4	263
22	HINESLY 1985	CORN					3.4	263
23	HINESLY 1985	CORN					3.4	263
24	HINESLY 1985	CORN					3.4	263
25	HINESLY 1985	CORN					3.4	263
26	HINESLY 1985	CORN					3.4	263
27	HINESLY 1985	CORN					3.4	263
28	HINESLY 1985	CORN					3.4	263
29	HINESLY 1985	CORN					3.4	263
30	HINESLY 1985	CORN					3.4	263
31	HINESLY 1985	CORN					3.4	263
32	HINESLY 1985	CORN					3.4	263
33	HINESLY 1985	CORN					3.4	263
34	HINESLY 1985	CORN					3.4	263
35	HINESLY 1985	CORN					3.4	263
36	HINESLY 1985	CORN					3.4	263
37	HINESLY 1985	CORN					3.4	263
38	HINESLY 1985	CORN					3.4	263

TABLE F-1 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
1	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
2	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
3	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
4	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
5	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
6	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
7	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
8	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
9	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
10	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
11	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
12	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
13	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
14	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
15	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
16	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
17	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
18	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
19	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
20	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
21	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
22	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
23	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
24	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
25	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
26	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
27	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
28	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
29	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
30	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
31	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
32	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
33	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
34	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
35	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
36	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
37	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
38	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-1 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %
1	CENT POLY, FECL3	0	0	NA		BLOUNT	SIL	
2	CENT POLY, FECL3	0	0	NA		BLOUNT	SIL	
3	CENT POLY, FECL3	0	0	NA		BLOUNT	SIL	
4	CENT POLY, FECL3	0	0	NA		BLOUNT	SIL	
5	CENT POLY, FECL3	0	0	NA		BLOUNT	SIL	
6	CENT POLY, FECL3	0	0	NA		BLOUNT	SIL	
7	CENT POLY, FECL3	0	0	NA		BLOUNT	SIL	
8	CENT POLY, FECL3	0	0	NA		BLOUNT	SIL	
9	CENT POLY, FECL3	0	0	NA		BLOUNT	SIL	
10	CENT POLY, FECL3	0	0	NA		BLOUNT	SIL	
11	CENT POLY, FECL3	14.5	31.8	0		BLOUNT	SIL	
12	CENT POLY, FECL3	11.1	42.9	0		BLOUNT	SIL	
13	CENT POLY, FECL3	15.3	58.2	0		BLOUNT	SIL	
14	CENT POLY, FECL3	0	58.2	1		BLOUNT	SIL	
15	CENT POLY, FECL3	0	58.2	2		BLOUNT	SIL	
16	CENT POLY, FECL3	0	58.2	3		BLOUNT	SIL	
17	CENT POLY, FECL3	0	58.2	4		BLOUNT	SIL	
18	CENT POLY, FECL3	0	58.2	5		BLOUNT	SIL	
19	CENT POLY, FECL3	0	58.2	6		BLOUNT	SIL	
20	CENT POLY, FECL3	0	58.2	7		BLOUNT	SIL	
21	CENT POLY, FECL3	29	63.6	0		BLOUNT	SIL	
22	CENT POLY, FECL3	22.2	85.8	0		BLOUNT	SIL	
23	CENT POLY, FECL3	30.6	116.4	0		BLOUNT	SIL	
24	CENT POLY, FECL3	0	116.4	1		BLOUNT	SIL	
25	CENT POLY, FECL3	0	116.4	2		BLOUNT	SIL	
26	CENT POLY, FECL3	0	116.4	3		BLOUNT	SIL	
27	CENT POLY, FECL3	0	116.4	4		BLOUNT	SIL	
28	CENT POLY, FECL3	0	116.4	5		BLOUNT	SIL	
29	CENT POLY, FECL3	0	116.4	6		BLOUNT	SIL	
30	CENT POLY, FECL3	0	116.4	7		BLOUNT	SIL	
31	CENT POLY, FECL3	57.8	127	0		BLOUNT	SIL	
32	CENT POLY, FECL3	44.4	171.4	0		BLOUNT	SIL	
33	CENT POLY, FECL3	61.1	232.5	0		BLOUNT	SIL	
34	CENT POLY, FECL3	0	232.5	1		BLOUNT	SIL	
35	CENT POLY, FECL3	0	232.5	1		BLOUNT	SIL	
36	CENT POLY, FECL3	0	232.5	1		BLOUNT	SIL	
37	CENT POLY, FECL3	0	232.5	1		BLOUNT	SIL	
38	CENT POLY, FECL3	0	232.5	1		BLOUNT	SIL	

TABLE F-1 (cont.)

	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM CR LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CR CONCENTRTN mg/kg	PLANT CR CONCENTRTN mg/kg	PLANT TISSUE SAMPLED
1				0.85	7.8	0	HCL-HF	39	1	LEAF
2				0.9	6.9	0	HCL-HF	36	1.3	LEAF
3				0.94	7.6	0	HCL-HF	50	0.9	LEAF
4				0.93	7.6	0	HCL-HF	35	<.6	LEAF
5				0.92	7.8	0	HCL-HF	54	0.7	LEAF
6				0.87	7.5	0	HCL-HF	48	<.6	LEAF
7				0.9	7.6	0	HCL-HF	45	1.3	LEAF
8				0.88	7.5	0	HCL-HF	54	<.6	LEAF
9				0.73	7.6	0	HCL-HF	49	<.6	LEAF
10				1	7.4	0	HCL-HF	40	<.1	LEAF
11				1.06	7.7	133	HCL-HF	74	0.8	LEAF
12				1.11	6.9	146	HCL-HF	57	1.5	LEAF
13				1.18	7.5	168	HCL-HF	73	1.2	LEAF
14				1.4	7.5	168	HCL-HF	75	<.6	LEAF
15				1.16	7.6	168	HCL-HF	82	1.6	LEAF
16				1.08	7.5	168	HCL-HF	82	<.6	LEAF
17				1.18	7.7	168	HCL-HF	75	0.8	LEAF
18				1.23	7.6	168	HCL-HF	95	<.6	LEAF
19				1.09	7.5	168	HCL-HF	89	<.6	LEAF
20				1.32	7.3	168	HCL-HF	63	0.2	LEAF
21				1.38	7.6	265	HCL-HF	109	1	LEAF
22				1.12	7	292	HCL-HF	74	1.4	LEAF
23				1.29	7.4	335	HCL-HF	116	1.6	LEAF
24				1.83	7.3	335	HCL-HF	97	0.7	LEAF
25				1.36	7.5	335	HCL-HF	114	0.6	LEAF
26				1.34	7.2	335	HCL-HF	99	0.7	LEAF
27				1.6	7.4	335	HCL-HF	107	0.9	LEAF
28				1.31	7.3	335	HCL-HF	145	<.6	LEAF
29				1.54	7.1	335	HCL-HF	104	<.6	LEAF
30				1.62	7.1	335	HCL-HF	87	<.1	LEAF
31				1.62	7.6	529	HCL-HF	180	1	LEAF
32				1.63	6.8	583	HCL-HF	135	1.1	LEAF
33				1.94	7.3	670	HCL-HF	176	1	LEAF
34				2.5	7.2	670	HCL-HF	199	0.6	LEAF
35				1.83	7.3	670	HCL-HF	175	1.2	LEAF
36				1.88	7.2	670	HCL-HF	175	<.6	LEAF
37				2.03	7.3	670	HCL-HF	180	1.1	LEAF
38				1.6	7.1	670	HCL-HF	207	<.6	LEAF

TABLE F-1 (cont.)

	EXPERIMENTAL PROTOCOL SUMMARY	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
1	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
2	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
3	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
4	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
5	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
6	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
7	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
8	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
9	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
10	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
11	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
12	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
13	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
14	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
15	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
16	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
17	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
18	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
19	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
20	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
21	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
22	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
23	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
24	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
25	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
26	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
27	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
28	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
29	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
30	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
31	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
32	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
33	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
34	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
35	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
36	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
37	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
38	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO

TABLE F-1 (cont.)

	COMMENTS	LOCATION OF STUDY
1		JOLIET, ILLINOIS
2		JOLIET, ILLINOIS
3		JOLIET, ILLINOIS
4		JOLIET, ILLINOIS
5		JOLIET, ILLINOIS
6		JOLIET, ILLINOIS
7		JOLIET, ILLINOIS
8		JOLIET, ILLINOIS
9		JOLIET, ILLINOIS
10		JOLIET, ILLINOIS
11		JOLIET, ILLINOIS
12		JOLIET, ILLINOIS
13		JOLIET, ILLINOIS
14		JOLIET, ILLINOIS
15		JOLIET, ILLINOIS
16		JOLIET, ILLINOIS
17		JOLIET, ILLINOIS
18		JOLIET, ILLINOIS
19		JOLIET, ILLINOIS
20		JOLIET, ILLINOIS
21		JOLIET, ILLINOIS
22		JOLIET, ILLINOIS
23		JOLIET, ILLINOIS
24		JOLIET, ILLINOIS
25		JOLIET, ILLINOIS
26		JOLIET, ILLINOIS
27		JOLIET, ILLINOIS
28		JOLIET, ILLINOIS
29		JOLIET, ILLINOIS
30		JOLIET, ILLINOIS
31		JOLIET, ILLINOIS
32		JOLIET, ILLINOIS
33		JOLIET, ILLINOIS
34		JOLIET, ILLINOIS
35		JOLIET, ILLINOIS
36		JOLIET, ILLINOIS
37		JOLIET, ILLINOIS
38		JOLIET, ILLINOIS

TABLE F-1 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
39	HINESLY 1985	CORN					3.4	263
40	HINESLY 1985	CORN					3.4	263
41	HINESLY 1985	CORN					3.4	263
42	HINESLY 1985	CORN					3.4	263
43	HINESLY 1985	CORN					3.4	263
44	HINESLY 1985	CORN					3.4	263
45	HINESLY 1985	CORN					3.4	263
46	HINESLY 1985	CORN					3.4	263
47	HINESLY 1985	CORN					3.4	263
48	HINESLY 1985	CORN					3.4	263
49	HINESLY 1985	CORN					3.4	263
50	HINESLY 1985	CORN					3.4	263
51	HINESLY 1985	CORN					3.4	263
52	HINESLY 1985	CORN					3.4	263
53	HINESLY 1985	CORN					3.4	263
54	HINESLY 1985	CORN					3.4	263
55	HINESLY 1985	CORN					3.4	263
56	HINESLY 1985	CORN					3.4	263
57	HINESLY 1985	CORN					3.4	263
58	HINESLY 1985	CORN					3.4	263
59	HINESLY 1985	CORN					3.4	263
60	HINESLY 1985	CORN					3.4	263
61	HINESLY 1985	CORN					3.4	263
62	HINESLY 1985	CORN					3.4	263
63	HINESLY 1985	CORN					3.4	263
64	HINESLY 1985	CORN					3.4	263
65	HINESLY 1985	CORN					3.4	263
66	HINESLY 1985	CORN					3.4	263
67	HINESLY 1985	CORN					3.4	263
68	HINESLY 1985	CORN					3.4	263
69	HINESLY 1985	CORN					3.4	263
70	HINESLY 1985	CORN					3.4	263
71	HINESLY 1985	CORN					3.4	263
72	HINESLY 1985	CORN					3.4	263
73	HINESLY 1985	CORN					3.4	263
74	HINESLY 1985	CORN					3.4	263
75	HINESLY 1985	CORN					3.4	263
76	HINESLY 1985	CORN					3.4	263

TABLE F-1 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
39	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
40	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
41	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
42	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
43	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
44	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
45	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
46	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
47	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
48	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
49	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
50	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
51	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
52	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
53	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
54	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
55	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
56	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
57	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
58	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
59	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
60	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
61	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
62	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
63	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
64	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
65	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
66	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
67	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
68	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
69	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
70	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
71	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
72	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
73	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
74	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
75	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
76	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-1 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %
39	CENT POLY, FECL3	0	232.5	1		BLOUNT	SiL	
40	CENT POLY, FECL3	0	232.5	1		BLOUNT	SiL	
41	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
42	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
43	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
44	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
45	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
46	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
47	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
48	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
49	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
50	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
51	CENT POLY, FECL3	14.5	31.8	0		ELLIOT	SiL	
52	CENT POLY, FECL3	11.1	42.9	0		ELLIOT	SiL	
53	CENT POLY, FECL3	15.3	58.2	0		ELLIOT	SiL	
54	CENT POLY, FECL3	0	58.2	1		ELLIOT	SiL	
55	CENT POLY, FECL3	0	58.2	2		ELLIOT	SiL	
56	CENT POLY, FECL3	0	58.2	3		ELLIOT	SiL	
57	CENT POLY, FECL3	0	58.2	4		ELLIOT	SiL	
58	CENT POLY, FECL3	0	58.2	5		ELLIOT	SiL	
59	CENT POLY, FECL3	0	58.2	6		ELLIOT	SiL	
60	CENT POLY, FECL3	0	58.2	7		ELLIOT	SiL	
61	CENT POLY, FECL3	29	63.6	0		ELLIOT	SiL	
62	CENT POLY, FECL3	22.2	85.8	0		ELLIOT	SiL	
63	CENT POLY, FECL3	30.6	116.4	0		ELLIOT	SiL	
64	CENT POLY, FECL3	0	116.4	1		ELLIOT	SiL	
65	CENT POLY, FECL3	0	116.4	2		ELLIOT	SiL	
66	CENT POLY, FECL3	0	116.4	3		ELLIOT	SiL	
67	CENT POLY, FECL3	0	116.4	4		ELLIOT	SiL	
68	CENT POLY, FECL3	0	116.4	5		ELLIOT	SiL	
69	CENT POLY, FECL3	0	116.4	6		ELLIOT	SiL	
70	CENT POLY, FECL3	0	116.4	7		ELLIOT	SiL	
71	CENT POLY, FECL3	57.8	127	0		ELLIOT	SiL	
72	CENT POLY, FECL3	44.4	171.4	0		ELLIOT	SiL	
73	CENT POLY, FECL3	61.1	232.5	0		ELLIOT	SiL	
74	CENT POLY, FECL3	69.8	302.3	0		ELLIOT	SiL	
75	CENT POLY, FECL3	54	356.3	0		ELLIOT	SiL	
76	CENT POLY, FECL3	72	428.3	0		ELLIOT	SiL	

TABLE F-1 (cont.)

	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM CR LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CR CONCENTRTN mg/kg	PLANT CR CONCENTRTN mg/kg	PLANT TISSUE SAMPLED
39				1.54	7.1	670	HCL-HF	126	<.6	LEAF
40				1.84	7	670	HCL-HF	121	0.2	LEAF
41				1.64	7.6	0	HCL-HF	31	1	LEAF
42				1.61	6.8	0	HCL-HF	37	2.2	LEAF
43				1.54	7.2	0	HCL-HF	40	1.1	LEAF
44				1.53	7.2	0	HCL-HF	34	<.6	LEAF
45				1.54	7	0	HCL-HF	42	2.1	LEAF
46				1.51	7	0	HCL-HF	41	<.6	LEAF
47				1.58	7.4	0	HCL-HF	38	2.7	LEAF
48				1.54	7.2	0	HCL-HF	50	<.6	LEAF
49				1.51	7	0	HCL-HF	60	<.6	LEAF
50				1.62	7	0	HCL-HF	37	<.1	LEAF
51				1.64	7.3	133	HCL-HF	64	1	LEAF
52				1.84	6.8	146	HCL-HF	73	1.5	LEAF
53				1.74	7.1	168	HCL-HF	65	0.9	LEAF
54				2.18	7.1	223	HCL-HF	73	<.6	LEAF
55				1.86	7.2	266	HCL-HF	74	0.6	LEAF
56				1.67	7.2	321	HCL-HF	74	<.6	LEAF
57				1.83	7.5	321	HCL-HF	88	<.6	LEAF
58				1.55	7.2	321	HCL-HF	90	<.6	LEAF
59				1.68	7	321	HCL-HF	81	0.7	LEAF
60				1.89	7.1	321	HCL-HF	71	<.1	LEAF
61				1.97	7.8	265	HCL-HF	121	1.2	LEAF
62				1.81	7	292	HCL-HF	96	1.3	LEAF
63				1.88	7.3	335	HCL-HF	106	1.4	LEAF
64				2.21	7.3	440	HCL-HF	99	<.6	LEAF
65				1.99	7.4	525	HCL-HF	116	2.9	LEAF
66				1.89	7.3	635	HCL-HF	112	<.6	LEAF
67				1.94	7.4	635	HCL-HF	102	2.1	LEAF
68				1.72	7.4	635	HCL-HF	155	<.6	LEAF
69				1.79	7.2	635	HCL-HF	110	<.6	LEAF
70				1.87	7.2	635	HCL-HF	91	<.1	LEAF
71				2.23	7.5	529	HCL-HF	216	1.2	LEAF
72				2.22	6.4	583	HCL-HF	145	1.2	LEAF
73				2.28	6.5	670	HCL-HF	174	1	LEAF
74				2.61	6.5	880	HCL-HF	188	<.6	LEAF
75				2.74	6.5	1050	HCL-HF	242	1	LEAF
76				2.94	5.9	1269	HCL-HF	248	<.6	LEAF

TABLE F-1 (cont.)

	EXPERIMENTAL PROTOCOL SUMMARY	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
39	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
40	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
41	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
42	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
43	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
44	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
45	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
46	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
47	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
48	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
49	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
50	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
51	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
52	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
53	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
54	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
55	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
56	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
57	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
58	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
59	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
60	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
61	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
62	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
63	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
64	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
65	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
66	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
67	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
68	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
69	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
70	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
71	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
72	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
73	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
74	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
75	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
76	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO

TABLE F-1 (cont.)

	COMMENTS	LOCATION OF STUDY
39		JOLIET, ILLINOIS
40		JOLIET, ILLINOIS
41		JOLIET, ILLINOIS
42		JOLIET, ILLINOIS
43		JOLIET, ILLINOIS
44		JOLIET, ILLINOIS
45		JOLIET, ILLINOIS
46		JOLIET, ILLINOIS
47		JOLIET, ILLINOIS
48		JOLIET, ILLINOIS
49		JOLIET, ILLINOIS
50		JOLIET, ILLINOIS
51		JOLIET, ILLINOIS
52		JOLIET, ILLINOIS
53		JOLIET, ILLINOIS
54		JOLIET, ILLINOIS
55		JOLIET, ILLINOIS
56		JOLIET, ILLINOIS
57		JOLIET, ILLINOIS
58		JOLIET, ILLINOIS
59		JOLIET, ILLINOIS
60		JOLIET, ILLINOIS
61		JOLIET, ILLINOIS
62		JOLIET, ILLINOIS
63		JOLIET, ILLINOIS
64		JOLIET, ILLINOIS
65		JOLIET, ILLINOIS
66		JOLIET, ILLINOIS
67		JOLIET, ILLINOIS
68		JOLIET, ILLINOIS
69		JOLIET, ILLINOIS
70		JOLIET, ILLINOIS
71		JOLIET, ILLINOIS
72		JOLIET, ILLINOIS
73		JOLIET, ILLINOIS
74		JOLIET, ILLINOIS
75		JOLIET, ILLINOIS
76		JOLIET, ILLINOIS

TABLE F-1 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
77	HINESLY 1985	CORN					3.4	263
78	HINESLY 1985	CORN					3.4	263
79	HINESLY 1985	CORN					3.4	263
80	HINESLY 1985	CORN					3.4	263
81	HINESLY 1985	CORN					3.4	263
82	HINESLY 1985	CORN					3.4	263
83	HINESLY 1985	CORN					3.4	263
84	HINESLY 1985	CORN					3.4	263
85	HINESLY 1985	CORN					3.4	263
86	HINESLY 1985	CORN					3.4	263
87	HINESLY 1985	CORN					3.4	263
88	HINESLY 1985	CORN					3.4	263
89	HINESLY 1985	CORN					3.4	263
90	HINESLY 1985	CORN					3.4	263
91	HINESLY 1985	CORN					3.4	263
92	HINESLY 1985	CORN					3.4	263
93	HINESLY 1985	CORN					3.4	263
94	HINESLY 1985	CORN					3.4	263
95	HINESLY 1985	CORN					3.4	263
96	HINESLY 1985	CORN					3.4	263
97	HINESLY 1985	CORN					3.4	263
98	HINESLY 1985	CORN					3.4	263
99	HINESLY 1985	CORN					3.4	263
100	HINESLY 1985	CORN					3.4	263
101	HINESLY 1985	CORN					3.4	263
102	HINESLY 1985	CORN					3.4	263
103	HINESLY 1985	CORN					3.4	263
104	HINESLY 1985	CORN					3.4	263
105	HINESLY 1985	CORN					3.4	263
106	HINESLY 1985	CORN					3.4	263
107	HINESLY 1985	CORN					3.4	263
108	HINESLY 1985	CORN					3.4	263
109	HINESLY 1985	CORN					3.4	263
110	HINESLY 1985	CORN					3.4	263
111	HINESLY 1985	CORN					3.4	263
112	HINESLY 1985	CORN					3.4	263
113	HINESLY 1985	CORN					3.4	263
114	HINESLY 1985	CORN					3.4	263

TABLE F-1 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
77	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
78	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
79	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
80	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
81	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
82	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
83	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
84	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
85	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
86	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
87	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
88	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
89	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
90	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
91	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
92	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
93	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
94	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
95	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
96	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
97	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
98	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
99	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
100	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
101	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
102	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
103	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
104	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
105	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
106	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
107	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
108	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
109	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
110	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
111	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
112	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
113	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
114	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-1 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %
77	CENT POLY, FECL3	0	428.3	1		ELLIOT	SIL	
78	CENT POLY, FECL3	0	428.3	2		ELLIOT	SIL	
79	CENT POLY, FECL3	0	428.3	3		ELLIOT	SIL	
80	CENT POLY, FECL3	0	428.3	4		ELLIOT	SIL	
81	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
82	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
83	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
84	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
85	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
86	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
87	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
88	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
89	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
90	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
91	CENT POLY, FECL3	14.5	31.8	0		PLAINFIELD	SL	
92	CENT POLY, FECL3	11.1	42.9	0		PLAINFIELD	SL	
93	CENT POLY, FECL3	15.3	58.2	0		PLAINFIELD	SL	
94	CENT POLY, FECL3	0	58.2	1		PLAINFIELD	SL	
95	CENT POLY, FECL3	0	58.2	2		PLAINFIELD	SL	
96	CENT POLY, FECL3	0	58.2	3		PLAINFIELD	SL	
97	CENT POLY, FECL3	0	58.2	4		PLAINFIELD	SL	
98	CENT POLY, FECL3	0	58.2	5		PLAINFIELD	SL	
99	CENT POLY, FECL3	0	58.2	6		PLAINFIELD	SL	
100	CENT POLY, FECL3	0	58.2	7		PLAINFIELD	SL	
101	CENT POLY, FECL3	29	63.6	0		PLAINFIELD	SL	
102	CENT POLY, FECL3	22.2	85.8	0		PLAINFIELD	SL	
103	CENT POLY, FECL3	30.6	116.4	0		PLAINFIELD	SL	
104	CENT POLY, FECL3	0	116.4	1		PLAINFIELD	SL	
105	CENT POLY, FECL3	0	116.4	2		PLAINFIELD	SL	
106	CENT POLY, FECL3	0	116.4	3		PLAINFIELD	SL	
107	CENT POLY, FECL3	0	116.4	4		PLAINFIELD	SL	
108	CENT POLY, FECL3	0	116.4	5		PLAINFIELD	SL	
109	CENT POLY, FECL3	0	116.4	6		PLAINFIELD	SL	
110	CENT POLY, FECL3	0	116.4	7		PLAINFIELD	SL	
111	CENT POLY, FECL3	57.8	127	0		PLAINFIELD	SL	
112	CENT POLY, FECL3	44.4	171.4	0		PLAINFIELD	SL	
113	CENT POLY, FECL3	61.1	232.5	0		PLAINFIELD	SL	
114	CENT POLY, FECL3	69.8	302.3	0		PLAINFIELD	SL	

TABLE F-1 (cont.)

	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM CR LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CR CONCENTRTN mg/kg	PLANT CR CONCENTRTN mg/kg	PLANT TISSUE SAMPLED
77				3.92	5.9	1269	HCL-HF	294	0.6	LEAF
78				3.77	5.8	1269	HCL-HF	432	<.6	LEAF
79				2.6	6.1	1269	HCL-HF	193	0.6	LEAF
80				3.2	6.1	1269	HCL-HF	220	0.2	LEAF
81				0.39	7.8	0	HCL-HF	22	1.1	LEAF
82				0.17	7.1	0	HCL-HF	16	1.4	LEAF
83				0.26	7.3	0	HCL-HF	23	1	LEAF
84				0.27	6.8	0	HCL-HF	25	<.6	LEAF
85				0.33	7.6	0	HCL-HF	31	0.8	LEAF
86				0.27	7.5	0	HCL-HF	22	<.6	LEAF
87				0.29	7.5	0	HCL-HF	16	2.4	LEAF
88				0.42	7.4	0	HCL-HF	29	<.6	LEAF
89				0.49	7.4	0	HCL-HF	38	0.7	LEAF
90				0.64	7.3	0	HCL-HF	25	0.2	LEAF
91				0.36	7.6	133	HCL-HF	67	1.2	LEAF
92				0.28	7.1	146	HCL-HF	38	0.9	LEAF
93				0.61	7.4	168	HCL-HF	48	1.2	LEAF
94				0.91	7.3	223	HCL-HF	58	0.7	LEAF
95				0.56	7.4	266	HCL-HF	59	0.8	LEAF
96				0.58	7.1	321	HCL-HF	55	<.6	LEAF
97				0.45	7.5	321	HCL-HF	43	1.3	LEAF
98				0.34	7.7	321	HCL-HF	55	<.6	LEAF
99				0.47	7.4	321	HCL-HF	85	0.6	LEAF
100				0.83	7.4	321	HCL-HF	52	0.6	LEAF
101				0.58	7.5	265	HCL-HF	129	1.7	LEAF
102				0.44	6.9	292	HCL-HF	56	1.4	LEAF
103				0.81	7.1	335	HCL-HF	83	1	LEAF
104				0.95	6.8	440	HCL-HF	83	0.6	LEAF
105				0.75	7.1	525	HCL-HF	103	1.3	LEAF
106				0.96	7.1	635	HCL-HF	69	<.6	LEAF
107				0.59	6.9	635	HCL-HF	91	1.3	LEAF
108				0.89	7	635	HCL-HF	90	<.6	LEAF
109				0.81	7.1	635	HCL-HF	105	0.8	LEAF
110				0.52	7.1	635	HCL-HF	39	<.1	LEAF
111				0.9	7.6	529	HCL-HF	273	1	LEAF
112				0.6	6.6	583	HCL-HF	93	1.1	LEAF
113				2.4	6.8	670	HCL-HF	226	1.2	LEAF
114				1.85	6.5	880	HCL-HF	93	<.6	LEAF

TABLE F-1 (cont.)

	EXPERIMENTAL PROTOCOL SUMMARY	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
77	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
78	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
79	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
80	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
81	SLUDGE, FIELD, MATURITY	NA	GRAIN	0	STOVER	NO
82	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
83	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
84	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
85	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
86	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
87	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
88	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
89	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
90	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
91	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
92	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
93	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
94	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
95	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
96	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
97	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
98	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
99	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
100	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
101	SLUDGE, FIELD, MATURITY	NA	GRAIN	NA	STOVER	NO
102	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
103	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
104	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
105	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
106	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
107	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
108	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
109	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
110	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
111	SLUDGE, FIELD, MATURITY	NA	GRAIN	NA	STOVER	NO
112	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
113	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
114	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO

TABLE F-1 (cont.)

	COMMENTS	LOCATION OF STUDY
77		JOLIET, ILLINOIS
78		JOLIET, ILLINOIS
79		JOLIET, ILLINOIS
80		JOLIET, ILLINOIS
81		JOLIET, ILLINOIS
82		JOLIET, ILLINOIS
83		JOLIET, ILLINOIS
84		JOLIET, ILLINOIS
85		JOLIET, ILLINOIS
86		JOLIET, ILLINOIS
87		JOLIET, ILLINOIS
88		JOLIET, ILLINOIS
89		JOLIET, ILLINOIS
90		JOLIET, ILLINOIS
91		JOLIET, ILLINOIS
92		JOLIET, ILLINOIS
93		JOLIET, ILLINOIS
94		JOLIET, ILLINOIS
95		JOLIET, ILLINOIS
96		JOLIET, ILLINOIS
97		JOLIET, ILLINOIS
98		JOLIET, ILLINOIS
99		JOLIET, ILLINOIS
100		JOLIET, ILLINOIS
101		JOLIET, ILLINOIS
102		JOLIET, ILLINOIS
103		JOLIET, ILLINOIS
104		JOLIET, ILLINOIS
105		JOLIET, ILLINOIS
106		JOLIET, ILLINOIS
107		JOLIET, ILLINOIS
108		JOLIET, ILLINOIS
109		JOLIET, ILLINOIS
110		JOLIET, ILLINOIS
111		JOLIET, ILLINOIS
112		JOLIET, ILLINOIS
113		JOLIET, ILLINOIS
114		JOLIET, ILLINOIS

TABLE F-1 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
115	HINESLY 1985	CORN					3.4	263
116	HINESLY 1985	CORN					3.4	263
117	HINESLY 1985	CORN					3.4	263
118	HINESLY 1985	CORN					3.4	263
119	HINESLY 1985	CORN					3.4	263
120	HINESLY 1985	CORN					3.4	263
121	HINESLY 1985	CORN					3.2	265
122	HINESLY 1985	CORN					3.2	265
123	HINESLY 1985	CORN					3.2	265
124	HINESLY 1985	CORN					3.2	265
125	HINESLY 1985	CORN					3.2	265
126	HINESLY 1985	CORN					3.2	265
127	HINESLY 1985	CORN					3.2	265
128	HINESLY 1985	CORN					3.2	265
129	HINESLY 1985	CORN					3.2	265
130	HINESLY 1985	CORN					3.2	265
131	HINESLY 1985	CORN					3.2	265
132	HINESLY 1985	CORN					3.2	265
133	HINESLY 1985	CORN					3.2	265
134	HINESLY 1985	CORN					3.2	265
135	HINESLY 1985	CORN					3.2	265
136	HINESLY 1985	CORN					3.2	265
137	HINESLY 1985	CORN					3.2	265
138	HINESLY 1985	CORN					3.2	265
139	HINESLY 1985	CORN					3.2	265
140	HINESLY 1985	CORN					3.2	265
141	HINESLY 1985	CORN					3.2	265
142	HINESLY 1985	CORN					3.2	265
143	HINESLY 1985	CORN					3.2	265
144	HINESLY 1985	CORN					3.2	265
145	HINESLY 1985	CORN					3.2	265
146	HINESLY 1985	CORN					3.2	265
147	HINESLY 1985	CORN					3.2	265
148	HINESLY 1985	CORN					3.2	265
149	HINESLY 1985	CORN					3.2	265
150	HINESLY 1985	CORN					3.2	265
151	HINESLY 1985	CORN					3.2	265
152	HINESLY 1985	CORN					3.2	265

TABLE F-1 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
115	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
116	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
117	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
118	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
119	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
120	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
121	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
122	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
123	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
124	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
125	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
126	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
127	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
128	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
129	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
130	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
131	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
132	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
133	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
134	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
135	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
136	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
137	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
138	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
139	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
140	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
141	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
142	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
143	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
144	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
145	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
146	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
147	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
148	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
149	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
150	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
151	2846	1311	4.2	5.5	305	3.3	1169	4769		2ND TRTMNT, ANAEROBIC DIGESTION
152	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-1 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %
115	CENT POLY, FECL3	54	356.3	0		PLAINFIELD	SL	
116	CENT POLY, FECL3	72	428.3	0		PLAINFIELD	SL	
117	CENT POLY, FECL3	0	428.3	1		PLAINFIELD	SL	
118	CENT POLY, FECL3	0	428.3	2		PLAINFIELD	SL	
119	CENT POLY, FECL3	0	428.3	3		PLAINFIELD	SL	
120	CENT POLY, FECL3	0	428.3	4		PLAINFIELD	SL	
121	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL	
122	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL	
123	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL	
124	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL	
125	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL	
126	CENT POLY, FECL3	26.2	40.1	0		BLOUNT	SiL	
127	CENT POLY, FECL3	8.1	48.2	0		BLOUNT	SiL	
128	CENT POLY, FECL3	14.7	62.9	0		BLOUNT	SiL	
129	CENT POLY, FECL3	17.7	80.6	0		BLOUNT	SiL	
130	CENT POLY, FECL3	13.1	93.7	0		BLOUNT	SiL	
131	CENT POLY, FECL3	52.4	80.2	0		BLOUNT	SiL	
132	CENT POLY, FECL3	16.2	96.4	0		BLOUNT	SiL	
133	CENT POLY, FECL3	29.4	125.8	0		BLOUNT	SiL	
134	CENT POLY, FECL3	35.4	161.2	0		BLOUNT	SiL	
135	CENT POLY, FECL3	26.2	187.4	0		BLOUNT	SiL	
136	CENT POLY, FECL3	104.8	160.4	0		BLOUNT	SiL	
137	CENT POLY, FECL3	32.4	192.8	0		BLOUNT	SiL	
138	CENT POLY, FECL3	58.8	251.6	0		BLOUNT	SiL	
139	CENT POLY, FECL3	70.8	322.4	0		BLOUNT	SiL	
140	CENT POLY, FECL3	52.4	374.8	0		BLOUNT	SiL	
141	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
142	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
143	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
144	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
145	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
146	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
147	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
148	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
149	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
150	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
151	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL	
152	CENT POLY, FECL3	26.2	40.1	0		ELLIOT	SiL	

TABLE F-1 (cont.)

	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM CR LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CR CONCENTRTN mg/kg	PLANT CR CONCENTRTN mg/kg	PLANT TISSUE SAMPLED
115				1.78	6.1	1050	HCL-HF	218	1.3	LEAF
116				1.96	6.2	1269	HCL-HF	224	0.7	LEAF
117				2.84	6	1269	HCL-HF	268	0.9	LEAF
118				3.35	5.9	1269	HCL-HF	522	<.6	LEAF
119				2.1	6.2	1269	HCL-HF	234	<.6	LEAF
120				3.03	6.1	1269	HCL-HF	352	0.3	LEAF
121				1.19	NA	0	HCL-HF	36	1	LEAF
122				1.01	7.1	0	HCL-HF	28	1.1	LEAF
123				0.93	7.5	0	HCL-HF	47	1.2	LEAF
124				1.05	7.7	0	HCL-HF	40	0.6	LEAF
125				1.07	7.3	0	HCL-HF	47	0.9	LEAF
126				1.29	NA	138	HCL-HF	54	1	LEAF
127				1.06	7.2	148	HCL-HF	50	1.1	LEAF
128				1.1	7.6	167	HCL-HF	83	0.9	LEAF
129				1.29	7.6	218	HCL-HF	71	0.6	LEAF
130				1.17	7.6	261	HCL-HF	103	1.3	LEAF
131				1.38	NA	276	HCL-HF	71	1	LEAF
132				1.15	7.1	296	HCL-HF	56	0.9	LEAF
133				1.29	7.6	334	HCL-HF	95	1.6	LEAF
134				1.58	7.6	436	HCL-HF	93	<.6	LEAF
135				1.75	7.5	521	HCL-HF	146	0.7	LEAF
136				1.63	NA	551	HCL-HF	110	1	LEAF
137				1.28	6.9	591	HCL-HF	96	1.1	LEAF
138				1.59	7.5	667	HCL-HF	150	1.1	LEAF
139				1.9	7.5	872	HCL-HF	142	0.7	LEAF
140				2.56	7.3	1042	HCL-HF	329	0.7	LEAF
141				1.51	NA	0	HCL-HF	31	0.9	LEAF
142				1.34	7	0	HCL-HF	27	1	LEAF
143				1.29	7.2	0	HCL-HF	47	1.2	LEAF
144				1.45	7.1	0	HCL-HF	35	0.9	LEAF
145				1.3	7.6	0	HCL-HF	48	<.6	LEAF
146				1.3	7	0	HCL-HF	48	<.6	LEAF
147				1.41	7.2	0	HCL-HF	45	<.6	LEAF
148				1.32	6.7	0	HCL-HF	49	<.6	LEAF
149				1.38	7	0	HCL-HF	44	<.6	LEAF
150				1.69	7	0	HCL-HF	38	0.2	LEAF
151				1.48	7.4	0	HCL-HF	45	NA	LEAF
152				1.52	NA	138	HCL-HF	53	1	LEAF

TABLE F-1 (cont.)

	EXPERIMENTAL PROTOCOL SUMMARY	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
115	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
116	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
117	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
118	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
119	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
120	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
121	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
122	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
123	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
124	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
125	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
126	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
127	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
128	SLUDGE, FIELD, MATURITY	0	GRAIN	37*	STOVER	*NO
129	SLUDGE, FIELD, MATURITY	60*	GRAIN	0	STOVER	*NO
130	SLUDGE, FIELD, MATURITY	28*	GRAIN	0	STOVER	*NO
131	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
132	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
133	SLUDGE, FIELD, MATURITY	0	GRAIN	22*	STOVER	*NO
134	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
135	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
136	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
137	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
138	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
139	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
140	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
141	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
142	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
143	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
144	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
145	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
146	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
147	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
148	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
149	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
150	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
151	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
152	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO

TABLE F-1 (cont.)

	COMMENTS	LOCATION OF STUDY
115		JOLIET, ILLINOIS
116		JOLIET, ILLINOIS
117		JOLIET, ILLINOIS
118		JOLIET, ILLINOIS
119		JOLIET, ILLINOIS
120		JOLIET, ILLINOIS
121		JOLIET, ILLINOIS
122		JOLIET, ILLINOIS
123		JOLIET, ILLINOIS
124		JOLIET, ILLINOIS
125		JOLIET, ILLINOIS
126		JOLIET, ILLINOIS
127		JOLIET, ILLINOIS
128	*DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
129	*DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
130	*DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
131		JOLIET, ILLINOIS
132		JOLIET, ILLINOIS
133	*DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
134		JOLIET, ILLINOIS
135		JOLIET, ILLINOIS
136		JOLIET, ILLINOIS
137		JOLIET, ILLINOIS
138		JOLIET, ILLINOIS
139		JOLIET, ILLINOIS
140		JOLIET, ILLINOIS
141		JOLIET, ILLINOIS
142		JOLIET, ILLINOIS
143		JOLIET, ILLINOIS
144		JOLIET, ILLINOIS
145		JOLIET, ILLINOIS
146		JOLIET, ILLINOIS
147		JOLIET, ILLINOIS
148		JOLIET, ILLINOIS
149		JOLIET, ILLINOIS
150		JOLIET, ILLINOIS
151		JOLIET, ILLINOIS
152		JOLIET, ILLINOIS

TABLE F-1 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
153	HINESLY 1985	CORN					3.2	265
154	HINESLY 1985	CORN					3.2	265
155	HINESLY 1985	CORN					3.2	265
156	HINESLY 1985	CORN					3.2	265
157	HINESLY 1985	CORN					3.2	265
158	HINESLY 1985	CORN					3.2	265
159	HINESLY 1985	CORN					3.2	265
160	HINESLY 1985	CORN					3.2	265
161	HINESLY 1985	CORN					3.2	265
162	HINESLY 1985	CORN					3.2	265
163	HINESLY 1985	CORN					3.2	265
164	HINESLY 1985	CORN					3.2	265
165	HINESLY 1985	CORN					3.2	265
166	HINESLY 1985	CORN					3.2	265
167	HINESLY 1985	CORN					3.2	265
168	HINESLY 1985	CORN					3.2	265
169	HINESLY 1985	CORN					3.2	265
170	HINESLY 1985	CORN					3.2	265
171	HINESLY 1985	CORN					3.2	265
172	HINESLY 1985	CORN					3.2	265
173	HINESLY 1985	CORN					3.2	265
174	HINESLY 1985	CORN					3.2	265
175	HINESLY 1985	CORN					3.2	265
176	HINESLY 1985	CORN					3.2	265
177	HINESLY 1985	CORN					3.2	265
178	HINESLY 1985	CORN					3.2	265
179	HINESLY 1985	CORN					3.2	265
180	HINESLY 1985	CORN					3.2	265
181	HINESLY 1985	CORN					3.2	265
182	HINESLY 1985	CORN					3.2	265
183	HINESLY 1985	CORN					3.2	265
184	HINESLY 1985	CORN					3.2	265
185	HINESLY 1985	CORN					3.2	265
186	HINESLY 1985	CORN					3.2	265
187	HINESLY 1985	CORN					3.2	265
188	HINESLY 1985	CORN					3.2	265
189	HINESLY 1985	CORN					3.2	265
190	HINESLY 1985	CORN					3.2	265

TABLE F-1 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
153	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
154	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
155	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
156	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
157	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
158	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
159	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
160	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
161	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
162	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
163	2846	1311	4.2	5.5	305	3.3	1169	4769		2ND TRTMNT, ANAEROBIC DIGESTION
164	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
165	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
166	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
167	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
168	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
169	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
170	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
171	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
172	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
173	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
174	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
175	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
176	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
177	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
178	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
179	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
180	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
181	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
182	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
183	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
184	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
185	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
186	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
187	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
188	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
189	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
190	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-1 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %
153	CENT POLY, FECL3	8.1	48.2	0		ELLIOT	SIL	
154	CENT POLY, FECL3	14.7	62.9	0		ELLIOT	SIL	
155	CENT POLY, FECL3	17.7	80.6	0		ELLIOT	SIL	
156	CENT POLY, FECL3	13.1	93.7	0		ELLIOT	SIL	
157	CENT POLY, FECL3	17.8	111.5	0		ELLIOT	SIL	
158	CENT POLY, FECL3	0	111.5	1		ELLIOT	SIL	
159	CENT POLY, FECL3	0	111.5	2		ELLIOT	SIL	
160	CENT POLY, FECL3	0	111.5	3		ELLIOT	SIL	
161	CENT POLY, FECL3	0	111.5	4		ELLIOT	SIL	
162	CENT POLY, FECL3	0	111.5	5		ELLIOT	SIL	
163	CENT POLY, FECL3	52.4	80.2	0		ELLIOT	SIL	
164	CENT POLY, FECL3	16.2	96.4	0		ELLIOT	SIL	
165	CENT POLY, FECL3	29.4	125.8	0		ELLIOT	SIL	
166	CENT POLY, FECL3	35.4	161.2	0		ELLIOT	SIL	
167	CENT POLY, FECL3	26.2	187.4	0		ELLIOT	SIL	
168	CENT POLY, FECL3	35.6	223	0		ELLIOT	SIL	
169	CENT POLY, FECL3	0	223	1		ELLIOT	SIL	
170	CENT POLY, FECL3	0	223	2		ELLIOT	SIL	
171	CENT POLY, FECL3	0	223	3		ELLIOT	SIL	
172	CENT POLY, FECL3	0	223	4		ELLIOT	SIL	
173	CENT POLY, FECL3	0	223	5		ELLIOT	SIL	
174	CENT POLY, FECL3	104.8	160.4	0		ELLIOT	SIL	
175	CENT POLY, FECL3	32.4	192.8	0		ELLIOT	SIL	
176	CENT POLY, FECL3	58.8	251.6	0		ELLIOT	SIL	
177	CENT POLY, FECL3	70.8	322.4	0		ELLIOT	SIL	
178	CENT POLY, FECL3	52.4	374.8	0		ELLIOT	SIL	
179	CENT POLY, FECL3	71.2	446	0		ELLIOT	SIL	
180	CENT POLY, FECL3	0	446	1		ELLIOT	SIL	
181	CENT POLY, FECL3	0	446	2		ELLIOT	SIL	
182	CENT POLY, FECL3	0	446	3		ELLIOT	SIL	
183	CENT POLY, FECL3	0	446	4		ELLIOT	SIL	
184	CENT POLY, FECL3	0	446	5		ELLIOT	SIL	
185	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
186	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
187	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
188	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
189	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
190	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	

TABLE F-1 (cont.)

	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM CR LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CR CONCENTRTN mg/kg	PLANT CR CONCENTRTN mg/kg	PLANT TISSUE SAMPLED
153				1.4	6.9	148	HCL-HF	42	0.9	LEAF
154				1.35	7.2	167	HCL-HF	64	1.7	LEAF
155				1.58	7.4	218	HCL-HF	65	2	LEAF
156				1.54	7.1	261	HCL-HF	84	<.6	LEAF
157				1.64	6.9	318	HCL-HF	99	0.6	LEAF
158				1.69	6.9	318	HCL-HF	94	1.4	LEAF
159				1.91	7	318	HCL-HF	116	<.6	LEAF
160				1.66	7.3	318	HCL-HF	110	<.6	LEAF
161				2.05	7.1	318	HCL-HF	100	<.1	LEAF
162				1.95	7.2	318	HCL-HF	78	NA	LEAF
163				1.71	NA	276	HCL-HF	65	1.1	LEAF
164				1.57	6.9	296	HCL-HF	51	1	LEAF
165				1.57	7.3	334	HCL-HF	85	1.6	LEAF
166				1.79	7.1	436	HCL-HF	83	0.9	LEAF
167				1.93	6.9	521	HCL-HF	117	<.6	LEAF
168				2.09	6.6	634	HCL-HF	99	1.2	LEAF
169				2.37	6.4	634	HCL-HF	145	1	LEAF
170				2.4	6.4	634	HCL-HF	235	1.8	LEAF
171				2.4	6.8	634	HCL-HF	173	<.6	LEAF
172				2.38	6.8	634	HCL-HF	122	0.2	LEAF
173				2.48	7.2	634	HCL-HF	131	NA	LEAF
174				2.06	NA	551	HCL-HF	91	1	LEAF
175				2	6.4	591	HCL-HF	106	1.1	LEAF
176				1.76	6.4	667	HCL-HF	106	1.9	LEAF
177				2.67	6.2	872	HCL-HF	149	0.6	LEAF
178				2.72	6.1	1042	HCL-HF	235	0.8	LEAF
179				3.53	5.4	1268	HCL-HF	311	1.9	LEAF
180				3.35	5.5	1268	HCL-HF	272	0.6	LEAF
181				3.29	5.8	1268	HCL-HF	314	2.6	LEAF
182				2.68	6	1268	HCL-HF	207	<.6	LEAF
183				3.02	6	1268	HCL-HF	179	0.2	LEAF
184				2.2	6.3	1268	HCL-HF	132	NA	LEAF
185				0.36	NA	0	HCL-HF	12	1.1	LEAF
186				0.17	7	0	HCL-HF	13	1.4	LEAF
187				0.21	7.2	0	HCL-HF	22	1.2	LEAF
188				0.42	7.1	0	HCL-HF	19	<.6	LEAF
189				0.44	7	0	HCL-HF	29	<.6	LEAF
190				0.56	6.9	0	HCL-HF	15	<.6	LEAF

TABLE F-1 (cont.)

	EXPERIMENTAL PROTOCOL SUMMARY	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
153	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
154	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
155	SLUDGE, FIELD, MATURITY	60*	GRAIN	0	STOVER	*NO
156	SLUDGE, FIELD, MATURITY	28*	GRAIN	0	STOVER	*NO
157	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
158	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
159	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
160	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
161	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
162	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
163	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
164	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
165	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
166	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
167	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
168	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
169	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
170	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
171	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
172	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
173	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
174	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
175	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
176	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
177	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
178	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
179	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
180	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
181	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
182	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
183	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
184	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
185	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
186	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
187	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
188	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
189	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
190	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO

TABLE F-1 (cont.)

	COMMENTS	LOCATION OF STUDY
153		JOLIET, ILLINOIS
154		JOLIET, ILLINOIS
155	*DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
156	*DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
157		JOLIET, ILLINOIS
158		JOLIET, ILLINOIS
159		JOLIET, ILLINOIS
160		JOLIET, ILLINOIS
161		JOLIET, ILLINOIS
162		JOLIET, ILLINOIS
163		JOLIET, ILLINOIS
164		JOLIET, ILLINOIS
165		JOLIET, ILLINOIS
166		JOLIET, ILLINOIS
167		JOLIET, ILLINOIS
168		JOLIET, ILLINOIS
169		JOLIET, ILLINOIS
170		JOLIET, ILLINOIS
171		JOLIET, ILLINOIS
172		JOLIET, ILLINOIS
173		JOLIET, ILLINOIS
174		JOLIET, ILLINOIS
175		JOLIET, ILLINOIS
176		JOLIET, ILLINOIS
177		JOLIET, ILLINOIS
178		JOLIET, ILLINOIS
179		JOLIET, ILLINOIS
180		JOLIET, ILLINOIS
181		JOLIET, ILLINOIS
182		JOLIET, ILLINOIS
183		JOLIET, ILLINOIS
184		JOLIET, ILLINOIS
185		JOLIET, ILLINOIS
186		JOLIET, ILLINOIS
187		JOLIET, ILLINOIS
188		JOLIET, ILLINOIS
189		JOLIET, ILLINOIS
190		JOLIET, ILLINOIS

TABLE F-1 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
191	HINESLY 1985	CORN					3.2	265
192	HINESLY 1985	CORN					3.2	265
193	HINESLY 1985	CORN					3.2	265
194	HINESLY 1985	CORN					3.2	265
195	HINESLY 1985	CORN					3.2	265
196	HINESLY 1985	CORN					3.2	265
197	HINESLY 1985	CORN					3.2	265
198	HINESLY 1985	CORN					3.2	265
199	HINESLY 1985	CORN					3.2	265
200	HINESLY 1985	CORN					3.2	265
201	HINESLY 1985	CORN					3.2	265
202	HINESLY 1985	CORN					3.2	265
203	HINESLY 1985	CORN					3.2	265
204	HINESLY 1985	CORN					3.2	265
205	HINESLY 1985	CORN					3.2	265
206	HINESLY 1985	CORN					3.2	265
207	HINESLY 1985	CORN					3.2	265
208	HINESLY 1985	CORN					3.2	265
209	HINESLY 1985	CORN					3.2	265
210	HINESLY 1985	CORN					3.2	265
211	HINESLY 1985	CORN					3.2	265
212	HINESLY 1985	CORN					3.2	265
213	HINESLY 1985	CORN					3.2	265
214	HINESLY 1985	CORN					3.2	265
215	HINESLY 1985	CORN					3.2	265
216	HINESLY 1985	CORN					3.2	265
217	HINESLY 1985	CORN					3.2	265
218	HINESLY 1985	CORN					3.2	265
219	HINESLY 1985	CORN					3.2	265
220	HINESLY 1985	CORN					3.2	265
221	HINESLY 1985	CORN					3.2	265
222	HINESLY 1985	CORN					3.2	265
223	HINESLY 1985	CORN					3.2	265
224	HINESLY 1985	CORN					3.2	265
225	HINESLY 1985	CORN					3.2	265
226	HINESLY 1985	CORN					3.2	265
227	HINESLY 1985	CORN					3.2	265
228	HINESLY 1985	CORN					3.2	265

TABLE F-1 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
191	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
192	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
193	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
194	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
195	2846	1311	4.2	5.5	305	3.3	1169	4769		2ND TRTMNT, ANAEROBIC DIGESTION
196	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
197	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
198	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
199	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
200	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
201	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
202	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
203	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
204	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
205	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
206	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
207	2846	1311	4.2	5.5	305	3.3	1169	4769		2ND TRTMNT, ANAEROBIC DIGESTION
208	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
209	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
210	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
211	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
212	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
213	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
214	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
215	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
216	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
217	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
218	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
219	2846	1311	4.2	5.5	305	3.3	1169	4769		2ND TRTMNT, ANAEROBIC DIGESTION
220	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
221	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
222	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
223	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
224	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
225	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
226	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
227	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
228	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-1 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %
191	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
192	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
193	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
194	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
195	CENT POLY, FECL3	0	0	NA		PLAINFIELD	SL	
196	CENT POLY, FECL3	26.2	40.1	0		PLAINFIELD	SL	
197	CENT POLY, FECL3	8.1	48.2	0		PLAINFIELD	SL	
198	CENT POLY, FECL3	14.7	62.9	0		PLAINFIELD	SL	
199	CENT POLY, FECL3	17.7	80.6	0		PLAINFIELD	SL	
200	CENT POLY, FECL3	13.1	93.7	0		PLAINFIELD	SL	
201	CENT POLY, FECL3	17.8	111.5	0		PLAINFIELD	SL	
202	CENT POLY, FECL3	0	111.5	1		PLAINFIELD	SL	
203	CENT POLY, FECL3	0	111.5	2		PLAINFIELD	SL	
204	CENT POLY, FECL3	0	111.5	3		PLAINFIELD	SL	
205	CENT POLY, FECL3	0	111.5	4		PLAINFIELD	SL	
206	CENT POLY, FECL3	0	111.5	5		PLAINFIELD	SL	
207	CENT POLY, FECL3	52.4	80.2	0		PLAINFIELD	SL	
208	CENT POLY, FECL3	16.2	96.4	0		PLAINFIELD	SL	
209	CENT POLY, FECL3	29.4	125.8	0		PLAINFIELD	SL	
210	CENT POLY, FECL3	35.4	161.2	0		PLAINFIELD	SL	
211	CENT POLY, FECL3	26.2	187.4	0		PLAINFIELD	SL	
212	CENT POLY, FECL3	35.6	223	0		PLAINFIELD	SL	
213	CENT POLY, FECL3	0	223	1		PLAINFIELD	SL	
214	CENT POLY, FECL3	0	223	2		PLAINFIELD	SL	
215	CENT POLY, FECL3	0	223	3		PLAINFIELD	SL	
216	CENT POLY, FECL3	0	223	4		PLAINFIELD	SL	
217	CENT POLY, FECL3	0	223	5		PLAINFIELD	SL	
218	CENT POLY, FECL3	104.8	160.4	0		PLAINFIELD	SL	
219	CENT POLY, FECL3	32.4	192.8	0		PLAINFIELD	SL	
220	CENT POLY, FECL3	58.8	251.6	0		PLAINFIELD	SL	
221	CENT POLY, FECL3	70.8	322.4	0		PLAINFIELD	SL	
222	CENT POLY, FECL3	52.4	374.8	0		PLAINFIELD	SL	
223	CENT POLY, FECL3	71.2	446	0		PLAINFIELD	SL	
224	CENT POLY, FECL3	0	446	1		PLAINFIELD	SL	
225	CENT POLY, FECL3	0	446	2		PLAINFIELD	SL	
226	CENT POLY, FECL3	0	446	3		PLAINFIELD	SL	
227	CENT POLY, FECL3	0	446	4		PLAINFIELD	SL	
228	CENT POLY, FECL3	0	446	5		PLAINFIELD	SL	

TABLE F-1 (cont.)

	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM CR LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CR CONCENTRTN mg/kg	PLANT CR CONCENTRTN mg/kg	PLANT TISSUE SAMPLED
191				0.48	7	0	HCL-HF	34	0.8	LEAF
192				0.75	7	0	HCL-HF	54	1.2	LEAF
193				0.76	7	0	HCL-HF	46	0.7	LEAF
194				1.21	6.9	0	HCL-HF	46	0.4	LEAF
195				0.84	7.1	0	HCL-HF	53	NA	LEAF
196				0.31	NA	138	HCL-HF	29	1.2	LEAF
197				0.44	7.2	148	HCL-HF	37	1.4	LEAF
198				0.63	7.3	167	HCL-HF	68	1.2	LEAF
199				0.67	7.5	218	HCL-HF	52	1.2	LEAF
200				0.78	7	261	HCL-HF	97	1.3	LEAF
201				0.8	7	318	HCL-HF	87	1.7	LEAF
202				0.99	6.6	318	HCL-HF	105	6.2	LEAF
203				1.42	7.1	318	HCL-HF	135	0.9	LEAF
204				1.71	7.2	318	HCL-HF	179	<.6	LEAF
205				1.82	7.2	318	HCL-HF	153	0.8	LEAF
206				1.96	7.1	318	HCL-HF	119	NA	LEAF
207				0.43	NA	276	HCL-HF	47	1.5	LEAF
208				0.51	7.1	296	HCL-HF	60	1	LEAF
209				0.94	7	334	HCL-HF	106	1.2	LEAF
210				1.16	7.2	436	HCL-HF	102	0.8	LEAF
211				1.4	7	521	HCL-HF	151	4	LEAF
212				1.75	6.4	634	HCL-HF	183	0.8	LEAF
213				2	6.3	634	HCL-HF	189	0.8	LEAF
214				2.16	6.8	634	HCL-HF	207	<.6	LEAF
215				2.02	6.8	634	HCL-HF	250	0.7	LEAF
216				2.33	7.1	634	HCL-HF	212	<.1	LEAF
217				1.66	7	634	HCL-HF	199	NA	LEAF
218				0.73	NA	551	HCL-HF	115	1	LEAF
219				0.57	6.8	591	HCL-HF	75	1.3	LEAF
220				1.3	6.7	667	HCL-HF	136	1.2	LEAF
221				1.42	6.6	872	HCL-HF	169	0.8	LEAF
222				2.4	6.4	1042	HCL-HF	341	<.6	LEAF
223				2.76	6.1	1268	HCL-HF	327	0.6	LEAF
224				3.44	5.8	1268	HCL-HF	344	3.6	LEAF
225				3.16	5.9	1268	HCL-HF	452	1.3	LEAF
226				3.28	6.2	1268	HCL-HF	334	0.7	LEAF
227				3.1	6.4	1268	HCL-HF	347	<.1	LEAF
228				3.15	6.5	1268	HCL-HF	379	NA	LEAF

TABLE F-1 (cont.)

	EXPERIMENTAL PROTOCOL SUMMARY	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
191	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
192	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
193	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
194	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
195	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
196	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
197	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
198	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
199	SLUDGE, FIELD, MATURITY	60*	GRAIN	0	STOVER	*NO
200	SLUDGE, FIELD, MATURITY	60*	GRAIN	0	STOVER	*NO
201	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
202	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
203	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
204	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
205	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
206	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
207	SLUDGE, FIELD, MATURITY	NA	GRAIN	NA	STOVER	NO
208	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
209	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
210	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
211	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
212	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
213	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
214	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
215	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
216	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
217	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
218	SLUDGE, FIELD, MATURITY	0	GRAIN	NA	STOVER	NO
219	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
220	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
221	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
222	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
223	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
224	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
225	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
226	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
227	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO
228	SLUDGE, FIELD, MATURITY	0	GRAIN	0	STOVER	NO

TABLE F-1 (cont.)

	COMMENTS	LOCATION OF STUDY
191		JOLIET, ILLINOIS
192		JOLIET, ILLINOIS
193		JOLIET, ILLINOIS
194		JOLIET, ILLINOIS
195		JOLIET, ILLINOIS
196		JOLIET, ILLINOIS
197		JOLIET, ILLINOIS
198		JOLIET, ILLINOIS
199	*DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
200	*DOSE RESPONSE AND TISSUE CR CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
201		JOLIET, ILLINOIS
202		JOLIET, ILLINOIS
203		JOLIET, ILLINOIS
204		JOLIET, ILLINOIS
205		JOLIET, ILLINOIS
206		JOLIET, ILLINOIS
207		JOLIET, ILLINOIS
208		JOLIET, ILLINOIS
209		JOLIET, ILLINOIS
210		JOLIET, ILLINOIS
211		JOLIET, ILLINOIS
212		JOLIET, ILLINOIS
213		JOLIET, ILLINOIS
214		JOLIET, ILLINOIS
215		JOLIET, ILLINOIS
216		JOLIET, ILLINOIS
217		JOLIET, ILLINOIS
218		JOLIET, ILLINOIS
219		JOLIET, ILLINOIS
220		JOLIET, ILLINOIS
221		JOLIET, ILLINOIS
222		JOLIET, ILLINOIS
223		JOLIET, ILLINOIS
224		JOLIET, ILLINOIS
225		JOLIET, ILLINOIS
226		JOLIET, ILLINOIS
227		JOLIET, ILLINOIS
228		JOLIET, ILLINOIS

TABLE F-1 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
229	CHAKRABARTI, C. & T. CHAKRABARTI, 1988. #29	WHEAT	HDM 1553	8.4				
230	CHAKRABARTI, C. & T. CHAKRABARTI, 1988. #29	WHEAT	HDM 1553					
231	CHAKRABARTI, C. & T. CHAKRABARTI, 1988. #29	WHEAT	HDM 1553					
232	GILLIES ET AL 1989	OAT	HARMON					4.6
233	GILLIES ET AL 1989	OAT	HARMON					4.6
234	GILLIES ET AL 1989	OAT	HARMON					4.6
235	KIRKHAM 1983	SORGHAM	MOENCH.	6.7				29.2
236	KIRKHAM 1983	SORGHAM	MOENCH.	6.7				29.2
237	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
238	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
239	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
240	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
241	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
242	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
243	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
244	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
245	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
246	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
247	WEBBER 1972	RED BEET						
248	WEBBER 1972	RED BEET						
249	WEBBER 1972	RED BEET						
250	WEBBER 1972	RED BEET						
251	WEBBER 1972	RED BEET						
252	WEBBER 1972	RED BEET						
253	WEBBER 1972	CELERY						
254	WEBBER 1972	CELERY						
255	WEBBER 1972	CELERY						
256	WEBBER 1972	CELERY						
257	WEBBER 1972	CELERY						
258	WEBBER 1972	CELERY						
259	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
260	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
261	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
262	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
263	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
264	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
265	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
266	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71

TABLE F-1 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
229	N/D	10						30		Well Water(Control)
230	45	428						562		Well Water + 10 t/ha sludge
231	45	428						562		Well Water + 20 t/ha sludge
232	191	143			26.3	27200	194	420		
233	191	143			26.3	27200	194	420		
234	191	143			26.3	27200	194	420		
235	851	375			35.6	21300	124	1890		
236	851	375			35.6	21300	124	1890		
237	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
238	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
239	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
240	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
241	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
242	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
243	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
244	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
245	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
246	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
247										
248	240	1100			210			3000		
249	9750	795			130			900		
250	9750	795			130			900		
251	240	1100			210			3000		
252	9750	795			130			900		
253										
254	240	1100			210			3000		
255	9750	795			130			900		
256	9750	795			130			900		
257	240	1100			210			3000		
258	9750	795			130			900		
259	3505	1471	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON
260	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
261	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
262	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
263	3505	1471	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON
264	775	460	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON
265	775	460	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON
266	775	460	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON

TABLE F-1 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %
229							Clayey	
230		10	10	0			Clayey	
231		20	20	0			Clayey	
232		0	0					
233		75	75					
234		150	150					
235		0	0		Typic Udifluvent	Haynie	fine sandy loam	
236		32	128		Typic Udifluvent	Haynie	fine sandy loam	
237		0	0	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL	
238		25	25	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL	
239		50	50	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL	
240		100	100	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL	
241		200	200	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL	
242		0	0	1	TYPIC TAPLUDOLL	WAUKEGAN	SiL	
243		25	25	1	TYPIC TAPLUDOLL	WAUKEGAN	SiL	
244		50	50	1	TYPIC TAPLUDOLL	WAUKEGAN	SiL	
245		100	100	1	TYPIC TAPLUDOLL	WAUKEGAN	SiL	
246		200	200	1	TYPIC TAPLUDOLL	WAUKEGAN	SiL	
247		0	0	0				
248		125.5	125.5	2				
249		125.5	125.5	2				
250		125.5	125.5	2				
251		31.4	94.2	0				
252		31.4	94.2	0				
253		0	0	0				
254		125.5	125.5	2				
255		125.5	125.5	2				
256		125.5	125.5	2				
257		31.4	94.2	0				
258		31.4	94.2	0				
259	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL			
260	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL			
261	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL			
262	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL			
263	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL			
264	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL			
265	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL			
266	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL			

TABLE F-1 (cont.)

	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM CR LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CR CONCENTRTN mg/kg	PLANT CR CONCENTRTN mg/kg	PLANT TISSUE SAMPLED
229				0.7	8		HCLO4/HNO3	17	3	Earhead
230				0.7	8		HCLO4/HNO3	27	3.1	Earhead
231				0.7	8		HCLO4/HNO3	31	3.4	Earhead
232			28					9.6	43	Root
233									72	Root
234									56	Root
235					7	0		0.2	0.398	Leaves
236					5.9	108.9		0.24	0.2	Leaves
237					6.5	0		N.L.	3.3	LEAF
238					6.5	28		N.L.	3.6	LEAF
239					6.5	55		N.L.	6.9	LEAF
240					6.5	110		N.L.	7.4	LEAF
241					6.5	220		N.L.	11.9	LEAF
242					6.5	0		N.L.	0.7	LEAF
243					6.5	28		N.L.	0.7	LEAF
244					6.5	55		N.L.	0.8	LEAF
245					6.5	110		N.L.	0.6	LEAF
246					6.5	220		N.L.	0.5	LEAF
247					6.1	0	.5 M HOAC	N.R.		
248					NR	29	.5 M HOAC	N.R.		
249					NR	552	.5 M HOAC	N.R.		
250					NR	1104	.5 M HOAC	N.R.		
251					NR	22	.5 M HOAC	N.R.		
252					NR	104	.5 M HOAC	N.R.		
253					6.1	0	.5 M HOAC	N.R.		
254					NR	29	.5 M HOAC	N.R.		
255					NR	552	.5 M HOAC	N.R.		
256					NR	1104	.5 M HOAC	N.R.		
257					NR	22	.5 M HOAC	N.R.		
258					NR	104	.5 M HOAC	N.R.		
259				0.44	7.5	0	0.1 M HCl	6.5	0.67	LEAF
260				0.36	7.5	0	0.1 M HCl	5.2	0.79	LEAF
261				0.36	7.5	0	0.1 M HCl	4.2	6.47	LEAF
262				0.46	7.5	0	0.1 M HCl	5.3	6.03	LEAF
263				0.46	7.5	0	0.1 M HCl	4.97	7.15	LEAF
264				0.73	7.5	0	0.1 M HCl	4.03	0.44	LEAF
265				0.73	7.5	0	0.1 M HCl	10.5	0.3	LEAF
266				0.7	7.5	0	0.1 M HCl	9.17	0.24	LEAF

TABLE F-1 (cont.)

	EXPERIMENTAL PROTOCOL SUMMARY	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
229	SALT, FIELD, MATURITY	0	Whole Plant	0	GRAIN	
230	SALT, FIELD, MATURITY	0	Whole Plant	0	GRAIN	
231	SALT, FIELD, MATURITY	0	Whole Plant	0	GRAIN	
232	FIELD, SLUDGE, MATURITY			0	GRAIN	
233	FIELD, SLUDGE, MATURITY			0	GRAIN	
234	FIELD, SLUDGE, MATURITY			0	GRAIN	
235	FIELD, SLUDGE, MATURITY	NOT REPORTED				
236	FIELD, SLUDGE, MATURITY	NOT REPORTED				
237	SLUDGE, FIELD, MATURITY	0	GRAIN			
238	SLUDGE, FIELD, MATURITY	0	GRAIN			
239	SLUDGE, FIELD, MATURITY	0	GRAIN			
240	SLUDGE, FIELD, MATURITY	0	GRAIN			
241	SLUDGE, FIELD, MATURITY	0	GRAIN			
242	SLUDGE, FIELD, MATURITY	0	GRAIN			
243	SLUDGE, FIELD, MATURITY	0	GRAIN			
244	SLUDGE, FIELD, MATURITY	0	GRAIN			
245	SLUDGE, FIELD, MATURITY	0	GRAIN			
246	SLUDGE, FIELD, MATURITY	0	GRAIN			
247	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS			NO
248	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS			NO
249	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS			NO
250	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS			NO
251	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS			NO
252	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS			NO
253	SLUDGE, FIELD, MATURITY	0	STALKS			NO
254	SLUDGE, FIELD, MATURITY	0	STALKS			NO
255	SLUDGE, FIELD, MATURITY	0	STALKS			NO
256	SLUDGE, FIELD, MATURITY	0	STALKS			NO
257	SLUDGE, FIELD, MATURITY	0	STALKS			NO
258	SLUDGE, FIELD, MATURITY	0	STALKS			NO
259	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
260	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
261	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
262	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
263	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
264	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
265	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
266	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	

TABLE F-1 (cont.)

	COMMENTS	LOCATION OF STUDY
229		India
230		India
231		India
232		Canada
233		Canada
234		Canada
235		Manhattan, Kansas
236		Manhattan, Kansas
237		MINNESOTA
238		MINNESOTA
239		MINNESOTA
240		MINNESOTA
241		MINNESOTA
242		MINNESOTA
243		MINNESOTA
244		MINNESOTA
245		MINNESOTA
246		MINNESOTA
247		LEEDS, U.K.
248		LEEDS, U.K.
249		LEEDS, U.K.
250		LEEDS, U.K.
251		LEEDS, U.K.
252		LEEDS, U.K.
253		LEEDS, U.K.
254		LEEDS, U.K.
255		LEEDS, U.K.
256		LEEDS, U.K.
257		LEEDS, U.K.
258		LEEDS, U.K.
259		FULTON COUNTY, ILLINOIS
260		FULTON COUNTY, ILLINOIS
261		FULTON COUNTY, ILLINOIS
262		FULTON COUNTY, ILLINOIS
263		FULTON COUNTY, ILLINOIS
264		FULTON COUNTY, ILLINOIS
265		FULTON COUNTY, ILLINOIS
266		FULTON COUNTY, ILLINOIS

TABLE F-1 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
267	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53
268	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
269	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
270	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
271	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
272	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
273	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
274	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
275	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71
276	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53
277	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
278	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
279	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
280	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
281	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
282	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
283	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
284	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71
285	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53
286	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
287	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
288	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
289	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
290	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
291	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
292	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
293	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71
294	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53

TABLE F-1 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
267	679	454	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON
268	3505	1471	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON
269	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
270	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
271	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
272	3505	1471	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON
273	775	460	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON
274	775	460	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON
275	775	460	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON
276	679	454	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON
277	3505	1471	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON
278	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
279	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
280	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
281	3505	1471	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON
282	775	460	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON
283	775	460	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON
284	775	460	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON
285	679	454	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON
286	3505	1471	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON
287	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
288	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
289	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
290	3505	1471	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON
291	775	460	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON
292	775	460	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON
293	775	460	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON
294	679	454	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON

TABLE F-1 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %
267	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL			
268	POLYMER,FECL3	17.4	115.3	0	STRIP MINE SPOIL			
269	POLYMER,FECL3	11.4	126.7	0	STRIP MINE SPOIL			
270	POLYMER,FECL3	16.8	143.5	0	STRIP MINE SPOIL			
271	POLYMER,FECL3	17.9	161.4	0	STRIP MINE SPOIL			
272	POLYMER,FECL3	16.8	178.2	0	STRIP MINE SPOIL			
273	POLYMER,FECL3	16.8	195	0	STRIP MINE SPOIL			
274	POLYMER,FECL3	16.8	211.8	0	STRIP MINE SPOIL			
275	POLYMER,FECL3	16.8	228.6	0	STRIP MINE SPOIL			
276	POLYMER,FECL3	16.8	245.4	0	STRIP MINE SPOIL			
277	POLYMER,FECL3	34.8	235.7	0	STRIP MINE SPOIL			
278	POLYMER,FECL3	22.8	258.5	0	STRIP MINE SPOIL			
279	POLYMER,FECL3	34.9	293.4	0	STRIP MINE SPOIL			
280	POLYMER,FECL3	35.8	329.2	0	STRIP MINE SPOIL			
281	POLYMER,FECL3	33.6	362.8	0	STRIP MINE SPOIL			
282	POLYMER,FECL3	33.6	396.4	0	STRIP MINE SPOIL			
283	POLYMER,FECL3	33.6	430	0	STRIP MINE SPOIL			
284	POLYMER,FECL3	33.6	463.6	0	STRIP MINE SPOIL			
285	POLYMER,FECL3	33.6	497.2	0	STRIP MINE SPOIL			
286	POLYMER,FECL3	69.8	471.4	0	STRIP MINE SPOIL			
287	POLYMER,FECL3	45.5	516.9	0	STRIP MINE SPOIL			
288	POLYMER,FECL3	68.8	585.7	0	STRIP MINE SPOIL			
289	POLYMER,FECL3	71.7	657.4	0	STRIP MINE SPOIL			
290	POLYMER,FECL3	67.2	724.6	0	STRIP MINE SPOIL			
291	POLYMER,FECL3	67.2	791.8	0	STRIP MINE SPOIL			
292	POLYMER,FECL3	67.2	859	0	STRIP MINE SPOIL			
293	POLYMER,FECL3	67.2	926.2	0	STRIP MINE SPOIL			
294	POLYMER,FECL3	67.2	993.4	0	STRIP MINE SPOIL			

TABLE F-1 (cont.)

	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM CR LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CR CONCENTRTN mg/kg	PLANT CR CONCENTRTN mg/kg	PLANT TISSUE SAMPLED
267				0.7	7.5	0	0.1 M HCl	13.7	1.66	LEAF
268				0.94	7.5	438.2	0.1 M HCl	27.6	0.8	LEAF
269				0.67	7.5	473.2	0.1 M HCl	16.8	1.14	LEAF
270				0.67	7.5	534.4	0.1 M HCl	13.8	2.96	LEAF
271				0.87	7.5	577.8	0.1 M HCl	20.7	6.78	LEAF
272				0.87	7.5	616.8	0.1 M HCl	16.7	6.25	LEAF
273				1.41	7.5	654.7	0.1 M HCl	24	0.43	LEAF
274				1.41	7.5	699.5	0.1 M HCl	28.3	0.43	LEAF
275				1.25	7.5	747.6	0.1 M HCl	27.4	0.4	LEAF
276				1.25	7.5	759	0.1 M HCl	33.8	1.03	LEAF
277				1.56	7.5	876.4	0.1 M HCl	62.9	0.69	LEAF
278				1.56	7.5	946.3	0.1 M HCl	42.9	0.67	LEAF
279				1.04	7.5	1068.8	0.1 M HCl	33.4	1.95	LEAF
280				1.04	7.5	1155.5	0.1 M HCl	52.7	6.32	LEAF
281				1.48	7.5	1233.6	0.1 M HCl	41.5	3.64	LEAF
282				1.48	7.5	1309.5	0.1 M HCl	43.7	0.39	LEAF
283				2.15	7.5	1399	0.1 M HCl	54.7	0.29	LEAF
284				2.15	7.5	1495.2	0.1 M HCl	51.4	0.2	LEAF
285				1.9	7.5	1518	0.1 M HCl	71	1.58	LEAF
286				3.02	7.5	1752.7	0.1 M HCl	118.8	0.77	LEAF
287				1.58	7.5	1892.6	0.1 M HCl	88.8	0.51	LEAF
288				1.58	7.5	2137.5	0.1 M HCl	55.1	2.11	LEAF
289				2.38	7.5	2311	0.1 M HCl	107.7	3.98	LEAF
290				2.38	7.5	2467.2	0.1 M HCl	79.6	10.6	LEAF
291				3.47	7.5	2618.9	0.1 M HCl	99.8	0.43	LEAF
292				3.47	7.5	2797.9	0.1 M HCl	89.7	0.27	LEAF
293				2.77	7.5	2990.4	0.1 M HCl	93.9	0.45	LEAF
294				2.77	7.5	3036	0.1 M HCl	114	1.31	LEAF

TABLE F-1 (cont.)

	EXPERIMENTAL PROTOCOL SUMMARY	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
267	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
268	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
269	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
270	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
271	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
272	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
273	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
274	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
275	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
276	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
277	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
278	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
279	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
280	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
281	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
282	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
283	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
284	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
285	FIELD, SLUDGE, MATURITY	43.7	GRAIN	0	STOVER	
286	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
287	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
288	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
289	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
290	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
291	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
292	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
293	FIELD, SLUDGE, MATURITY	0	GRAIN	0	STOVER	
294	FIELD, SLUDGE, MATURITY	59.2	GRAIN	0	STOVER	

TABLE F-1 (cont.)

	COMMENTS	LOCATION OF STUDY
267		FULTON COUNTY, ILLINOIS
268		FULTON COUNTY, ILLINOIS
269		FULTON COUNTY, ILLINOIS
270		FULTON COUNTY, ILLINOIS
271		FULTON COUNTY, ILLINOIS
272		FULTON COUNTY, ILLINOIS
273		FULTON COUNTY, ILLINOIS
274		FULTON COUNTY, ILLINOIS
275		FULTON COUNTY, ILLINOIS
276		FULTON COUNTY, ILLINOIS
277		FULTON COUNTY, ILLINOIS
278		FULTON COUNTY, ILLINOIS
279		FULTON COUNTY, ILLINOIS
280		FULTON COUNTY, ILLINOIS
281		FULTON COUNTY, ILLINOIS
282		FULTON COUNTY, ILLINOIS
283		FULTON COUNTY, ILLINOIS
284		FULTON COUNTY, ILLINOIS
285		FULTON COUNTY, ILLINOIS
286		FULTON COUNTY, ILLINOIS
287		FULTON COUNTY, ILLINOIS
288		FULTON COUNTY, ILLINOIS
289		FULTON COUNTY, ILLINOIS
290		FULTON COUNTY, ILLINOIS
291		FULTON COUNTY, ILLINOIS
292		FULTON COUNTY, ILLINOIS
293		FULTON COUNTY, ILLINOIS
294		FULTON COUNTY, ILLINOIS

TABLE F-2. COPPER DATA

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
1	GIORDANO AND MAYS 1977	BEANS								
2	GIORDANO AND MAYS 1977	BEANS		6.6			2.5	50	350	730
3	GIORDANO AND MAYS 1977	BEANS		6.1			1.7	40	400	520
4	GIORDANO AND MAYS 1977	OKRA								
5	GIORDANO AND MAYS 1977	OKRA		6.6			2.5	50	350	730
6	GIORDANO AND MAYS 1977	OKRA		6.1			1.7	40	400	520
7	GIORDANO AND MAYS 1977	PEPPERS								
8	GIORDANO AND MAYS 1977	PEPPERS		6.6			2.5	50	350	730
9	GIORDANO AND MAYS 1977	PEPPERS		6.1			1.7	40	400	520
10	GIORDANO AND MAYS 1977	TOMATO								
11	GIORDANO AND MAYS 1977	TOMATO		6.6			2.5	50	350	730
12	GIORDANO AND MAYS 1977	TOMATO		6.1			1.7	40	400	520
13	GIORDANO AND MAYS 1977	SQUASH								
14	GIORDANO AND MAYS 1977	SQUASH		6.6			2.5	50	350	730
15	GIORDANO AND MAYS 1977	SQUASH		6.1			1.7	40	400	520
16	GIORDANO AND MAYS 1977	TURNIP								
17	GIORDANO AND MAYS 1977	TURNIP		6.6			2.5	50	350	730
18	GIORDANO AND MAYS 1977	TURNIP		6.1			1.7	40	400	520
19	GIORDANO AND MAYS 1977	KALE								
20	GIORDANO AND MAYS 1977	KALE		6.6			2.5	50	350	730
21	GIORDANO AND MAYS 1977	KALE		6.1			1.7	40	400	520
22	GIORDANO AND MAYS 1977	OKRA								
23	GIORDANO AND MAYS 1977	OKRA		6.6			2.5	50	350	730
24	GIORDANO AND MAYS 1977	OKRA		6.1			1.7	40	400	520
25	GIORDANO AND MAYS 1977	PEPPER								
26	GIORDANO AND MAYS 1977	PEPPER		6.6			2.5	50	350	730
27	GIORDANO AND MAYS 1977	PEPPER		6.1			1.7	40	400	520
28	GIORDANO AND MAYS 1977	TOMATO								
29	GIORDANO AND MAYS 1977	TOMATO		6.6			2.5	50	350	730
30	GIORDANO AND MAYS 1977	TOMATO		6.1			1.7	40	400	520
31	GIORDANO AND MAYS 1977	SQUASH								
32	GIORDANO AND MAYS 1977	SQUASH		6.6			2.5	50	350	730
33	GIORDANO AND MAYS 1977	SQUASH		6.1			1.7	40	400	520
34	GIORDANO AND MAYS 1977	LETTUCE								
35	GIORDANO AND MAYS 1977	LETTUCE		6.6			2.5	50	350	730
36	GIORDANO AND MAYS 1977	LETTUCE		6.1			1.7	40	400	520
37	HINESLY 1985	CORN					3.4	263	2963	1422

TABLE F-2 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
1									
2	1.7	2.3	20	1.6	530	1800			
3	1.5	2.1	40	1.3	1600	1800			
4									
5	1.7	2.3	20	1.6	530	1800			
6	1.5	2.1	40	1.3	1600	1800			
7									
8	1.7	2.3	20	1.6	530	1800			
9	1.5	2.1	40	1.3	1600	1800			
10									
11	1.7	2.3	20	1.6	530	1800			
12	1.5	2.1	40	1.3	1600	1800			
13									
14	1.7	2.3	20	1.6	530	1800			
15	1.5	2.1	40	1.3	1600	1800			
16									
17	1.7	2.3	20	1.6	530	1800			
18	1.5	2.1	40	1.3	1600	1800			
19									
20	1.7	2.3	20	1.6	530	1800			
21	1.5	2.1	40	1.3	1600	1800			
22									
23	1.7	2.3	20	1.6	530	1800			
24	1.5	2.1	40	1.3	1600	1800			
25									
26	1.7	2.3	20	1.6	530	1800			
27	1.5	2.1	40	1.3	1600	1800			
28									
29	1.7	2.3	20	1.6	530	1800			
30	1.5	2.1	40	1.3	1600	1800			
31									
32	1.7	2.3	20	1.6	530	1800			
33	1.5	2.1	40	1.3	1600	1800			
34									
35	1.7	2.3	20	1.6	530	1800			
36	1.5	2.1	40	1.3	1600	1800			
37	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-2 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg
1	0	0			SANGO	SiL				
2	112	112	0		SANGO	SiL				
3	112	112	0		SANGO	SiL				
4	0	0			SANGO	SiL				
5	112	112	0		SANGO	SiL				
6	112	112	0		SANGO	SiL				
7	0	0			SANGO	SiL				
8	112	112	0		SANGO	SiL				
9	112	112	0		SANGO	SiL				
10	0	0			SANGO	SiL				
11	112	112	0		SANGO	SiL				
12	112	112	0		SANGO	SiL				
13	0	0			SANGO	SiL				
14	112	112	0		SANGO	SiL				
15	112	112	0		SANGO	SiL				
16	0	0			SANGO	SiL				
17	112	112	0		SANGO	SiL				
18	112	112	0		SANGO	SiL				
19	0	0			SANGO	SiL				
20	112	112	0		SANGO	SiL				
21	112	112	0		SANGO	SiL				
22	0	0			SANGO	SiL				
23	112	112	1		SANGO	SiL				
24	112	112	1		SANGO	SiL				
25	0	0			SANGO	SiL				
26	112	112	1		SANGO	SiL				
27	112	112	1		SANGO	SiL				
28	0	0			SANGO	SiL				
29	112	112	1		SANGO	SiL				
30	112	112	1		SANGO	SiL				
31	0	0			SANGO	SiL				
32	112	112	1		SANGO	SiL				
33	112	112	1		SANGO	SiL				
34	0	0			SANGO	SiL				
35	112	112	1		SANGO	SiL				
36	112	112	1		SANGO	SiL				
37	0	0	NA		BLOUNT	SiL				

TABLE F-2 (cont.)

	SOIL OC %	SOIL pH	CUMM CU LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CU CONCENTRTN mg/kg	PLANT CU CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %
1		6.4	0	0.5 M HCL	4	6	LEAF	FIELD, SLUDGE, MATURITY	0
2		6.4	82	0.5 M HCL	41	7.8	LEAF	FIELD, SLUDGE, MATURITY	0
3		6.4	58	0.5 M HCL	17	5.8	LEAF	FIELD, SLUDGE, MATURITY	14.3*
4		6.4	0	0.5 M HCL	4	6.9	LEAF	FIELD, SLUDGE, MATURITY	0
5		6.4	82	0.5 M HCL	41	10	LEAF	FIELD, SLUDGE, MATURITY	8.3*
6		6.4	58	0.5 M HCL	17	7.1	LEAF	FIELD, SLUDGE, MATURITY	8.3*
7		6.4	0	0.5 M HCL	4	19	LEAF	FIELD, SLUDGE, MATURITY	0
8		6.4	82	0.5 M HCL	41	21	LEAF	FIELD, SLUDGE, MATURITY	0
9		6.4	58	0.5 M HCL	17	18	LEAF	FIELD, SLUDGE, MATURITY	13*
10		6.4	0	0.5 M HCL	4	19	LEAF	FIELD, SLUDGE, MATURITY	0
11		6.4	82	0.5 M HCL	41	22	LEAF	FIELD, SLUDGE, MATURITY	0
12		6.4	58	0.5 M HCL	17	18	LEAF	FIELD, SLUDGE, MATURITY	0
13		6.4	0	0.5 M HCL	4	14	LEAF	FIELD, SLUDGE, MATURITY	0
14		6.4	82	0.5 M HCL	41	19	LEAF	FIELD, SLUDGE, MATURITY	0
15		6.4	58	0.5 M HCL	17	15	LEAF	FIELD, SLUDGE, MATURITY	0
16		6.4	0	0.5 M HCL	4	6.3	LEAF	FIELD, SLUDGE, MATURITY	0
17		6.4	82	0.5 M HCL	41	9.4	LEAF	FIELD, SLUDGE, MATURITY	0
18		6.4	58	0.5 M HCL	17	7.3	LEAF	FIELD, SLUDGE, MATURITY	0
19		6.4	0	0.5 M HCL	4	6	LEAF	FIELD, SLUDGE, MATURITY	0
20		6.4	82	0.5 M HCL	41	8.1	LEAF	FIELD, SLUDGE, MATURITY	0
21		6.4	58	0.5 M HCL	17	7.6	LEAF	FIELD, SLUDGE, MATURITY	0
22		5.8	0	0.5 M HCL	4	15.4	LEAF	FIELD, SLUDGE, MATURITY	0
23		5.8	82	0.5 M HCL	41	14.1	LEAF	FIELD, SLUDGE, MATURITY	0
24		5.8	58	0.5 M HCL	17	14.1	LEAF	FIELD, SLUDGE, MATURITY	0
25		5.8	0	0.5 M HCL	4	14.7	LEAF	FIELD, SLUDGE, MATURITY	0
26		5.8	82	0.5 M HCL	41	15.4	LEAF	FIELD, SLUDGE, MATURITY	0
27		5.8	58	0.5 M HCL	17	15.4	LEAF	FIELD, SLUDGE, MATURITY	25*
28		5.8	0	0.5 M HCL	4	21.4	LEAF	FIELD, SLUDGE, MATURITY	0
29		5.8	82	0.5 M HCL	41	19.4	LEAF	FIELD, SLUDGE, MATURITY	0
30		5.8	58	0.5 M HCL	17	22.8	LEAF	FIELD, SLUDGE, MATURITY	0
31		5.8	0	0.5 M HCL	4	16.1	LEAF	FIELD, SLUDGE, MATURITY	0
32		5.8	82	0.5 M HCL	41	12.1	LEAF	FIELD, SLUDGE, MATURITY	0
33		5.8	58	0.5 M HCL	17	9.4	LEAF	FIELD, SLUDGE, MATURITY	21.1*
34		5.8	0	0.5 M HCL	4	17.4	LEAF	FIELD, SLUDGE, MATURITY	0
35		5.8	82	0.5 M HCL	41	18.1	LEAF	FIELD, SLUDGE, MATURITY	0
36		5.8	58	0.5 M HCL	17	12.7	LEAF	FIELD, SLUDGE, MATURITY	0
37	0.85	7.8	0	HCL-HF	22	9	LEAF	SLUDGE, FIELD, MATURITY	0

TABLE F-2 (cont.)

	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
1	EDIBLE PART			NO
2	EDIBLE PART			NO
3	EDIBLE PART			*NO
4	EDIBLE PART			NO
5	EDIBLE PART			*NO
6	EDIBLE PART			*NO
7	EDIBLE PART			NO
8	EDIBLE PART			NO
9	EDIBLE PART			*NO
10	EDIBLE PART			NO
11	EDIBLE PART			NO
12	EDIBLE PART			NO
13	EDIBLE PART			NO
14	EDIBLE PART			NO
15	EDIBLE PART			NO
16	EDIBLE PART			NO
17	EDIBLE PART			NO
18	EDIBLE PART			NO
19	EDIBLE PART			NO
20	EDIBLE PART			NO
21	EDIBLE PART			NO
22	EDIBLE PART			NO
23	EDIBLE PART			NO
24	EDIBLE PART			NO
25	EDIBLE PART			NO
26	EDIBLE PART			NO
27	EDIBLE PART			*NO
28	EDIBLE PART			NO
29	EDIBLE PART			NO
30	EDIBLE PART			NO
31	EDIBLE PART			NO
32	EDIBLE PART			NO
33	EDIBLE PART			*NO
34	EDIBLE PART			NO
35	EDIBLE PART			NO
36	EDIBLE PART			NO
37	GRAIN	0	STOVER	NO

TABLE F-2 (cont.)

	COMMENTS	LOCATION
1		
2		
3	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	
4		
5	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	
6	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	
7		
8		
9	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	
28		
29		
30		
31		
32		
33	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	
34		
35		
36		
37		JOLIET, ILLINOIS

TABLE F-2 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
38	HINESLY 1985	CORN					3.4	263	2963	1422
39	HINESLY 1985	CORN					3.4	263	2963	1422
40	HINESLY 1985	CORN					3.4	263	2963	1422
41	HINESLY 1985	CORN					3.4	263	2963	1422
42	HINESLY 1985	CORN					3.4	263	2963	1422
43	HINESLY 1985	CORN					3.4	263	2963	1422
44	HINESLY 1985	CORN					3.4	263	2963	1422
45	HINESLY 1985	CORN					3.4	263	2963	1422
46	HINESLY 1985	CORN					3.4	263	2963	1422
47	HINESLY 1985	CORN					3.4	263	2963	1422
48	HINESLY 1985	CORN					3.4	263	2963	1422
49	HINESLY 1985	CORN					3.4	263	2963	1422
50	HINESLY 1985	CORN					3.4	263	2963	1422
51	HINESLY 1985	CORN					3.4	263	2963	1422
52	HINESLY 1985	CORN					3.4	263	2963	1422
53	HINESLY 1985	CORN					3.4	263	2963	1422
54	HINESLY 1985	CORN					3.4	263	2963	1422
55	HINESLY 1985	CORN					3.4	263	2963	1422
56	HINESLY 1985	CORN					3.4	263	2963	1422
57	HINESLY 1985	CORN					3.4	263	2963	1422
58	HINESLY 1985	CORN					3.4	263	2963	1422
59	HINESLY 1985	CORN					3.4	263	2963	1422
60	HINESLY 1985	CORN					3.4	263	2963	1422
61	HINESLY 1985	CORN					3.4	263	2963	1422
62	HINESLY 1985	CORN					3.4	263	2963	1422
63	HINESLY 1985	CORN					3.4	263	2963	1422
64	HINESLY 1985	CORN					3.4	263	2963	1422
65	HINESLY 1985	CORN					3.4	263	2963	1422
66	HINESLY 1985	CORN					3.4	263	2963	1422
67	HINESLY 1985	CORN					3.4	263	2963	1422
68	HINESLY 1985	CORN					3.4	263	2963	1422
69	HINESLY 1985	CORN					3.4	263	2963	1422
70	HINESLY 1985	CORN					3.4	263	2963	1422
71	HINESLY 1985	CORN					3.4	263	2963	1422
72	HINESLY 1985	CORN					3.4	263	2963	1422
73	HINESLY 1985	CORN					3.4	263	2963	1422
74	HINESLY 1985	CORN					3.4	263	2963	1422

TABLE F-2 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
38	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
39	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
40	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
41	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
42	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
43	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
44	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
45	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
46	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
47	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
48	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
49	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
50	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
51	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
52	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
53	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
54	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
55	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
56	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
57	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
58	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
59	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
60	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
61	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
62	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
63	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
64	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
65	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
66	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
67	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
68	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
69	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
70	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
71	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
72	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
73	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
74	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-2 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg
38	0	0	NA		BLOUNT	SiL				
39	0	0	NA		BLOUNT	SiL				
40	0	0	NA		BLOUNT	SiL				
41	0	0	NA		BLOUNT	SiL				
42	0	0	NA		BLOUNT	SiL				
43	0	0	NA		BLOUNT	SiL				
44	0	0	NA		BLOUNT	SiL				
45	0	0	NA		BLOUNT	SiL				
46	0	0	NA		BLOUNT	SiL				
47	14.5	31.8	0		BLOUNT	SiL				
48	11.1	42.9	0		BLOUNT	SiL				
49	15.3	58.2	0		BLOUNT	SiL				
50	0	58.2	1		BLOUNT	SiL				
51	0	58.2	2		BLOUNT	SiL				
52	0	58.2	3		BLOUNT	SiL				
53	0	58.2	4		BLOUNT	SiL				
54	0	58.2	5		BLOUNT	SiL				
55	0	58.2	6		BLOUNT	SiL				
56	0	58.2	7		BLOUNT	SiL				
57	29	63.6	0		BLOUNT	SiL				
58	22.2	85.8	0		BLOUNT	SiL				
59	30.6	116.4	0		BLOUNT	SiL				
60	0	116.4	1		BLOUNT	SiL				
61	0	116.4	2		BLOUNT	SiL				
62	0	116.4	3		BLOUNT	SiL				
63	0	116.4	4		BLOUNT	SiL				
64	0	116.4	5		BLOUNT	SiL				
65	0	116.4	6		BLOUNT	SiL				
66	0	116.4	7		BLOUNT	SiL				
67	57.8	127	0		BLOUNT	SiL				
68	44.4	171.4	0		BLOUNT	SiL				
69	61.1	232.5	0		BLOUNT	SiL				
70	0	232.5	1		BLOUNT	SiL				
71	0	232.5	1		BLOUNT	SiL				
72	0	232.5	1		BLOUNT	SiL				
73	0	232.5	1		BLOUNT	SiL				
74	0	232.5	1		BLOUNT	SiL				

TABLE F-2 (cont.)

	SOIL OC %	SOIL pH	CUMM CU LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CU CONCENTRTN mg/kg	PLANT CU CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %
38	0.9	6.9	0	HCL-HF	20	11.8	LEAF	SLUDGE, FIELD, MATURITY	0
39	0.94	7.6	0	HCL-HF	28	9.3	LEAF	SLUDGE, FIELD, MATURITY	0
40	0.93	7.6	0	HCL-HF	22	11.4	LEAF	SLUDGE, FIELD, MATURITY	0
41	0.92	7.8	0	HCL-HF	24	7	LEAF	SLUDGE, FIELD, MATURITY	0
42	0.87	7.5	0	HCL-HF	21	10.6	LEAF	SLUDGE, FIELD, MATURITY	0
43	0.9	7.6	0	HCL-HF	25	6.1	LEAF	SLUDGE, FIELD, MATURITY	0
44	0.88	7.5	0	HCL-HF	26	3.4	LEAF	SLUDGE, FIELD, MATURITY	0
45	0.73	7.6	0	HCL-HF	22	8.3	LEAF	SLUDGE, FIELD, MATURITY	0
46	1	7.4	0	HCL-HF	28	8.5	LEAF	SLUDGE, FIELD, MATURITY	0
47	1.06	7.7	51.5	HCL-HF	42	11.4	LEAF	SLUDGE, FIELD, MATURITY	0
48	1.11	6.9	59.8	HCL-HF	28	12.2	LEAF	SLUDGE, FIELD, MATURITY	0
49	1.18	7.5	70	HCL-HF	42	8.7	LEAF	SLUDGE, FIELD, MATURITY	0
50	1.4	7.5	70	HCL-HF	40	9.6	LEAF	SLUDGE, FIELD, MATURITY.	0
51	1.16	7.6	70	HCL-HF	42	7.7	LEAF	SLUDGE, FIELD, MATURITY	0
52	1.08	7.5	70	HCL-HF	38	7.9	LEAF	SLUDGE, FIELD, MATURITY	0
53	1.18	7.7	70	HCL-HF	45	5.9	LEAF	SLUDGE, FIELD, MATURITY	0
54	1.23	7.6	70	HCL-HF	44	3.8	LEAF	SLUDGE, FIELD, MATURITY	0
55	1.09	7.5	70	HCL-HF	36	8.8	LEAF	SLUDGE, FIELD, MATURITY	0
56	1.32	7.3	70	HCL-HF	45	8.6	LEAF	SLUDGE, FIELD, MATURITY	0
57	1.38	7.6	103	HCL-HF	60	11.9	LEAF	SLUDGE, FIELD, MATURITY	0
58	1.12	7	119.6	HCL-HF	38	14	LEAF	SLUDGE, FIELD, MATURITY	0
59	1.29	7.4	140	HCL-HF	57	8.7	LEAF	SLUDGE, FIELD, MATURITY	0
60	1.83	7.3	140	HCL-HF	67	9.7	LEAF	SLUDGE, FIELD, MATURITY	0
61	1.36	7.5	140	HCL-HF	56	9.8	LEAF	SLUDGE, FIELD, MATURITY	0
62	1.34	7.2	140	HCL-HF	49	7.9	LEAF	SLUDGE, FIELD, MATURITY	0
63	1.6	7.4	140	HCL-HF	64	6.9	LEAF	SLUDGE, FIELD, MATURITY	0
64	1.31	7.3	140	HCL-HF	68	3.9	LEAF	SLUDGE, FIELD, MATURITY	0
65	1.54	7.1	140	HCL-HF	48	8.6	LEAF	SLUDGE, FIELD, MATURITY	0
66	1.62	7.1	140	HCL-HF	67	8.9	LEAF	SLUDGE, FIELD, MATURITY	0
67	1.62	7.6	206	HCL-HF	102	10.7	LEAF	SLUDGE, FIELD, MATURITY	0
68	1.63	6.8	239	HCL-HF	65	14.9	LEAF	SLUDGE, FIELD, MATURITY	0
69	1.94	7.3	280	HCL-HF	91	9.4	LEAF	SLUDGE, FIELD, MATURITY	0
70	2.5	7.2	280	HCL-HF	116	11.2	LEAF	SLUDGE, FIELD, MATURITY	0
71	1.83	7.3	280	HCL-HF	91	10.3	LEAF	SLUDGE, FIELD, MATURITY	0
72	1.88	7.2	280	HCL-HF	88	9.2	LEAF	SLUDGE, FIELD, MATURITY	0
73	2.03	7.3	280	HCL-HF	106	7.3	LEAF	SLUDGE, FIELD, MATURITY	0
74	1.6	7.1	280	HCL-HF	94	4.5	LEAF	SLUDGE, FIELD, MATURITY	0

TABLE F-2 (cont.)

	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
38	GRAIN	0	STOVER	NO
39	GRAIN	0	STOVER	NO
40	GRAIN	0	STOVER	NO
41	GRAIN	0	STOVER	NO
42	GRAIN	0	STOVER	NO
43	GRAIN	0	STOVER	NO
44	GRAIN	0	STOVER	NO
45	GRAIN	0	STOVER	NO
46	GRAIN	0	STOVER	NO
47	GRAIN	NA	STOVER	NO
48	GRAIN	0	STOVER	NO
49	GRAIN	0	STOVER	NO
50	GRAIN	0	STOVER	NO
51	GRAIN	0	STOVER	NO
52	GRAIN	0	STOVER	NO
53	GRAIN	0	STOVER	NO
54	GRAIN	0	STOVER	NO
55	GRAIN	0	STOVER	NO
56	GRAIN	0	STOVER	NO
57	GRAIN	NA	STOVER	NO
58	GRAIN	0	STOVER	NO
59	GRAIN	0	STOVER	NO
60	GRAIN	0	STOVER	NO
61	GRAIN	0	STOVER	NO
62	GRAIN	0	STOVER	NO
63	GRAIN	0	STOVER	NO
64	GRAIN	0	STOVER	NO
65	GRAIN	0	STOVER	NO
66	GRAIN	0	STOVER	NO
67	GRAIN	NA	STOVER	NO
68	GRAIN	0	STOVER	NO
69	GRAIN	0	STOVER	NO
70	GRAIN	0	STOVER	NO
71	GRAIN	0	STOVER	NO
72	GRAIN	0	STOVER	NO
73	GRAIN	0	STOVER	NO
74	GRAIN	0	STOVER	NO

TABLE F-2 (cont.)

	COMMENTS	LOCATION
38		JOLIET, ILLINOIS
39		JOLIET, ILLINOIS
40		JOLIET, ILLINOIS
41		JOLIET, ILLINOIS
42		JOLIET, ILLINOIS
43		JOLIET, ILLINOIS
44		JOLIET, ILLINOIS
45		JOLIET, ILLINOIS
46		JOLIET, ILLINOIS
47		JOLIET, ILLINOIS
48		JOLIET, ILLINOIS
49		JOLIET, ILLINOIS
50		JOLIET, ILLINOIS
51		JOLIET, ILLINOIS
52		JOLIET, ILLINOIS
53		JOLIET, ILLINOIS
54		JOLIET, ILLINOIS
55		JOLIET, ILLINOIS
56		JOLIET, ILLINOIS
57		JOLIET, ILLINOIS
58		JOLIET, ILLINOIS
59		JOLIET, ILLINOIS
60		JOLIET, ILLINOIS
61		JOLIET, ILLINOIS
62		JOLIET, ILLINOIS
63		JOLIET, ILLINOIS
64		JOLIET, ILLINOIS
65		JOLIET, ILLINOIS
66		JOLIET, ILLINOIS
67		JOLIET, ILLINOIS
68		JOLIET, ILLINOIS
69		JOLIET, ILLINOIS
70		JOLIET, ILLINOIS
71		JOLIET, ILLINOIS
72		JOLIET, ILLINOIS
73		JOLIET, ILLINOIS
74		JOLIET, ILLINOIS

TABLE F-2 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
75	HINESLY 1985	CORN					3.4	263	2963	1422
76	HINESLY 1985	CORN					3.4	263	2963	1422
77	HINESLY 1985	CORN					3.4	263	2963	1422
78	HINESLY 1985	CORN					3.4	263	2963	1422
79	HINESLY 1985	CORN					3.4	263	2963	1422
80	HINESLY 1985	CORN					3.4	263	2963	1422
81	HINESLY 1985	CORN					3.4	263	2963	1422
82	HINESLY 1985	CORN					3.4	263	2963	1422
83	HINESLY 1985	CORN					3.4	263	2963	1422
84	HINESLY 1985	CORN					3.4	263	2963	1422
85	HINESLY 1985	CORN					3.4	263	2963	1422
86	HINESLY 1985	CORN					3.4	263	2963	1422
87	HINESLY 1985	CORN					3.4	263	2963	1422
88	HINESLY 1985	CORN					3.4	263	2963	1422
89	HINESLY 1985	CORN					3.4	263	2963	1422
90	HINESLY 1985	CORN					3.4	263	2963	1422
91	HINESLY 1985	CORN					3.4	263	2963	1422
92	HINESLY 1985	CORN					3.4	263	2963	1422
93	HINESLY 1985	CORN					3.4	263	2963	1422
94	HINESLY 1985	CORN					3.4	263	2963	1422
95	HINESLY 1985	CORN					3.4	263	2963	1422
96	HINESLY 1985	CORN					3.4	263	2963	1422
97	HINESLY 1985	CORN					3.4	263	2963	1422
98	HINESLY 1985	CORN					3.4	263	2963	1422
99	HINESLY 1985	CORN					3.4	263	2963	1422
100	HINESLY 1985	CORN					3.4	263	2963	1422
101	HINESLY 1985	CORN					3.4	263	2963	1422
102	HINESLY 1985	CORN					3.4	263	2963	1422
103	HINESLY 1985	CORN					3.4	263	2963	1422
104	HINESLY 1985	CORN					3.4	263	2963	1422
105	HINESLY 1985	CORN					3.4	263	2963	1422
106	HINESLY 1985	CORN					3.4	263	2963	1422
107	HINESLY 1985	CORN					3.4	263	2963	1422
108	HINESLY 1985	CORN					3.4	263	2963	1422
109	HINESLY 1985	CORN					3.4	263	2963	1422
110	HINESLY 1985	CORN					3.4	263	2963	1422
111	HINESLY 1985	CORN					3.4	263	2963	1422

TABLE F-2 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
75	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
76	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
77	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
78	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
79	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
80	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
81	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
82	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
83	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
84	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
85	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
86	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
87	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
88	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
89	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
90	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
91	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
92	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
93	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
94	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
95	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
96	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
97	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
98	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
99	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
100	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
101	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
102	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
103	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
104	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
105	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
106	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
107	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
108	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
109	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
110	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
111	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-2 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg
75	0	232.5	1		BLOUNT	SiL				
76	0	232.5	1		BLOUNT	SiL				
77	0	0	NA		ELLIOT	SiL				
78	0	0	NA		ELLIOT	SiL				
79	0	0	NA		ELLIOT	SiL				
80	0	0	NA		ELLIOT	SiL				
81	0	0	NA		ELLIOT	SiL				
82	0	0	NA		ELLIOT	SiL				
83	0	0	NA		ELLIOT	SiL				
84	0	0	NA		ELLIOT	SiL				
85	0	0	NA		ELLIOT	SiL				
86	0	0	NA		ELLIOT	SiL				
87	14.5	31.8	0		ELLIOT	SiL				
88	11.1	42.9	0		ELLIOT	SiL				
89	15.3	58.2	0		ELLIOT	SiL				
90	0	58.2	1		ELLIOT	SiL				
91	0	58.2	2		ELLIOT	SiL				
92	0	58.2	3		ELLIOT	SiL				
93	0	58.2	4		ELLIOT	SiL				
94	0	58.2	5		ELLIOT	SiL				
95	0	58.2	6		ELLIOT	SiL				
96	0	58.2	7		ELLIOT	SiL				
97	29	63.6	0		ELLIOT	SiL				
98	22.2	85.8	0		ELLIOT	SiL				
99	30.6	116.4	0		ELLIOT	SiL				
100	0	116.4	1		ELLIOT	SiL				
101	0	116.4	2		ELLIOT	SiL				
102	0	116.4	3		ELLIOT	SiL				
103	0	116.4	4		ELLIOT	SiL				
104	0	116.4	5		ELLIOT	SiL				
105	0	116.4	6		ELLIOT	SiL				
106	0	116.4	7		ELLIOT	SiL				
107	57.8	127	0		ELLIOT	SiL				
108	44.4	171.4	0		ELLIOT	SiL				
109	61.1	232.5	0		ELLIOT	SiL				
110	69.8	302.3	0		ELLIOT	SiL				
111	54	356.3	0		ELLIOT	SiL				

TABLE F-2 (cont.)

	SOIL OC %	SOIL pH	CUMM CU LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CU CONCENTRTN mg/kg	PLANT CU CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %
75	1.54	7.1	280	HCL-HF	62	8.8	LEAF	SLUDGE, FIELD, MATURITY	0
76	1.84	7	280	HCL-HF	86	8.7	LEAF	SLUDGE, FIELD, MATURITY	0
77	1.64	7.6	0	HCL-HF	19	10.2	LEAF	SLUDGE, FIELD, MATURITY	0
78	1.61	6.8	0	HCL-HF	27	11.6	LEAF	SLUDGE, FIELD, MATURITY	0
79	1.54	7.2	0	HCL-HF	26	5.8	LEAF	SLUDGE, FIELD, MATURITY	0
80	1.53	7.2	0	HCL-HF	20	11.1	LEAF	SLUDGE, FIELD, MATURITY	0
81	1.54	7	0	HCL-HF	22	9.5	LEAF	SLUDGE, FIELD, MATURITY	0
82	1.51	7	0	HCL-HF	18	8	LEAF	SLUDGE, FIELD, MATURITY	0
83	1.58	7.4	0	HCL-HF	23	5.3	LEAF	SLUDGE, FIELD, MATURITY	0
84	1.54	7.2	0	HCL-HF	26	3.7	LEAF	SLUDGE, FIELD, MATURITY	0
85	1.51	7	0	HCL-HF	19	8.6	LEAF	SLUDGE, FIELD, MATURITY	0
86	1.62	7	0	HCL-HF	26	7.8	LEAF	SLUDGE, FIELD, MATURITY	0
87	1.64	7.3	51.5	HCL-HF	39	13.2	LEAF	SLUDGE, FIELD, MATURITY	0
88	1.84	6.8	59.8	HCL-HF	32	9.6	LEAF	SLUDGE, FIELD, MATURITY	0
89	1.74	7.1	70	HCL-HF	39	7.5	LEAF	SLUDGE, FIELD, MATURITY	0
90	2.18	7.1	70	HCL-HF	32	9.8	LEAF	SLUDGE, FIELD, MATURITY	0
91	1.86	7.2	70	HCL-HF	44	8.6	LEAF	SLUDGE, FIELD, MATURITY	0
92	1.67	7.2	70	HCL-HF	38	6.9	LEAF	SLUDGE, FIELD, MATURITY	0
93	1.83	7.5	70	HCL-HF	49	6.4	LEAF	SLUDGE, FIELD, MATURITY	0
94	1.55	7.2	70	HCL-HF	44	4	LEAF	SLUDGE, FIELD, MATURITY	0
95	1.68	7	70	HCL-HF	36	9.1	LEAF	SLUDGE, FIELD, MATURITY	0
96	1.89	7.1	70	HCL-HF	51	7.7	LEAF	SLUDGE, FIELD, MATURITY	0
97	1.97	7.8	103	HCL-HF	65	12.8	LEAF	SLUDGE, FIELD, MATURITY	0
98	1.81	7	119.6	HCL-HF	41	12.7	LEAF	SLUDGE, FIELD, MATURITY	0
99	1.88	7.3	140	HCL-HF	64	9.9	LEAF	SLUDGE, FIELD, MATURITY	0
100	2.21	7.3	140	HCL-HF	62	9.9	LEAF	SLUDGE, FIELD, MATURITY	0
101	1.99	7.4	140	HCL-HF	59	9.9	LEAF	SLUDGE, FIELD, MATURITY	0
102	1.89	7.3	140	HCL-HF	56	8	LEAF	SLUDGE, FIELD, MATURITY	0
103	1.94	7.4	140	HCL-HF	61	7.8	LEAF	SLUDGE, FIELD, MATURITY	0
104	1.72	7.4	140	HCL-HF	68	4.4	LEAF	SLUDGE, FIELD, MATURITY	0
105	1.79	7.2	140	HCL-HF	50	8.4	LEAF	SLUDGE, FIELD, MATURITY	0
106	1.87	7.2	140	HCL-HF	54	8.7	LEAF	SLUDGE, FIELD, MATURITY	0
107	2.23	7.5	206	HCL-HF	150	6.4	LEAF	SLUDGE, FIELD, MATURITY	0
108	2.22	6.4	239.2	HCL-HF	64	13.9	LEAF	SLUDGE, FIELD, MATURITY	0
109	2.28	6.5	280	HCL-HF	92	5.6	LEAF	SLUDGE, FIELD, MATURITY	0
110	2.61	6.5	397	HCL-HF	112	9	LEAF	SLUDGE, FIELD, MATURITY	0
111	2.74	6.5	482	HCL-HF	117	12.4	LEAF	SLUDGE, FIELD, MATURITY	0

TABLE F-2 (cont.)

	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
75	GRAIN	0	STOVER	NO
76	GRAIN	0	STOVER	NO
77	GRAIN	0	STOVER	NO
78	GRAIN	0	STOVER	NO
79	GRAIN	0	STOVER	NO
80	GRAIN	0	STOVER	NO
81	GRAIN	0	STOVER	NO
82	GRAIN	0	STOVER	NO
83	GRAIN	0	STOVER	NO
84	GRAIN	0	STOVER	NO
85	GRAIN	0	STOVER	NO
86	GRAIN	0	STOVER	NO
87	GRAIN	NA	STOVER	NO
88	GRAIN	0	STOVER	NO
89	GRAIN	0	STOVER	NO
90	GRAIN	0	STOVER	NO
91	GRAIN	0	STOVER	NO
92	GRAIN	0	STOVER	NO
93	GRAIN	0	STOVER	NO
94	GRAIN	0	STOVER	NO
95	GRAIN	0	STOVER	NO
96	GRAIN	0	STOVER	NO
97	GRAIN	NA	STOVER	NO
98	GRAIN	0	STOVER	NO
99	GRAIN	0	STOVER	NO
100	GRAIN	0	STOVER	NO
101	GRAIN	0	STOVER	NO
102	GRAIN	0	STOVER	NO
103	GRAIN	0	STOVER	NO
104	GRAIN	0	STOVER	NO
105	GRAIN	0	STOVER	NO
106	GRAIN	0	STOVER	NO
107	GRAIN	NA	STOVER	NO
108	GRAIN	0	STOVER	NO
109	GRAIN	0	STOVER	NO
110	GRAIN	0	STOVER	NO
111	GRAIN	0	STOVER	NO

TABLE F-2 (cont.)

	COMMENTS	LOCATION
75		JOLIET, ILLINOIS
76		JOLIET, ILLINOIS
77		JOLIET, ILLINOIS
78		JOLIET, ILLINOIS
79		JOLIET, ILLINOIS
80		JOLIET, ILLINOIS
81		JOLIET, ILLINOIS
82		JOLIET, ILLINOIS
83		JOLIET, ILLINOIS
84		JOLIET, ILLINOIS
85		JOLIET, ILLINOIS
86		JOLIET, ILLINOIS
87		JOLIET, ILLINOIS
88		JOLIET, ILLINOIS
89		JOLIET, ILLINOIS
90		JOLIET, ILLINOIS
91		JOLIET, ILLINOIS
92		JOLIET, ILLINOIS
93		JOLIET, ILLINOIS
94		JOLIET, ILLINOIS
95		JOLIET, ILLINOIS
96		JOLIET, ILLINOIS
97		JOLIET, ILLINOIS
98		JOLIET, ILLINOIS
99		JOLIET, ILLINOIS
100		JOLIET, ILLINOIS
101		JOLIET, ILLINOIS
102		JOLIET, ILLINOIS
103		JOLIET, ILLINOIS
104		JOLIET, ILLINOIS
105		JOLIET, ILLINOIS
106		JOLIET, ILLINOIS
107		JOLIET, ILLINOIS
108		JOLIET, ILLINOIS
109		JOLIET, ILLINOIS
110		JOLIET, ILLINOIS
111		JOLIET, ILLINOIS

TABLE F-2 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
112	HINESLY 1985	CORN					3.4	263	2963	1422
113	HINESLY 1985	CORN					3.4	263	2963	1422
114	HINESLY 1985	CORN					3.4	263	2963	1422
115	HINESLY 1985	CORN					3.4	263	2963	1422
116	HINESLY 1985	CORN					3.4	263	2963	1422
117	HINESLY 1985	CORN					3.4	263	2963	1422
118	HINESLY 1985	CORN					3.4	263	2963	1422
119	HINESLY 1985	CORN					3.4	263	2963	1422
120	HINESLY 1985	CORN					3.4	263	2963	1422
121	HINESLY 1985	CORN					3.4	263	2963	1422
122	HINESLY 1985	CORN					3.4	263	2963	1422
123	HINESLY 1985	CORN					3.4	263	2963	1422
124	HINESLY 1985	CORN					3.4	263	2963	1422
125	HINESLY 1985	CORN					3.4	263	2963	1422
126	HINESLY 1985	CORN					3.4	263	2963	1422
127	HINESLY 1985	CORN					3.4	263	2963	1422
128	HINESLY 1985	CORN					3.4	263	2963	1422
129	HINESLY 1985	CORN					3.4	263	2963	1422
130	HINESLY 1985	CORN					3.4	263	2963	1422
131	HINESLY 1985	CORN					3.4	263	2963	1422
132	HINESLY 1985	CORN					3.4	263	2963	1422
133	HINESLY 1985	CORN					3.4	263	2963	1422
134	HINESLY 1985	CORN					3.4	263	2963	1422
135	HINESLY 1985	CORN					3.4	263	2963	1422
136	HINESLY 1985	CORN					3.4	263	2963	1422
137	HINESLY 1985	CORN					3.4	263	2963	1422
138	HINESLY 1985	CORN					3.4	263	2963	1422
139	HINESLY 1985	CORN					3.4	263	2963	1422
140	HINESLY 1985	CORN					3.4	263	2963	1422
141	HINESLY 1985	CORN					3.4	263	2963	1422
142	HINESLY 1985	CORN					3.4	263	2963	1422
143	HINESLY 1985	CORN					3.4	263	2963	1422
144	HINESLY 1985	CORN					3.4	263	2963	1422
145	HINESLY 1985	CORN					3.4	263	2963	1422
146	HINESLY 1985	CORN					3.4	263	2963	1422
147	HINESLY 1985	CORN					3.4	263	2963	1422
148	HINESLY 1985	CORN					3.4	263	2963	1422

TABLE F-2 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
112	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
113	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
114	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
115	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
116	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
117	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
118	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
119	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
120	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
121	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
122	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
123	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
124	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
125	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
126	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
127	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
128	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
129	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
130	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
131	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
132	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
133	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
134	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
135	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
136	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
137	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
138	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
139	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
140	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
141	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
142	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
143	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
144	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
145	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
146	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
147	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
148	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-2 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg
112	72	428.3	0		ELLIOT	SiL				
113	0	428.3	1		ELLIOT	SiL				
114	0	428.3	2		ELLIOT	SiL				
115	0	428.3	3		ELLIOT	SiL				
116	0	428.3	4		ELLIOT	SiL				
117	0	0	NA		PLAINFIELD	SL				
118	0	0	NA		PLAINFIELD	SL				
119	0	0	NA		PLAINFIELD	SL				
120	0	0	NA		PLAINFIELD	SL				
121	0	0	NA		PLAINFIELD	SL				
122	0	0	NA		PLAINFIELD	SL				
123	0	0	NA		PLAINFIELD	SL				
124	0	0	NA		PLAINFIELD	SL				
125	0	0	NA		PLAINFIELD	SL				
126	0	0	NA		PLAINFIELD	SL				
127	14.5	31.8	0		PLAINFIELD	SL				
128	11.1	42.9	0		PLAINFIELD	SL				
129	15.3	58.2	0		PLAINFIELD	SL				
130	0	58.2	1		PLAINFIELD	SL				
131	0	58.2	2		PLAINFIELD	SL				
132	0	58.2	3		PLAINFIELD	SL				
133	0	58.2	4		PLAINFIELD	SL				
134	0	58.2	5		PLAINFIELD	SL				
135	0	58.2	6		PLAINFIELD	SL				
136	0	58.2	7		PLAINFIELD	SL				
137	29	63.6	0		PLAINFIELD	SL				
138	22.2	85.8	0		PLAINFIELD	SL				
139	30.6	116.4	0		PLAINFIELD	SL				
140	0	116.4	1		PLAINFIELD	SL				
141	0	116.4	2		PLAINFIELD	SL				
142	0	116.4	3		PLAINFIELD	SL				
143	0	116.4	4		PLAINFIELD	SL				
144	0	116.4	5		PLAINFIELD	SL				
145	0	116.4	6		PLAINFIELD	SL				
146	0	116.4	7		PLAINFIELD	SL				
147	57.8	127	0		PLAINFIELD	SL				
148	44.4	171.4	0		PLAINFIELD	SL				

TABLE F-2 (cont.)

	SOIL OC %	SOIL pH	CUMM CU LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CU CONCENTRTN mg/kg	PLANT CU CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %
112	2.94	5.9	609	HCL-HF	151	9.2	LEAF	SLUDGE, FIELD, MATURITY	0
113	3.92	5.9	609	HCL-HF	22	8.4	LEAF	SLUDGE, FIELD, MATURITY	0
114	3.77	5.8	609	HCL-HF	214	9.4	LEAF	SLUDGE, FIELD, MATURITY	0
115	2.6	6.1	609	HCL-HF	125	10.3	LEAF	SLUDGE, FIELD, MATURITY	0
116	3.2	6.1	609	HCL-HF	184	11.2	LEAF	SLUDGE, FIELD, MATURITY	0
117	0.39	7.8	0	HCL-HF	10	5	LEAF	SLUDGE, FIELD, MATURITY	NA
118	0.17	7.1	0	HCL-HF	9	10.5	LEAF	SLUDGE, FIELD, MATURITY	0
119	0.26	7.3	0	HCL-HF	12	7.9	LEAF	SLUDGE, FIELD, MATURITY	0
120	0.27	6.8	0	HCL-HF	5	5.6	LEAF	SLUDGE, FIELD, MATURITY	0
121	0.33	7.6	0	HCL-HF	12	5.4	LEAF	SLUDGE, FIELD, MATURITY	0
122	0.27	7.5	0	HCL-HF	8	5	LEAF	SLUDGE, FIELD, MATURITY	0
123	0.29	7.5	0	HCL-HF	10	4.5	LEAF	SLUDGE, FIELD, MATURITY	0
124	0.42	7.4	0	HCL-HF	12	2.7	LEAF	SLUDGE, FIELD, MATURITY	0
125	0.49	7.4	0	HCL-HF	12	5.8	LEAF	SLUDGE, FIELD, MATURITY	0
126	0.64	7.3	51.5	HCL-HF	21	5.6	LEAF	SLUDGE, FIELD, MATURITY	0
127	0.36	7.6	59.8	HCL-HF	36	9	LEAF	SLUDGE, FIELD, MATURITY	0
128	0.28	7.1	70	HCL-HF	14	12.5	LEAF	SLUDGE, FIELD, MATURITY	0
129	0.61	7.4	70	HCL-HF	27	8.7	LEAF	SLUDGE, FIELD, MATURITY	0
130	0.91	7.3	70	HCL-HF	37	6.2	LEAF	SLUDGE, FIELD, MATURITY	0
131	0.56	7.4	70	HCL-HF	28	4.4	LEAF	SLUDGE, FIELD, MATURITY	0
132	0.58	7.1	70	HCL-HF	26	6.5	LEAF	SLUDGE, FIELD, MATURITY	0
133	0.45	7.5	70	HCL-HF	25	3.6	LEAF	SLUDGE, FIELD, MATURITY	0
134	0.34	7.7	70	HCL-HF	33	3.1	LEAF	SLUDGE, FIELD, MATURITY	0
135	0.47	7.4	70	HCL-HF	36	7.5	LEAF	SLUDGE, FIELD, MATURITY	0
136	0.83	7.4	70	HCL-HF	37	6	LEAF	SLUDGE, FIELD, MATURITY	0
137	0.58	7.5	103	HCL-HF	68	9	LEAF	SLUDGE, FIELD, MATURITY	NA
138	0.44	6.9	119.6	HCL-HF	36	16.2	LEAF	SLUDGE, FIELD, MATURITY	0
139	0.81	7.1	140	HCL-HF	47	10.1	LEAF	SLUDGE, FIELD, MATURITY	0
140	0.95	6.8	140	HCL-HF	47	10.9	LEAF	SLUDGE, FIELD, MATURITY	0
141	0.75	7.1	140	HCL-HF	46	9.9	LEAF	SLUDGE, FIELD, MATURITY	0
142	0.96	7.1	140	HCL-HF	37	8.6	LEAF	SLUDGE, FIELD, MATURITY	0
143	0.59	6.9	140	HCL-HF	52	5	LEAF	SLUDGE, FIELD, MATURITY	0
144	0.89	7	140	HCL-HF	50	3.2	LEAF	SLUDGE, FIELD, MATURITY	0
145	0.81	7.1	140	HCL-HF	52	8.4	LEAF	SLUDGE, FIELD, MATURITY	0
146	0.52	7.1	140	HCL-HF	36	5.9	LEAF	SLUDGE, FIELD, MATURITY	0
147	0.9	7.6	206	HCL-HF	154	10.6	LEAF	SLUDGE, FIELD, MATURITY	NA
148	0.6	6.6	239	HCL-HF	42	12.2	LEAF	SLUDGE, FIELD, MATURITY	0

TABLE F-2 (cont.)

	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
112	GRAIN	0	STOVER	NO
113	GRAIN	0	STOVER	NO
114	GRAIN	0	STOVER	NO
115	GRAIN	0	STOVER	NO
116	GRAIN	0	STOVER	NO
117	GRAIN	0	STOVER	NO
118	GRAIN	0	STOVER	NO
119	GRAIN	0	STOVER	NO
120	GRAIN	0	STOVER	NO
121	GRAIN	0	STOVER	NO
122	GRAIN	0	STOVER	NO
123	GRAIN	0	STOVER	NO
124	GRAIN	0	STOVER	NO
125	GRAIN	0	STOVER	NO
126	GRAIN	0	STOVER	NO
127	GRAIN	NA	STOVER	NO
128	GRAIN	0	STOVER	NO
129	GRAIN	0	STOVER	NO
130	GRAIN	0	STOVER	NO
131	GRAIN	0	STOVER	NO
132	GRAIN	0	STOVER	NO
133	GRAIN	0	STOVER	NO
134	GRAIN	0	STOVER	NO
135	GRAIN	0	STOVER	NO
136	GRAIN	0	STOVER	NO
137	GRAIN	NA	STOVER	NO
138	GRAIN	0	STOVER	NO
139	GRAIN	0	STOVER	NO
140	GRAIN	0	STOVER	NO
141	GRAIN	0	STOVER	NO
142	GRAIN	0	STOVER	NO
143	GRAIN	0	STOVER	NO
144	GRAIN	0	STOVER	NO
145	GRAIN	0	STOVER	NO
146	GRAIN	0	STOVER	NO
147	GRAIN	NA	STOVER	NO
148	GRAIN	0	STOVER	NO

TABLE F-2 (cont.)

	COMMENTS	LOCATION
112		JOLIET, ILLINOIS
113		JOLIET, ILLINOIS
114		JOLIET, ILLINOIS
115		JOLIET, ILLINOIS
116		JOLIET, ILLINOIS
117		JOLIET, ILLINOIS
118		JOLIET, ILLINOIS
119		JOLIET, ILLINOIS
120		JOLIET, ILLINOIS
121		JOLIET, ILLINOIS
122		JOLIET, ILLINOIS
123		JOLIET, ILLINOIS
124		JOLIET, ILLINOIS
125		JOLIET, ILLINOIS
126		JOLIET, ILLINOIS
127		JOLIET, ILLINOIS
128		JOLIET, ILLINOIS
129		JOLIET, ILLINOIS
130		JOLIET, ILLINOIS
131		JOLIET, ILLINOIS
132		JOLIET, ILLINOIS
133		JOLIET, ILLINOIS
134		JOLIET, ILLINOIS
135		JOLIET, ILLINOIS
136		JOLIET, ILLINOIS
137		JOLIET, ILLINOIS
138		JOLIET, ILLINOIS
139		JOLIET, ILLINOIS
140		JOLIET, ILLINOIS
141		JOLIET, ILLINOIS
142		JOLIET, ILLINOIS
143		JOLIET, ILLINOIS
144		JOLIET, ILLINOIS
145		JOLIET, ILLINOIS
146		JOLIET, ILLINOIS
147		JOLIET, ILLINOIS
148		JOLIET, ILLINOIS

TABLE F-2 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
149	HINESLY 1985	CORN					3.4	263	2963	1422
150	HINESLY 1985	CORN					3.4	263	2963	1422
151	HINESLY 1985	CORN					3.4	263	2963	1422
152	HINESLY 1985	CORN					3.4	263	2963	1422
153	HINESLY 1985	CORN					3.4	263	2963	1422
154	HINESLY 1985	CORN					3.4	263	2963	1422
155	HINESLY 1985	CORN					3.4	263	2963	1422
156	HINESLY 1985	CORN					3.4	263	2963	1422
157	HINESLY 1985	CORN					3.2	265	2846	1311
158	HINESLY 1985	CORN					3.2	265	2846	1311
159	HINESLY 1985	CORN					3.2	265	2846	1311
160	HINESLY 1985	CORN					3.2	265	2846	1311
161	HINESLY 1985	CORN					3.2	265	2846	1311
162	HINESLY 1985	CORN					3.2	265	2846	1311
163	HINESLY 1985	CORN					3.2	265	2846	1311
164	HINESLY 1985	CORN					3.2	265	2846	1311
165	HINESLY 1985	CORN					3.2	265	2846	1311
166	HINESLY 1985	CORN					3.2	265	2846	1311
167	HINESLY 1985	CORN					3.2	265	2846	1311
168	HINESLY 1985	CORN					3.2	265	2846	1311
169	HINESLY 1985	CORN					3.2	265	2846	1311
170	HINESLY 1985	CORN					3.2	265	2846	1311
171	HINESLY 1985	CORN					3.2	265	2846	1311
172	HINESLY 1985	CORN					3.2	265	2846	1311
173	HINESLY 1985	CORN					3.2	265	2846	1311
174	HINESLY 1985	CORN					3.2	265	2846	1311
175	HINESLY 1985	CORN					3.2	265	2846	1311
176	HINESLY 1985	CORN					3.2	265	2846	1311
177	HINESLY 1985	CORN					3.2	265	2846	1311
178	HINESLY 1985	CORN					3.2	265	2846	1311
179	HINESLY 1985	CORN					3.2	265	2846	1311
180	HINESLY 1985	CORN					3.2	265	2846	1311
181	HINESLY 1985	CORN					3.2	265	2846	1311
182	HINESLY 1985	CORN					3.2	265	2846	1311
183	HINESLY 1985	CORN					3.2	265	2846	1311
184	HINESLY 1985	CORN					3.2	265	2846	1311
185	HINESLY 1985	CORN					3.2	265	2846	1311

TABLE F-2 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
149	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
150	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
151	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
152	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
153	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
154	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
155	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
156	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
157	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
158	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
159	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
160	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
161	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
162	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
163	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
164	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
165	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
166	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
167	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
168	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
169	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
170	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
171	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
172	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
173	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
174	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
175	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
176	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
177	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
178	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
179	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
180	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
181	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
182	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
183	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
184	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
185	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-2 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg
149	61.1	232.5	0		PLAINFIELD	SL				
150	69.8	302.3	0		PLAINFIELD	SL				
151	54	356.3	0		PLAINFIELD	SL				
152	72	428.3	0		PLAINFIELD	SL				
153	0	428.3	1		PLAINFIELD	SL				
154	0	428.3	2		PLAINFIELD	SL				
155	0	428.3	3		PLAINFIELD	SL				
156	0	428.3	4		PLAINFIELD	SL				
157	0	0	NA		BLOUNT	SiL				
158	0	0	NA		BLOUNT	SiL				
159	0	0	NA		BLOUNT	SiL				
160	0	0	NA		BLOUNT	SiL				
161	0	0	NA		BLOUNT	SiL				
162	26.2	40.1	0		BLOUNT	SiL				
163	8.1	48.2	0		BLOUNT	SiL				
164	14.7	62.9	0		BLOUNT	SiL				
165	17.7	80.6	0		BLOUNT	SiL				
166	13.1	93.7	0		BLOUNT	SiL				
167	52.4	80.2	0		BLOUNT	SiL				
168	16.2	96.4	0		BLOUNT	SiL				
169	29.4	125.8	0		BLOUNT	SiL				
170	35.4	161.2	0		BLOUNT	SiL				
171	26.2	187.4	0		BLOUNT	SiL				
172	104.8	160.4	0		BLOUNT	SiL				
173	32.4	192.8	0		BLOUNT	SiL				
174	58.8	251.6	0		BLOUNT	SiL				
175	70.8	322.4	0		BLOUNT	SiL				
176	52.4	374.8	0		BLOUNT	SiL				
177	0	0	NA		ELLIOT	SiL				
178	0	0	NA		ELLIOT	SiL				
179	0	0	NA		ELLIOT	SiL				
180	0	0	NA		ELLIOT	SiL				
181	0	0	NA		ELLIOT	SiL				
182	0	0	NA		ELLIOT	SiL				
183	0	0	NA		ELLIOT	SiL				
184	0	0	NA		ELLIOT	SiL				
185	0	0	NA		ELLIOT	SiL				

TABLE F-2 (cont.)

	SOIL OC %	SOIL pH	CUMM CU LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CU CONCENTRTN mg/kg	PLANT CU CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %
149	2.4	6.8	397	HCL-HF	118	11.1	LEAF	SLUDGE, FIELD, MATURITY	0
150	1.85	6.5	482	HCL-HF	60	11.9	LEAF	SLUDGE, FIELD, MATURITY	0
151	1.78	6.1	609	HCL-HF	104	13.2	LEAF	SLUDGE, FIELD, MATURITY	0
152	1.96	6.2	609	HCL-HF	116	15.3	LEAF	SLUDGE, FIELD, MATURITY	0
153	2.84	6	609	HCL-HF	164	9.3	LEAF	SLUDGE, FIELD, MATURITY	0
154	3.35	5.9	609	HCL-HF	245	5.9	LEAF	SLUDGE, FIELD, MATURITY	0
155	2.1	6.2	609	HCL-HF	150	9.9	LEAF	SLUDGE, FIELD, MATURITY	0
156	3.03	6.1	609	HCL-HF	224	7.1	LEAF	SLUDGE, FIELD, MATURITY	0
157	1.19	NA	0	HCL-HF	20	8.9	LEAF	SLUDGE, FIELD, MATURITY	0
158	1.01	7.1	0	HCL-HF	15	11.2	LEAF	SLUDGE, FIELD, MATURITY	0
159	0.93	7.5	0	HCL-HF	19	10.3	LEAF	SLUDGE, FIELD, MATURITY	0
160	1.05	7.7	0	HCL-HF	20	9.8	LEAF	SLUDGE, FIELD, MATURITY	0
161	1.07	7.3	0	HCL-HF	22	10.6	LEAF	SLUDGE, FIELD, MATURITY	0
162	1.29	NA	52	HCL-HF	30	9.4	LEAF	SLUDGE, FIELD, MATURITY	0
163	1.06	7.2	58	HCL-HF	24	11.7	LEAF	SLUDGE, FIELD, MATURITY	0
164	1.1	7.6	67	HCL-HF	35	6.9	LEAF	SLUDGE, FIELD, MATURITY	0
165	1.29	7.6	96	HCL-HF	39	11.8	LEAF	SLUDGE, FIELD, MATURITY	60*
166	1.17	7.6	117	HCL-HF	47	10.4	LEAF	SLUDGE, FIELD, MATURITY	28*
167	1.38	NA	105	HCL-HF	44	9.7	LEAF	SLUDGE, FIELD, MATURITY	0
168	1.15	7.1	116	HCL-HF	27	12.6	LEAF	SLUDGE, FIELD, MATURITY	0
169	1.29	7.6	135	HCL-HF	45	6.2	LEAF	SLUDGE, FIELD, MATURITY	0
170	1.58	7.6	192	HCL-HF	52	9.9	LEAF	SLUDGE, FIELD, MATURITY	0
171	1.75	7.5	235	HCL-HF	75	11.3	LEAF	SLUDGE, FIELD, MATURITY	0
172	1.63	NA	210	HCL-HF	66	9.3	LEAF	SLUDGE, FIELD, MATURITY	0
173	1.28	6.9	232	HCL-HF	50	14.3	LEAF	SLUDGE, FIELD, MATURITY	0
174	1.59	7.5	270	HCL-HF	76	6.1	LEAF	SLUDGE, FIELD, MATURITY	0
175	1.9	7.5	384	HCL-HF	78	11.1	LEAF	SLUDGE, FIELD, MATURITY	0
176	2.56	7.3	469	HCL-HF	133	13.1	LEAF	SLUDGE, FIELD, MATURITY	0
177	1.51	NA	0	HCL-HF	19	9	LEAF	SLUDGE, FIELD, MATURITY	0
178	1.34	7	0	HCL-HF	13	10.1	LEAF	SLUDGE, FIELD, MATURITY	0
179	1.29	7.2	0	HCL-HF	18	4.6	LEAF	SLUDGE, FIELD, MATURITY	0
180	1.45	7.1	0	HCL-HF	19	10	LEAF	SLUDGE, FIELD, MATURITY	0
181	1.3	7.6	0	HCL-HF	22	8.3	LEAF	SLUDGE, FIELD, MATURITY	0
182	1.3	7	0	HCL-HF	19	8.3	LEAF	SLUDGE, FIELD, MATURITY	0
183	1.41	7.2	0	HCL-HF	20	8	LEAF	SLUDGE, FIELD, MATURITY	0
184	1.32	6.7	0	HCL-HF	24	6.5	LEAF	SLUDGE, FIELD, MATURITY	0
185	1.38	7	0	HCL-HF	23	8.4	LEAF	SLUDGE, FIELD, MATURITY	0

TABLE F-2 (cont.)

	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
149	GRAIN	0	STOVER	NO
150	GRAIN	0	STOVER	NO
151	GRAIN	0	STOVER	NO
152	GRAIN	0	STOVER	NO
153	GRAIN	0	STOVER	NO
154	GRAIN	0	STOVER	NO
155	GRAIN	0	STOVER	NO
156	GRAIN	0	STOVER	NO
157	GRAIN	NA	STOVER	NO
158	GRAIN	0	STOVER	NO
159	GRAIN	0	STOVER	NO
160	GRAIN	0	STOVER	NO
161	GRAIN	0	STOVER	NO
162	GRAIN	NA	STOVER	NO
163	GRAIN	0	STOVER	NO
164	GRAIN	37*	STOVER	*NO
165	GRAIN	0	STOVER	*NO
166	GRAIN	0	STOVER	*NO
167	GRAIN	NA	STOVER	NO
168	GRAIN	0	STOVER	NO
169	GRAIN	22*	STOVER	*NO
170	GRAIN	0	STOVER	NO
171	GRAIN	0	STOVER	NO
172	GRAIN	NA	STOVER	NO
173	GRAIN	0	STOVER	NO
174	GRAIN	0	STOVER	NO
175	GRAIN	0	STOVER	NO
176	GRAIN	0	STOVER	NO
177	GRAIN	NA	STOVER	NO
178	GRAIN	0	STOVER	NO
179	GRAIN	0	STOVER	NO
180	GRAIN	0	STOVER	NO
181	GRAIN	0	STOVER	NO
182	GRAIN	0	STOVER	NO
183	GRAIN	0	STOVER	NO
184	GRAIN	0	STOVER	NO
185	GRAIN	0	STOVER	NO

TABLE F-2 (cont.)

	COMMENTS	LOCATION
149		JOLIET, ILLINOIS
150		JOLIET, ILLINOIS
151		JOLIET, ILLINOIS
152		JOLIET, ILLINOIS
153		JOLIET, ILLINOIS
154		JOLIET, ILLINOIS
155		JOLIET, ILLINOIS
156		JOLIET, ILLINOIS
157		JOLIET, ILLINOIS
158		JOLIET, ILLINOIS
159		JOLIET, ILLINOIS
160		JOLIET, ILLINOIS
161		JOLIET, ILLINOIS
162		JOLIET, ILLINOIS
163		JOLIET, ILLINOIS
164	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
165	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
166	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
167		JOLIET, ILLINOIS
168		JOLIET, ILLINOIS
169	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
170		JOLIET, ILLINOIS
171		JOLIET, ILLINOIS
172		JOLIET, ILLINOIS
173		JOLIET, ILLINOIS
174		JOLIET, ILLINOIS
175		JOLIET, ILLINOIS
176		JOLIET, ILLINOIS
177		JOLIET, ILLINOIS
178		JOLIET, ILLINOIS
179		JOLIET, ILLINOIS
180		JOLIET, ILLINOIS
181		JOLIET, ILLINOIS
182		JOLIET, ILLINOIS
183		JOLIET, ILLINOIS
184		JOLIET, ILLINOIS
185		JOLIET, ILLINOIS

TABLE F-2 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
186	HINESLY 1985	CORN					3.2	265	2846	1311
187	HINESLY 1985	CORN					3.2	265	2846	1311
188	HINESLY 1985	CORN					3.2	265	2846	1311
189	HINESLY 1985	CORN					3.2	265	2846	1311
190	HINESLY 1985	CORN					3.2	265	2846	1311
191	HINESLY 1985	CORN					3.2	265	2846	1311
192	HINESLY 1985	CORN					3.2	265	2846	1311
193	HINESLY 1985	CORN					3.2	265	2846	1311
194	HINESLY 1985	CORN					3.2	265	2846	1311
195	HINESLY 1985	CORN					3.2	265	2846	1311
196	HINESLY 1985	CORN					3.2	265	2846	1311
197	HINESLY 1985	CORN					3.2	265	2846	1311
198	HINESLY 1985	CORN					3.2	265	2846	1311
199	HINESLY 1985	CORN					3.2	265	2846	1311
200	HINESLY 1985	CORN					3.2	265	2846	1311
201	HINESLY 1985	CORN					3.2	265	2846	1311
202	HINESLY 1985	CORN					3.2	265	2846	1311
203	HINESLY 1985	CORN					3.2	265	2846	1311
204	HINESLY 1985	CORN					3.2	265	2846	1311
205	HINESLY 1985	CORN					3.2	265	2846	1311
206	HINESLY 1985	CORN					3.2	265	2846	1311
207	HINESLY 1985	CORN					3.2	265	2846	1311
208	HINESLY 1985	CORN					3.2	265	2846	1311
209	HINESLY 1985	CORN					3.2	265	2846	1311
210	HINESLY 1985	CORN					3.2	265	2846	1311
211	HINESLY 1985	CORN					3.2	265	2846	1311
212	HINESLY 1985	CORN					3.2	265	2846	1311
213	HINESLY 1985	CORN					3.2	265	2846	1311
214	HINESLY 1985	CORN					3.2	265	2846	1311
215	HINESLY 1985	CORN					3.2	265	2846	1311
216	HINESLY 1985	CORN					3.2	265	2846	1311
217	HINESLY 1985	CORN					3.2	265	2846	1311
218	HINESLY 1985	CORN					3.2	265	2846	1311
219	HINESLY 1985	CORN					3.2	265	2846	1311
220	HINESLY 1985	CORN					3.2	265	2846	1311
221	HINESLY 1985	CORN					3.2	265	2846	1311
222	HINESLY 1985	CORN					3.2	265	2846	1311

TABLE F-2 (cont.)

	SLUDGE	SLUDGE	SLUDGE	SLUDGE	SLUDGE	SLUDGE	SLUDGE	SLUDGE	SLUDGE
	Fe	N	Ni	P	Pb	Zn	SOLIDS	BIOLOGICAL	CHEMICAL
	%	%	mg/kg	mg/kg	mg/kg	mg/kg	CONTNT	PROCESSING	STABILIZATN
186	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
187	4.2	5.5	305	3.3	1169	4769		2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
188	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
189	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
190	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
191	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
192	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
193	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
194	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
195	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
196	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
197	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
198	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
199	4.2	5.5	305	3.3	1169	4769		2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
200	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
201	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
202	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
203	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
204	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
205	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
206	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
207	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
208	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
209	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
210	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
211	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
212	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
213	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
214	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
215	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
216	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
217	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
218	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
219	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
220	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
221	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
222	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-2 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg
186	0	0	NA		ELLIOT	SIL				
187	0	0	NA		ELLIOT	SIL				
188	26.2	40.1	0		ELLIOT	SIL				
189	8.1	48.2	0		ELLIOT	SIL				
190	14.7	62.9	0		ELLIOT	SIL				
191	17.7	80.6	0		ELLIOT	SIL				
192	13.1	93.7	0		ELLIOT	SIL				
193	17.8	111.5	0		ELLIOT	SIL				
194	0	111.5	1		ELLIOT	SIL				
195	0	111.5	2		ELLIOT	SIL				
196	0	111.5	3		ELLIOT	SIL				
197	0	111.5	4		ELLIOT	SIL				
198	0	111.5	5		ELLIOT	SIL				
199	52.4	80.2	0		ELLIOT	SIL				
200	16.2	96.4	0		ELLIOT	SIL				
201	29.4	125.8	0		ELLIOT	SIL				
202	35.4	161.2	0		ELLIOT	SIL				
203	26.2	187.4	0		ELLIOT	SIL				
204	35.6	223	0		ELLIOT	SIL				
205	0	223	1		ELLIOT	SIL				
206	0	223	2		ELLIOT	SIL				
207	0	223	3		ELLIOT	SIL				
208	0	223	4		ELLIOT	SIL				
209	0	223	5		ELLIOT	SIL				
210	104.8	160.4	0		ELLIOT	SIL				
211	32.4	192.8	0		ELLIOT	SIL				
212	58.8	251.6	0		ELLIOT	SIL				
213	70.8	322.4	0		ELLIOT	SIL				
214	52.4	374.8	0		ELLIOT	SIL				
215	71.2	446	0		ELLIOT	SIL				
216	0	446	1		ELLIOT	SIL				
217	0	446	2		ELLIOT	SIL				
218	0	446	3		ELLIOT	SIL				
219	0	446	4		ELLIOT	SIL				
220	0	446	5		ELLIOT	SIL				
221	0	0	NA		PLAINFIELD	SL				
222	0	0	NA		PLAINFIELD	SL				

TABLE F-2 (cont.)

	SOIL OC %	SOIL pH	CUMM CU LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CU CONCENTRTN mg/kg	PLANT CU CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %
186	1.69	7	0	HCL-HF	23	8.3	LEAF	SLUDGE, FIELD, MATURITY	0
187	1.48	7.4	0	HCL-HF	22	NA	LEAF	SLUDGE, FIELD, MATURITY	0
188	1.52	NA	52	HCL-HF	30	9.6	LEAF	SLUDGE, FIELD, MATURITY	0
189	1.4	6.9	58	HCL-HF	20	10.7	LEAF	SLUDGE, FIELD, MATURITY	0
190	1.35	7.2	67	HCL-HF	27	6.2	LEAF	SLUDGE, FIELD, MATURITY	0
191	1.58	7.4	96	HCL-HF	36	9.8	LEAF	SLUDGE, FIELD, MATURITY	60*
192	1.54	7.1	117	HCL-HF	52	13.2	LEAF	SLUDGE, FIELD, MATURITY	28*
193	1.64	6.9	146	HCL-HF	50	9.7	LEAF	SLUDGE, FIELD, MATURITY	0
194	1.69	6.9	146	HCL-HF	54	9.7	LEAF	SLUDGE, FIELD, MATURITY	0
195	1.91	7	146	HCL-HF	45	4.8	LEAF	SLUDGE, FIELD, MATURITY	0
196	1.66	7.3	146	HCL-HF	67	6.8	LEAF	SLUDGE, FIELD, MATURITY	0
197	2.05	7.1	146	HCL-HF	63	6.4	LEAF	SLUDGE, FIELD, MATURITY	0
198	1.95	7.2	146	HCL-HF	48	NA	LEAF	SLUDGE, FIELD, MATURITY	0
199	1.71	NA	105	HCL-HF	38	10.8	LEAF	SLUDGE, FIELD, MATURITY	0
200	1.57	6.9	116	HCL-HF	28	12.4	LEAF	SLUDGE, FIELD, MATURITY	0
201	1.57	7.3	135	HCL-HF	41	5.8	LEAF	SLUDGE, FIELD, MATURITY	0
202	1.79	7.1	192	HCL-HF	46	10.3	LEAF	SLUDGE, FIELD, MATURITY	0
203	1.93	6.9	235	HCL-HF	64	11.7	LEAF	SLUDGE, FIELD, MATURITY	0
204	2.09	6.6	292	HCL-HF	80	14.7	LEAF	SLUDGE, FIELD, MATURITY	0
205	2.37	6.4	292	HCL-HF	96	10.6	LEAF	SLUDGE, FIELD, MATURITY	0
206	2.4	6.4	292	HCL-HF	101	6.1	LEAF	SLUDGE, FIELD, MATURITY	0
207	2.4	6.8	292	HCL-HF	108	8.1	LEAF	SLUDGE, FIELD, MATURITY	0
208	2.38	6.8	292	HCL-HF	91	6.8	LEAF	SLUDGE, FIELD, MATURITY	0
209	2.48	7.2	292	HCL-HF	89	NA	LEAF	SLUDGE, FIELD, MATURITY	0
210	2.06	NA	210	HCL-HF	60	10.4	LEAF	SLUDGE, FIELD, MATURITY	0
211	2	6.4	232	HCL-HF	50	11	LEAF	SLUDGE, FIELD, MATURITY	0
212	1.76	6.4	270	HCL-HF	56	8.2	LEAF	SLUDGE, FIELD, MATURITY	0
213	2.67	6.2	384	HCL-HF	90	11.7	LEAF	SLUDGE, FIELD, MATURITY	0
214	2.72	6.1	469	HCL-HF	115	12.2	LEAF	SLUDGE, FIELD, MATURITY	0
215	3.53	5.4	584	HCL-HF	171	11.6	LEAF	SLUDGE, FIELD, MATURITY	0
216	3.35	5.5	584	HCL-HF	171	11.3	LEAF	SLUDGE, FIELD, MATURITY	0
217	3.29	5.8	584	HCL-HF	148	8.7	LEAF	SLUDGE, FIELD, MATURITY	0
218	2.68	6	584	HCL-HF	140	8.9	LEAF	SLUDGE, FIELD, MATURITY	0
219	3.02	6	584	HCL-HF	188	8.2	LEAF	SLUDGE, FIELD, MATURITY	0
220	2.2	6.3	584	HCL-HF	97	NA	LEAF	SLUDGE, FIELD, MATURITY	0
221	0.36	NA	0	HCL-HF	7	7.3	LEAF	SLUDGE, FIELD, MATURITY	0
222	0.17	7	0	HCL-HF	7	10.4	LEAF	SLUDGE, FIELD, MATURITY	0

TABLE F-2 (cont.)

	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
186	GRAIN	0	STOVER	NO
187	GRAIN	0	STOVER	NO
188	GRAIN	NA	STOVER	NO
189	GRAIN	0	STOVER	NO
190	GRAIN	0	STOVER	NO
191	GRAIN	0	STOVER	*NO
192	GRAIN	0	STOVER	*NO
193	GRAIN	0	STOVER	NO
194	GRAIN	0	STOVER	NO
195	GRAIN	0	STOVER	NO
196	GRAIN	0	STOVER	NO
197	GRAIN	0	STOVER	NO
198	GRAIN	0	STOVER	NO
199	GRAIN	NA	STOVER	NO
200	GRAIN	0	STOVER	NO
201	GRAIN	0	STOVER	NO
202	GRAIN	0	STOVER	NO
203	GRAIN	0	STOVER	NO
204	GRAIN	0	STOVER	NO
205	GRAIN	0	STOVER	NO
206	GRAIN	0	STOVER	NO
207	GRAIN	0	STOVER	NO
208	GRAIN	0	STOVER	NO
209	GRAIN	0	STOVER	NO
210	GRAIN	NA	STOVER	NO
211	GRAIN	0	STOVER	NO
212	GRAIN	0	STOVER	NO
213	GRAIN	0	STOVER	NO
214	GRAIN	0	STOVER	NO
215	GRAIN	0	STOVER	NO
216	GRAIN	0	STOVER	NO
217	GRAIN	0	STOVER	NO
218	GRAIN	0	STOVER	NO
219	GRAIN	0	STOVER	NO
220	GRAIN	0	STOVER	NO
221	GRAIN	NA	STOVER	NO
222	GRAIN	0	STOVER	NO

TABLE F-2 (cont.)

	COMMENTS	LOCATION
186		JOLIET, ILLINOIS
187		JOLIET, ILLINOIS
188		JOLIET, ILLINOIS
189		JOLIET, ILLINOIS
190		JOLIET, ILLINOIS
191	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
192	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
193		JOLIET, ILLINOIS
194		JOLIET, ILLINOIS
195		JOLIET, ILLINOIS
196		JOLIET, ILLINOIS
197		JOLIET, ILLINOIS
198		JOLIET, ILLINOIS
199		JOLIET, ILLINOIS
200		JOLIET, ILLINOIS
201		JOLIET, ILLINOIS
202		JOLIET, ILLINOIS
203		JOLIET, ILLINOIS
204		JOLIET, ILLINOIS
205		JOLIET, ILLINOIS
206		JOLIET, ILLINOIS
207		JOLIET, ILLINOIS
208		JOLIET, ILLINOIS
209		JOLIET, ILLINOIS
210		JOLIET, ILLINOIS
211		JOLIET, ILLINOIS
212		JOLIET, ILLINOIS
213		JOLIET, ILLINOIS
214		JOLIET, ILLINOIS
215		JOLIET, ILLINOIS
216		JOLIET, ILLINOIS
217		JOLIET, ILLINOIS
218		JOLIET, ILLINOIS
219		JOLIET, ILLINOIS
220		JOLIET, ILLINOIS
221		JOLIET, ILLINOIS
222		JOLIET, ILLINOIS

TABLE F-2 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
223	HINESLY 1985	CORN					3.2	265	2846	1311
224	HINESLY 1985	CORN					3.2	265	2846	1311
225	HINESLY 1985	CORN					3.2	265	2846	1311
226	HINESLY 1985	CORN					3.2	265	2846	1311
227	HINESLY 1985	CORN					3.2	265	2846	1311
228	HINESLY 1985	CORN					3.2	265	2846	1311
229	HINESLY 1985	CORN					3.2	265	2846	1311
230	HINESLY 1985	CORN					3.2	265	2846	1311
231	HINESLY 1985	CORN					3.2	265	2846	1311
232	HINESLY 1985	CORN					3.2	265	2846	1311
233	HINESLY 1985	CORN					3.2	265	2846	1311
234	HINESLY 1985	CORN					3.2	265	2846	1311
235	HINESLY 1985	CORN					3.2	265	2846	1311
236	HINESLY 1985	CORN					3.2	265	2846	1311
237	HINESLY 1985	CORN					3.2	265	2846	1311
238	HINESLY 1985	CORN					3.2	265	2846	1311
239	HINESLY 1985	CORN					3.2	265	2846	1311
240	HINESLY 1985	CORN					3.2	265	2846	1311
241	HINESLY 1985	CORN					3.2	265	2846	1311
242	HINESLY 1985	CORN					3.2	265	2846	1311
243	HINESLY 1985	CORN					3.2	265	2846	1311
244	HINESLY 1985	CORN					3.2	265	2846	1311
245	HINESLY 1985	CORN					3.2	265	2846	1311
246	HINESLY 1985	CORN					3.2	265	2846	1311
247	HINESLY 1985	CORN					3.2	265	2846	1311
248	HINESLY 1985	CORN					3.2	265	2846	1311
249	HINESLY 1985	CORN					3.2	265	2846	1311
250	HINESLY 1985	CORN					3.2	265	2846	1311
251	HINESLY 1985	CORN					3.2	265	2846	1311
252	HINESLY 1985	CORN					3.2	265	2846	1311
253	HINESLY 1985	CORN					3.2	265	2846	1311
254	HINESLY 1985	CORN					3.2	265	2846	1311
255	HINESLY 1985	CORN					3.2	265	2846	1311
256	HINESLY 1985	CORN					3.2	265	2846	1311
257	HINESLY 1985	CORN					3.2	265	2846	1311
258	HINESLY 1985	CORN					3.2	265	2846	1311
259	HINESLY 1985	CORN					3.2	265	2846	1311

TABLE F-2 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
223	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
224	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
225	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
226	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
227	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
228	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
229	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
230	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
231	4.2	5.5	305	3.3	1169	4769		2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
232	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
233	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
234	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
235	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
236	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
237	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
238	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
239	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
240	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
241	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
242	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
243	4.2	5.5	305	3.3	1169	4769		2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
244	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
245	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
246	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
247	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
248	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
249	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
250	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
251	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
252	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
253	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
254	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
255	4.2	5.5	305	3.3	1169	4769		2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
256	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
257	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
258	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
259	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-2 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg
223	0	0	NA		PLAINFIELD	SL				
224	0	0	NA		PLAINFIELD	SL				
225	0	0	NA		PLAINFIELD	SL				
226	0	0	NA		PLAINFIELD	SL				
227	0	0	NA		PLAINFIELD	SL				
228	0	0	NA		PLAINFIELD	SL				
229	0	0	NA		PLAINFIELD	SL				
230	0	0	NA		PLAINFIELD	SL				
231	0	0	NA		PLAINFIELD	SL				
232	26.2	40.1	0		PLAINFIELD	SL				
233	8.1	48.2	0		PLAINFIELD	SL				
234	14.7	62.9	0		PLAINFIELD	SL				
235	17.7	80.6	0		PLAINFIELD	SL				
236	13.1	93.7	0		PLAINFIELD	SL				
237	17.8	111.5	0		PLAINFIELD	SL				
238	0	111.5	1		PLAINFIELD	SL				
239	0	111.5	2		PLAINFIELD	SL				
240	0	111.5	3		PLAINFIELD	SL				
241	0	111.5	4		PLAINFIELD	SL				
242	0	111.5	5		PLAINFIELD	SL				
243	52.4	80.2	0		PLAINFIELD	SL				
244	16.2	96.4	0		PLAINFIELD	SL				
245	29.4	125.8	0		PLAINFIELD	SL				
246	35.4	161.2	0		PLAINFIELD	SL				
247	26.2	187.4	0		PLAINFIELD	SL				
248	35.6	223	0		PLAINFIELD	SL				
249	0	223	1		PLAINFIELD	SL				
250	0	223	2		PLAINFIELD	SL				
251	0	223	3		PLAINFIELD	SL				
252	0	223	4		PLAINFIELD	SL				
253	0	223	5		PLAINFIELD	SL				
254	104.8	160.4	0		PLAINFIELD	SL				
255	32.4	192.8	0		PLAINFIELD	SL				
256	58.8	251.6	0		PLAINFIELD	SL				
257	70.8	322.4	0		PLAINFIELD	SL				
258	52.4	374.8	0		PLAINFIELD	SL				
259	71.2	446	0		PLAINFIELD	SL				

TABLE F-2 (cont.)

	SOIL OC %	SOIL pH	CUMM CU LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CU CONCENTRTN mg/kg	PLANT CU CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %
223	0.21	7.2	0	HCL-HF	6	7.9	LEAF	SLUDGE, FIELD, MATURITY	0
224	0.42	7.1	0	HCL-HF	9	7	LEAF	SLUDGE, FIELD, MATURITY	0
225	0.44	7	0	HCL-HF	14	5.7	LEAF	SLUDGE, FIELD, MATURITY	0
226	0.56	6.9	0	HCL-HF	6	7.7	LEAF	SLUDGE, FIELD, MATURITY	0
227	0.48	7	0	HCL-HF	14	4.6	LEAF	SLUDGE, FIELD, MATURITY	0
228	0.75	7	0	HCL-HF	7	4.5	LEAF	SLUDGE, FIELD, MATURITY	0
229	0.76	7	0	HCL-HF	22	7.2	LEAF	SLUDGE, FIELD, MATURITY	0
230	1.21	6.9	0	HCL-HF	24	5.6	LEAF	SLUDGE, FIELD, MATURITY	0
231	0.84	7.1	0	HCL-HF	30	NA	LEAF	SLUDGE, FIELD, MATURITY	0
232	0.31	NA	52	HCL-HF	23	9.1	LEAF	SLUDGE, FIELD, MATURITY	0
233	0.44	7.2	58	HCL-HF	23	12.4	LEAF	SLUDGE, FIELD, MATURITY	0
234	0.63	7.3	67	HCL-HF	33	5.9	LEAF	SLUDGE, FIELD, MATURITY	0
235	0.67	7.5	96	HCL-HF	28	8.1	LEAF	SLUDGE, FIELD, MATURITY	60*
236	0.78	7	117	HCL-HF	45	11.1	LEAF	SLUDGE, FIELD, MATURITY	60*
237	0.8	7	146	HCL-HF	42	9.7	LEAF	SLUDGE, FIELD, MATURITY	0
238	0.99	6.6	146	HCL-HF	62	7.8	LEAF	SLUDGE, FIELD, MATURITY	0
239	1.42	7.1	146	HCL-HF	71	3	LEAF	SLUDGE, FIELD, MATURITY	0
240	1.71	7.2	146	HCL-HF	92	6.5	LEAF	SLUDGE, FIELD, MATURITY	0
241	1.82	7.2	146	HCL-HF	93	7.3	LEAF	SLUDGE, FIELD, MATURITY	0
242	1.96	7.1	146	HCL-HF	69	NA	LEAF	SLUDGE, FIELD, MATURITY	0
243	0.43	NA	105	HCL-HF	35	9.6	LEAF	SLUDGE, FIELD, MATURITY	NA
244	0.51	7.1	116	HCL-HF	26	12.4	LEAF	SLUDGE, FIELD, MATURITY	0
245	0.94	7	135	HCL-HF	53	7.9	LEAF	SLUDGE, FIELD, MATURITY	0
246	1.16	7.2	192	HCL-HF	57	10	LEAF	SLUDGE, FIELD, MATURITY	0
247	1.4	7	235	HCL-HF	65	10.6	LEAF	SLUDGE, FIELD, MATURITY	0
248	1.75	6.4	292	HCL-HF	99	13	LEAF	SLUDGE, FIELD, MATURITY	0
249	2	6.3	292	HCL-HF	111	9.7	LEAF	SLUDGE, FIELD, MATURITY	0
250	2.16	6.8	292	HCL-HF	102	5.3	LEAF	SLUDGE, FIELD, MATURITY	0
251	2.02	6.8	292	HCL-HF	151	8.4	LEAF	SLUDGE, FIELD, MATURITY	0
252	2.33	7.1	292	HCL-HF	146	6.9	LEAF	SLUDGE, FIELD, MATURITY	0
253	1.66	7	292	HCL-HF	124	NA	LEAF	SLUDGE, FIELD, MATURITY	0
254	0.73	NA	210	HCL-HF	61	9.9	LEAF	SLUDGE, FIELD, MATURITY	0
255	0.57	6.8	232	HCL-HF	33	14.8	LEAF	SLUDGE, FIELD, MATURITY	0
256	1.3	6.7	270	HCL-HF	73	8.8	LEAF	SLUDGE, FIELD, MATURITY	0
257	1.42	6.6	384	HCL-HF	77	13.3	LEAF	SLUDGE, FIELD, MATURITY	0
258	2.4	6.4	469	HCL-HF	162	14.7	LEAF	SLUDGE, FIELD, MATURITY	0
259	2.76	6.1	584	HCL-HF	155	17.2	LEAF	SLUDGE, FIELD, MATURITY	0

TABLE F-2 (cont.)

	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
223	GRAIN	0	STOVER	NO
224	GRAIN	0	STOVER	NO
225	GRAIN	0	STOVER	NO
226	GRAIN	0	STOVER	NO
227	GRAIN	0	STOVER	NO
228	GRAIN	0	STOVER	NO
229	GRAIN	0	STOVER	NO
230	GRAIN	0	STOVER	NO
231	GRAIN	0	STOVER	NO
232	GRAIN	NA	STOVER	NO
233	GRAIN	0	STOVER	NO
234	GRAIN	0	STOVER	NO
235	GRAIN	0	STOVER	*NO
236	GRAIN	0	STOVER	*NO
237	GRAIN	0	STOVER	NO
238	GRAIN	0	STOVER	NO
239	GRAIN	0	STOVER	NO
240	GRAIN	0	STOVER	NO
241	GRAIN	0	STOVER	NO
242	GRAIN	0	STOVER	NO
243	GRAIN	NA	STOVER	NO
244	GRAIN	0	STOVER	NO
245	GRAIN	0	STOVER	NO
246	GRAIN	0	STOVER	NO
247	GRAIN	0	STOVER	NO
248	GRAIN	0	STOVER	NO
249	GRAIN	0	STOVER	NO
250	GRAIN	0	STOVER	NO
251	GRAIN	0	STOVER	NO
252	GRAIN	0	STOVER	NO
253	GRAIN	0	STOVER	NO
254	GRAIN	NA	STOVER	NO
255	GRAIN	0	STOVER	NO
256	GRAIN	0	STOVER	NO
257	GRAIN	0	STOVER	NO
258	GRAIN	0	STOVER	NO
259	GRAIN	0	STOVER	NO

TABLE F-2 (cont.)

	COMMENTS	LOCATION
223		JOLIET, ILLINOIS
224		JOLIET, ILLINOIS
225		JOLIET, ILLINOIS
226		JOLIET, ILLINOIS
227		JOLIET, ILLINOIS
228		JOLIET, ILLINOIS
229		JOLIET, ILLINOIS
230		JOLIET, ILLINOIS
231		JOLIET, ILLINOIS
232		JOLIET, ILLINOIS
233		JOLIET, ILLINOIS
234		JOLIET, ILLINOIS
235	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
236	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
237		JOLIET, ILLINOIS
238		JOLIET, ILLINOIS
239		JOLIET, ILLINOIS
240		JOLIET, ILLINOIS
241		JOLIET, ILLINOIS
242		JOLIET, ILLINOIS
243		JOLIET, ILLINOIS
244		JOLIET, ILLINOIS
245		JOLIET, ILLINOIS
246		JOLIET, ILLINOIS
247		JOLIET, ILLINOIS
248		JOLIET, ILLINOIS
249		JOLIET, ILLINOIS
250		JOLIET, ILLINOIS
251		JOLIET, ILLINOIS
252		JOLIET, ILLINOIS
253		JOLIET, ILLINOIS
254		JOLIET, ILLINOIS
255		JOLIET, ILLINOIS
256		JOLIET, ILLINOIS
257		JOLIET, ILLINOIS
258		JOLIET, ILLINOIS
259		JOLIET, ILLINOIS

TABLE F-2 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
260	HINESLY 1985	CORN					3.2	265	2846	1311
261	HINESLY 1985	CORN					3.2	265	2846	1311
262	HINESLY 1985	CORN					3.2	265	2846	1311
263	HINESLY 1985	CORN					3.2	265	2846	1311
264	HINESLY 1985	CORN					3.2	265	2846	1311
265	DAVIS 1981	HERBAGE								1040
266	DAVIS 1981	HERBAGE								1040
267	DAVIS 1981	HERBAGE								1040
268	DAVIS 1981	HERBAGE								1040
269	DAVIS 1981	HERBAGE								1040
270	DAVIS 1981	HERBAGE								1040
271	DAVIS 1981	HERBAGE								1040
272	DAVIS 1981	HERBAGE								1040
273	DAVIS 1981	HERBAGE								1040
274	DAVIS 1981	HERBAGE								1040
275	DAVIS 1981	HERBAGE								1040
276	DAVIS 1981	HERBAGE								1040
277	DAVIS 1981	HERBAGE								1040
278	DAVIS 1981	HERBAGE								1040
279	DAVIS 1981	HERBAGE								1040
280	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
281	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
282	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
283	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
284	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
285	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
286	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
287	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
288	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
289	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
290	KING & MORRIS 1972	RYE					1.42			453
291	KING & MORRIS 1972	RYE					1.42			453
292	KING & MORRIS 1972	RYE					1.42			453
293	KING & MORRIS 1972	RYE					1.42			453
294	KING & MORRIS 1972	RYE					1.42			453
295	KING & MORRIS 1972	RYE					1.42			453
296	KING & MORRIS 1972	RYE					1.42			453

TABLE F-2 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
260	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
261	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
262	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
263	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
264	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
265								DIGESTED	
266								DIGESTED	
267								DIGESTED	
268								DIGESTED	
269								DIGESTED	
270								DIGESTED	
271								DIGESTED	
272								DIGESTED	
273								DIGESTED	
274								DIGESTED	
275								DIGESTED	
276								DIGESTED	
277								DIGESTED	
278								DIGESTED	
279								DIGESTED	
280	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
281	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
282	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
283	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
284	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
285	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
286	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
287	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
288	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
289	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
290		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
291		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
292		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
293		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
294		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
295		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
296		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	

TABLE F-2 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg
260	0	446	1		PLAINFIELD	SL				
261	0	446	2		PLAINFIELD	SL				
262	0	446	3		PLAINFIELD	SL				
263	0	446	4		PLAINFIELD	SL				
264	0	446	5		PLAINFIELD	SL				
265	0	0	0	LANDFILL CAP		CLAY				
266	53	53	0	LANDFILL CAP		CLAY				
267	107	107	0	LANDFILL CAP		CLAY				
268	213	213	0	LANDFILL CAP		CLAY				
269	426	426	0	LANDFILL CAP		CLAY				
270	0	0	1	LANDFILL CAP		CLAY				
271	53	53	1	LANDFILL CAP		CLAY				
272	107	107	1	LANDFILL CAP		CLAY				
273	213	213	1	LANDFILL CAP		CLAY				
274	426	426	1	LANDFILL CAP		CLAY				
275	0	0	2	LANDFILL CAP		CLAY				
276	53	53	2	LANDFILL CAP		CLAY				
277	107	107	2	LANDFILL CAP		CLAY				
278	213	213	2	LANDFILL CAP		CLAY				
279	426	426	2	LANDFILL CAP		CLAY				
280	0	0	0	TYPIC TAPLUDOLL	WAUKEGAN	SIL				
281	25	25	0	TYPIC TAPLUDOLL	WAUKEGAN	SIL				
282	50	50	0	TYPIC TAPLUDOLL	WAUKEGAN	SIL				
283	100	100	0	TYPIC TAPLUDOLL	WAUKEGAN	SIL				
284	200	200	0	TYPIC TAPLUDOLL	WAUKEGAN	SIL				
285	0	0	1	TYPIC TAPLUDOLL	WAUKEGAN	SIL				
286	25	25	1	TYPIC TAPLUDOLL	WAUKEGAN	SIL				
287	50	50	1	TYPIC TAPLUDOLL	WAUKEGAN	SIL				
288	100	100	1	TYPIC TAPLUDOLL	WAUKEGAN	SIL				
289	200	200	1	TYPIC TAPLUDOLL	WAUKEGAN	SIL				
290	0	0	0	TYPIC HAPLUDULT	CECIL	SCL				
291	26.5	26.5	0	TYPIC HAPLUDULT	CECIL	SCL				
292	52.5	52.5	0	TYPIC HAPLUDULT	CECIL	SCL				
293	60	60	0	TYPIC HAPLUDULT	CECIL	SCL				
294	120	120	0	TYPIC HAPLUDULT	CECIL	SCL				
295	0	0	0	TYPIC HAPLUDULT	CECIL	SCL				
296	15.1	41.6	0	TYPIC HAPLUDULT	CECIL	SCL				

TABLE F-2 (cont.)

	SOIL OC %	SOIL pH	CUMM CU LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CU CONCENTRTN mg/kg	PLANT CU CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %
260	3.44	5.8	584	HCL-HF	199	13.3	LEAF	SLUDGE, FIELD, MATURITY	0
261	3.16	5.9	584	HCL-HF	17[illegible]	8.6	LEAF	SLUDGE, FIELD, MATURITY	0
262	3.28	6.2	584	HCL-HF	202	10.9	LEAF	SLUDGE, FIELD, MATURITY	0
263	3.1	6.4	584	HCL-HF	236	8.3	LEAF	SLUDGE, FIELD, MATURITY	0
264	3.15	6.5	584	HCL-HF	236	NA	LEAF	SLUDGE, FIELD, MATURITY	0
265		7.9	0			4.8	LEAF	FIELD, SLUDGE, MATURITY	0
266		7.9	55			5	LEAF	FIELD, SLUDGE, MATURITY	0
267		7.9	111			6	LEAF	FIELD, SLUDGE, MATURITY	0
268		7.9	222			7	LEAF	FIELD, SLUDGE, MATURITY	0
269		7.9	443			6.5	LEAF	FIELD, SLUDGE, MATURITY	0
270		7.9	0			7.4	LEAF	FIELD, SLUDGE, MATURITY	0
271		7.9	55			7.3	LEAF	FIELD, SLUDGE, MATURITY	0
272		7.9	111			6.2	LEAF	FIELD, SLUDGE, MATURITY	0
273		7.9	222			5	LEAF	FIELD, SLUDGE, MATURITY	0
274		7.9	443			5.5	LEAF	FIELD, SLUDGE, MATURITY	0
275		7.9	0			5	LEAF	FIELD, SLUDGE, MATURITY	0
276		7.9	55			5	LEAF	FIELD, SLUDGE, MATURITY	0
277		7.9	111			4.9	LEAF	FIELD, SLUDGE, MATURITY	0
278		7.9	222			4.8	LEAF	FIELD, SLUDGE, MATURITY	0
279		7.9	443			5.3	LEAF	FIELD, SLUDGE, MATURITY	0
280		6.5	0		N.L.	5	LEAF	FIELD, SLUDGE, MATURITY	0
281		6.5	50		N.L.	6	LEAF	FIELD, SLUDGE, MATURITY	0
282		6.5	100		N.L.	9	LEAF	FIELD, SLUDGE, MATURITY	0
283		6.5	200		N.L.	10	LEAF	FIELD, SLUDGE, MATURITY	0
284		6.5	400		N.L.	15	LEAF	FIELD, SLUDGE, MATURITY	0
285		6.5	0		N.L.	17	LEAF	FIELD, SLUDGE, MATURITY	0
286		6.5	50		N.L.	15	LEAF	FIELD, SLUDGE, MATURITY	0
287		6.5	100		N.L.	14	LEAF	FIELD, SLUDGE, MATURITY	0
288		6.5	200		N.L.	11	LEAF	FIELD, SLUDGE, MATURITY	0
289		6.5	400		N.L.	10	LEAF	FIELD, SLUDGE, MATURITY	0
290		5.2	0		NR	NR		FIELD, SLUDGE, MATURITY	0
291		NR	13		NR	NR		FIELD, SLUDGE, MATURITY	34*
292		NR	26		NR	NR		FIELD, SLUDGE, MATURITY	0
293		NR	34		NR	NR		FIELD, SLUDGE, MATURITY	0
294		NR	68		NR	NR		FIELD, SLUDGE, MATURITY	0
295		5.2	0		NR	10	FORAGE	FIELD, SLUDGE, MATURITY	0
296		5.1	32		NR	11	FORAGE	FIELD, SLUDGE, MATURITY	41*

TABLE F-2 (cont.)

	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
260	GRAIN	0	STOVER	NO
261	GRAIN	0	STOVER	NO
262	GRAIN	0	STOVER	NO
263	GRAIN	0	STOVER	NO
264	GRAIN	0	STOVER	NO
265	BIOMASS			
266	BIOMASS			
267	BIOMASS			
268	BIOMASS			
269	BIOMASS			
270	BIOMASS			
271	BIOMASS			
272	BIOMASS			
273	BIOMASS			
274	BIOMASS			
275	BIOMASS			
276	BIOMASS			
277	BIOMASS			
278	BIOMASS			
279	BIOMASS			
280	GRAIN			
281	GRAIN			
282	GRAIN			
283	GRAIN			
284	GRAIN			
285	GRAIN			
286	GRAIN			
287	GRAIN			
288	GRAIN			
289	GRAIN			
290	FORAGE			NO
291	FORAGE			NO*
292	FORAGE			NO
293	FORAGE			NO
294	FORAGE			NO
295	FORAGE			NO
296	FORAGE			NO*

TABLE F-2 (cont.)

	COMMENTS	LOCATION
260		JOLIET, ILLINOIS
261		JOLIET, ILLINOIS
262		JOLIET, ILLINOIS
263		JOLIET, ILLINOIS
264		JOLIET, ILLINOIS
265	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
266	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
267	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
268	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
269	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
270	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
271	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
272	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
273	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
274	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
275	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
276	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
277	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
278	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
279	YIELDS DRAMATICALLY INCREASED BY SLUDGE ON LANDFILL CAP (HERBAGE = OATS/RYE)	UNITED KINGDOM
280		MINNESOTA
281		MINNESOTA
282		MINNESOTA
283		MINNESOTA
284		MINNESOTA
285		MINNESOTA
286		MINNESOTA
287		MINNESOTA
288		MINNESOTA
289		MINNESOTA
290		GEORGIA
291	*DOSE RESPONSE NOT CONSISTENT	GEORGIA
292		GEORGIA
293		GEORGIA
294		GEORGIA
295		GEORGIA
296	*DOSE RESPONSE & TISSUE CU CONCENTRATION ARE NOT CONSISTENT, PH<5.5	GEORGIA

TABLE F-2 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
297	KING & MORRIS 1972	RYE					1.42			453
298	KING & MORRIS 1972	RYE					1.42			453
299	KING & MORRIS 1972	RYE					1.42			453
300	KING & MORRIS 1972	RYE					1.42			453
301	KING & MORRIS 1972	RYE					1.42			453
302	KING & MORRIS 1972	RYE					1.42			453
303	KING & MORRIS 1972	RYE					1.42			453
304	KING & MORRIS 1972	RYE					1.42			453
305	WEBBER 1972	RED BEET								
306	WEBBER 1972	RED BEET							240	1100
307	WEBBER 1972	RED BEET							175	11300
308	WEBBER 1972	RED BEET							175	11300
309	WEBBER 1972	RED BEET							240	1100
310	WEBBER 1972	RED BEET							175	11300
311	WEBBER 1972	CELERY								
312	WEBBER 1972	CELERY							240	1100
313	WEBBER 1972	CELERY							175	11300
314	WEBBER 1972	CELERY							175	11300
315	WEBBER 1972	CELERY							240	1100
316	WEBBER 1972	CELERY							175	11300
317	WEBBER 1972	CELERY								
318	WEBBER 1972									
319	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
320	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
321	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307	3505	1471
322	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307	3505	1471
323	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307	3505	1471
324	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
325	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
326	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307	3505	1471
327	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307	3505	1471
328	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307	3505	1471
329	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
330	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
331	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307	3505	1471
332	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307	3505	1471
333	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307	3505	1471

TABLE F-2 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
297		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
298		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
299		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
300		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
301		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
302		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
303		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
304		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED	
305									
306			210			3000			
307			104			3900			
308			104			3900			
309			210			3000			
310			104			3900			
311									
312			210			3000			
313			104			3900			
314			104			3900			
315			210			3000			
316			104			3900			
317									
318									
319	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
320	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
321	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
322	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
323	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
324	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
325	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
326	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
327	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
328	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
329	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
330	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
331	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
332	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
333	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3

TABLE F-2 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg
297	30	82.5	0	TYPIC HAPLUDULT	CECIL	SCL				
298	60	120	0	TYPIC HAPLUDULT	CECIL	SCL				
299	120	240	0	TYPIC HAPLUDULT	CECIL	SCL				
300	0	0	0	TYPIC HAPLUDULT	CECIL	SCL				
301	15.1	41.6	0	TYPIC HAPLUDULT	CECIL	SCL				
302	30	82.5	0	TYPIC HAPLUDULT	CECIL	SCL				
303	60	120	0	TYPIC HAPLUDULT	CECIL	SCL				
304	120	240	0	TYPIC HAPLUDULT	CECIL	SCL				
305	0	0	0							
306	125.5	125.5	2							
307	125.5	125.5	2							
308	125.5	125.5	2							
309	31.4	94.2	0							
310	31.4	94.2	0							
311	0	0	0							
312	125.5	125.5	2							
313	125.5	125.5	2							
314	125.5	125.5	2							
315	31.4	94.2	0							
316	31.4	94.2	0							
317										
318										
319	0	0		STRIP MINE SPOIL						12.6
320	0	0		STRIP MINE SPOIL						12.6
321	0	0		STRIP MINE SPOIL						12.6
322	0	0		STRIP MINE SPOIL						12.6
323	0	0		STRIP MINE SPOIL						12.6
324	3	3		STRIP MINE SPOIL						12.6
325	12.8	15.8	0	STRIP MINE SPOIL						12.6
326	12.4	28.1	0	STRIP MINE SPOIL						12.6
327	14.3	42.4	0	STRIP MINE SPOIL						12.6
328	19.5	61.9	0	STRIP MINE SPOIL						12.6
329	6	6	0	STRIP MINE SPOIL						12.6
330	25.5	31.5	0	STRIP MINE SPOIL						12.6
331	29.8	61.3	0	STRIP MINE SPOIL						12.6
332	28.6	89.9	0	STRIP MINE SPOIL						12.6
333	39	128.9	0	STRIP MINE SPOIL						12.6

TABLE F-2 (cont.)

	SOIL OC %	SOIL pH	CUMM CU LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CU CONCENTRTN mg/kg	PLANT CU CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %
297		NR	64		NR	12.5	FORAGE	FIELD, SLUDGE, MATURITY	0
298		4.5	102		NR	14.5	FORAGE	FIELD, SLUDGE, MATURITY	0
299		4.2	184		NR	20	FORAGE	FIELD, SLUDGE, MATURITY	80
300		LIMED	0		NR	10.2	FORAGE	FIELD, SLUDGE, MATURITY	0
301		LIMED	32		NR	10.2	FORAGE	FIELD, SLUDGE, MATURITY	0
302		LIMED	64		NR	11.5	FORAGE	FIELD, SLUDGE, MATURITY	0
303		LIMED	102		NR	12	FORAGE	FIELD, SLUDGE, MATURITY	0
304		LIMED	184		NR	16	FORAGE	FIELD, SLUDGE, MATURITY	58
305		6.1	0	.5 M HOAC	1.1			SLUDGE, FIELD, MATURITY	0
306		NR	138	.5 M HOAC	7.3			SLUDGE, FIELD, MATURITY	0
307		NR	502	.5 M HOAC	36			SLUDGE, FIELD, MATURITY	0
308		NR	1004	.5 M HOAC	76			SLUDGE, FIELD, MATURITY	64
309		NR	104	.5 M HOAC	6			SLUDGE, FIELD, MATURITY	0
310		NR	502	.5 M HOAC	14.5			SLUDGE, FIELD, MATURITY	0
311		6.1	0	.5 M HOAC	1.1			SLUDGE, FIELD, MATURITY	0
312		NR	138	.5 M HOAC	7.3			SLUDGE, FIELD, MATURITY	0
313		NR	502	.5 M HOAC	36			SLUDGE, FIELD, MATURITY	0
314		NR	1004	.5 M HOAC	76			SLUDGE, FIELD, MATURITY	0
315		NR	104	.5 M HOAC	6			SLUDGE, FIELD, MATURITY	0
316		NR	502	.5 M HOAC	14.5			SLUDGE, FIELD, MATURITY	0
317									
318									
319	0.25	7.8	0	0.1 M HCl	3.3	12	LEAF	FIELD, SLUDGE, MATURITY	0
320	0.25	7.8	0	0.1 M HCl	3.6	16	LEAF	FIELD, SLUDGE, MATURITY	0
321	0.33	7.8	0	0.1 M HCl	2.3	12	LEAF	FIELD, SLUDGE, MATURITY	0
322	0.33	7.8	0	0.1 M HCl	6.8	13	LEAF	FIELD, SLUDGE, MATURITY	0
323	0.33	7.8	0	0.1 M HCl	4	9	LEAF	FIELD, SLUDGE, MATURITY	0
324	0.33	7.8	2.8	0.1 M HCl	2.7	15	LEAF	FIELD, SLUDGE, MATURITY	0
325	0.27	7.8	25	0.1 M HCl	5.3	10	LEAF	FIELD, SLUDGE, MATURITY	0
326	0.41	7.8	48	0.1 M HCl	7.8	11	LEAF	FIELD, SLUDGE, MATURITY	0
327	0.41	7.8	73	0.1 M HCl	14.6	13	LEAF	FIELD, SLUDGE, MATURITY	0
328	0.59	7.8	107	0.1 M HCl	9.4	11	LEAF	FIELD, SLUDGE, MATURITY	0
329	0.35	7.8	5.6	0.1 M HCl	3.3	16	LEAF	FIELD, SLUDGE, MATURITY	0
330	0.3	7.8	50	0.1 M HCl	5.6	10	LEAF	FIELD, SLUDGE, MATURITY	0
331	0.3	7.8	96	0.1 M HCl	19.4	11	LEAF	FIELD, SLUDGE, MATURITY	0
332	0.5	7.8	146	0.1 M HCl	19.5	13	LEAF	FIELD, SLUDGE, MATURITY	0
333	0.5	7.8	214	0.1 M HCl	14	13	LEAF	FIELD, SLUDGE, MATURITY	0

TABLE F-2 (cont.)

	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
297	FORAGE			NO
298	FORAGE			NO
299	FORAGE			POSSIBLE
300	FORAGE			NO
301	FORAGE			NO
302	FORAGE			NO
303	FORAGE			NO
304	FORAGE			POSSIBLE
305	TOTAL BIOMASS			NO
306	TOTAL BIOMASS			NO
307	TOTAL BIOMASS			NO
308	TOTAL BIOMASS			POSSIBLE
309	TOTAL BIOMASS			NO
310	TOTAL BIOMASS			NO
311	STALKS			NO
312	STALKS			NO
313	STALKS			NO
314	STALKS			NO
315	STALKS			NO
316	STALKS			NO
317				
318				
319	GRAIN	0	STOVER	
320	GRAIN	0	STOVER	
321	GRAIN	0	STOVER	
322	GRAIN	0	STOVER	
323	GRAIN	0	STOVER	
324	GRAIN	0	STOVER	
325	GRAIN	0	STOVER	
326	GRAIN	0	STOVER	
327	GRAIN	0	STOVER	
328	GRAIN	0	STOVER	
329	GRAIN	0	STOVER	
330	GRAIN	0	STOVER	
331	GRAIN	0	STOVER	
332	GRAIN	0	STOVER	
333	GRAIN	0	STOVER	

TABLE F-2 (cont.)

	COMMENTS	LOCATION
297		GEORGIA
298		GEORGIA
299	PH<5.5 (=4.2)	GEORGIA
300		GEORGIA
301		GEORGIA
302		GEORGIA
303		GEORGIA
304	LOADING IN EXCESS OF AGRONOMIC RATES, PH UNKNOWN AND QUESTIONABLE	GEORGIA
305		LEEDS, U.K.
306		LEEDS, U.K.
307		LEEDS, U.K.
308	HIGH CU SLUDGE (11300 MG/KG)BLENDED WITH LOWER ZN SLUDGE WAS USED	LEEDS, U.K.
309		LEEDS, U.K.
310		LEEDS, U.K.
311		LEEDS, U.K.
312		LEEDS, U.K.
313		LEEDS, U.K.
314		LEEDS, U.K.
315		LEEDS, U.K.
316		LEEDS, U.K.
317		
318		
319		FULTON CO., ILLINOIS
320		FULTON CO., ILLINOIS
321		FULTON CO., ILLINOIS
322		FULTON CO., ILLINOIS
323		FULTON CO., ILLINOIS
324		FULTON CO., ILLINOIS
325		FULTON CO., ILLINOIS
326		FULTON CO., ILLINOIS
327		FULTON CO., ILLINOIS
328		FULTON CO., ILLINOIS
329		FULTON CO., ILLINOIS
330		FULTON CO., ILLINOIS
331		FULTON CO., ILLINOIS
332		FULTON CO., ILLINOIS
333		FULTON CO., ILLINOIS

TABLE F-2 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
334	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
335	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
336	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307	3505	1471
337	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307	3505	1471
338	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307	3505	1471
339	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
340	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
341	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
342	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
343	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
344	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
345	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
346	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
347	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
348	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71	775	460
349	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53	679	454
350	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
351	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
352	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
353	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
354	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
355	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
356	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
357	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
358	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
359	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71	775	460
360	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53	679	454
361	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
362	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
363	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
364	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
365	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
366	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
367	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
368	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
369	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
370	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71	775	460

TABLE F-2 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
334	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
335	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
336	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
337	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
338	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
339	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
340	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
341	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
342	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
343	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
344	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
345	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
346	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
347	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
348	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
349	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
350	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
351	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
352	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
353	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
354	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
355	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
356	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
357	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
358	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
359	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
360	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
361	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
362	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
363	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
364	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
365	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
366	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
367	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
368	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
369	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
370	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3

TABLE F-2 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg
334	11.9	11.9	0	STRIP MINE SPOIL						12.6
335	51	62.9	0	STRIP MINE SPOIL						12.6
336	59.6	122.5	0	STRIP MINE SPOIL						12.6
337	57.1	179.6	0	STRIP MINE SPOIL						12.6
338	78	257.6	0	STRIP MINE SPOIL						12.6
339	0	0	0	STRIP MINE SPOIL						
340	0	0	0	STRIP MINE SPOIL						
341	0	0	0	STRIP MINE SPOIL						
342	0	0	0	STRIP MINE SPOIL						
343	0	0	0	STRIP MINE SPOIL						
344	0	0	0	STRIP MINE SPOIL						
345	0	0	0	STRIP MINE SPOIL						
346	0	0	0	STRIP MINE SPOIL						
347	0	0	0	STRIP MINE SPOIL						
348	0	0	0	STRIP MINE SPOIL						
349	0	0	0	STRIP MINE SPOIL						
350	16.1	78	0	STRIP MINE SPOIL						
351	19.9	97.9	0	STRIP MINE SPOIL						
352	17.4	115.3	0	STRIP MINE SPOIL						
353	11.4	126.7	0	STRIP MINE SPOIL						
354	16.8	143.5	0	STRIP MINE SPOIL						
355	17.9	161.4	0	STRIP MINE SPOIL						
356	16.8	178.2	0	STRIP MINE SPOIL						
357	16.8	195	0	STRIP MINE SPOIL						
358	16.8	211.8	0	STRIP MINE SPOIL						
359	16.8	228.6	0	STRIP MINE SPOIL						
360	16.8	245.4	0	STRIP MINE SPOIL						
361	32.2	161.1	0	STRIP MINE SPOIL						
362	39.8	200.9	0	STRIP MINE SPOIL						
363	34.8	235.7	0	STRIP MINE SPOIL						
364	22.8	258.5	0	STRIP MINE SPOIL						
365	34.9	293.4	0	STRIP MINE SPOIL						
366	35.8	329.2	0	STRIP MINE SPOIL						
367	33.6	362.8	0	STRIP MINE SPOIL						
368	33.6	396.4	0	STRIP MINE SPOIL						
369	33.6	430	0	STRIP MINE SPOIL						
370	33.6	463.6	0	STRIP MINE SPOIL						

TABLE F-2 (cont.)

	SOIL OC %	SOIL pH	CUMM CU LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CU CONCENTRTN mg/kg	PLANT CU CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %
334	0.33	7.8	11.2	0.1 M HCl	3.7	11	LEAF	FIELD, SLUDGE, MATURITY	0
335	0.33	7.8	100	0.1 M HCl	6.	11	LEAF	FIELD, SLUDGE, MATURITY	0
336	0.76	7.8	192	0.1 M HCl	39.6	12	LEAF	FIELD, SLUDGE, MATURITY	0
337	0.76	7.8	292	0.1 M HCl	32.6	14	LEAF	FIELD, SLUDGE, MATURITY	0
338	1.22	7.8	428	0.1 M HCl	29.8	15	LEAF	FIELD, SLUDGE, MATURITY	0
339	0.33	7.5	0	0.1 M HCl	11.7	8	LEAF	FIELD, SLUDGE, MATURITY	0
340	0.44	7.5	0	0.1 M HCl	9.5	10	LEAF	FIELD, SLUDGE, MATURITY	0
341	0.44	7.5	0	0.1 M HCl	11.5	14	LEAF	FIELD, SLUDGE, MATURITY	0
342	0.36	7.5	0	0.1 M HCl	13.3	12	LEAF	FIELD, SLUDGE, MATURITY	0
343	0.36	7.5	0	0.1 M HCl	11.9	9	LEAF	FIELD, SLUDGE, MATURITY	0
344	0.46	7.5	0	0.1 M HCl	14.3	8	LEAF	FIELD, SLUDGE, MATURITY	0
345	0.46	7.5	0	0.1 M HCl	16.4	11	LEAF	FIELD, SLUDGE, MATURITY	0
346	0.73	7.5	0	0.1 M HCl	18.8	11	LEAF	FIELD, SLUDGE, MATURITY	0
347	0.73	7.5	0	0.1 M HCl	24.6	10	LEAF	FIELD, SLUDGE, MATURITY	0
348	0.7	7.5	0	0.1 M HCl	26.2	6	LEAF	FIELD, SLUDGE, MATURITY	0
349	0.7	7.5	0	0.1 M HCl	29.3	9	LEAF	FIELD, SLUDGE, MATURITY	0
350	0.59	7.5	140	0.1 M HCl	19.8	8	LEAF	FIELD, SLUDGE, MATURITY	29.5
351	0.94	7.5	175	0.1 M HCl	23.4	9	LEAF	FIELD, SLUDGE, MATURITY	NA
352	0.94	7.5	206	0.1 M HCl	51	11	LEAF	FIELD, SLUDGE, MATURITY	0
353	0.67	7.5	228	0.1 M HCl	41.5	12	LEAF	FIELD, SLUDGE, MATURITY	0
354	0.67	7.5	264	0.1 M HCl	38.2	7	LEAF	FIELD, SLUDGE, MATURITY	0
355	0.87	7.5	289	0.1 M HCl	50.6	8	LEAF	FIELD, SLUDGE, MATURITY	0
356	0.87	7.5	313	0.1 M HCl	51.2	15	LEAF	FIELD, SLUDGE, MATURITY	0
357	1.41	7.5	334	0.1 M HCl	72.1	11	LEAF	FIELD, SLUDGE, MATURITY	0
358	1.41	7.5	351	0.1 M HCl	80.1	10	LEAF	FIELD, SLUDGE, MATURITY	0
359	1.25	7.5	373	0.1 M HCl	76.2	6	LEAF	FIELD, SLUDGE, MATURITY	0
360	1.25	7.5	387	0.1 M HCl	69.7	9	LEAF	FIELD, SLUDGE, MATURITY	0
361	0.94	7.5	280	0.1 M HCl	40.5	10	LEAF	FIELD, SLUDGE, MATURITY	21.5
362	0.94	7.5	350	0.1 M HCl	37.2	13	LEAF	FIELD, SLUDGE, MATURITY	NA
363	1.56	7.5	412	0.1 M HCl	103	14	LEAF	FIELD, SLUDGE, MATURITY	0
364	1.56	7.5	456	0.1 M HCl	89	13	LEAF	FIELD, SLUDGE, MATURITY	0
365	1.04	7.5	528	0.1 M HCl	84.4	12	LEAF	FIELD, SLUDGE, MATURITY	0
366	1.04	7.5	578	0.1 M HCl	106	10	LEAF	FIELD, SLUDGE, MATURITY	0
367	1.48	7.5	626	0.1 M HCl	112	14	LEAF	FIELD, SLUDGE, MATURITY	0
368	1.48	7.5	668	0.1 M HCl	128	11	LEAF	FIELD, SLUDGE, MATURITY	0
369	2.15	7.5	702	0.1 M HCl	148	13	LEAF	FIELD, SLUDGE, MATURITY	0
370	2.15	7.5	746	0.1 M HCl	123	5	LEAF	FIELD, SLUDGE, MATURITY	0

TABLE F-2 (cont.)

	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
334	GRAIN	0	STOVER	
335	GRAIN	0	STOVER	
336	GRAIN	0	STOVER	
337	GRAIN	0	STOVER	
338	GRAIN	0	STOVER	
339	GRAIN	0	STOVER	
340	GRAIN	0	STOVER	
341	GRAIN	0	STOVER	
342	GRAIN	0	STOVER	
343	GRAIN	0	STOVER	
344	GRAIN	0	STOVER	
345	GRAIN	0	STOVER	
346	GRAIN	0	STOVER	
347	GRAIN	0	STOVER	
348	GRAIN	0	STOVER	
349	GRAIN	0	STOVER	
350	GRAIN	0	STOVER	
351	GRAIN	NA	STOVER	
352	GRAIN	0	STOVER	
353	GRAIN	0	STOVER	
354	GRAIN	0	STOVER	
355	GRAIN	0	STOVER	
356	GRAIN	0	STOVER	
357	GRAIN	0	STOVER	
358	GRAIN	0	STOVER	
359	GRAIN	0	STOVER	
360	GRAIN	0	STOVER	
361	GRAIN	0	STOVER	
362	GRAIN	NA	STOVER	
363	GRAIN	0	STOVER	
364	GRAIN	0	STOVER	
365	GRAIN	0	STOVER	
366	GRAIN	0	STOVER	
367	GRAIN	0	STOVER	
368	GRAIN	0	STOVER	
369	GRAIN	0	STOVER	
370	GRAIN	0	STOVER	

TABLE F-2 (cont.)

	COMMENTS	LOCATION
334		FULTON CO., ILLINOIS
335		FULTON CO., ILLINOIS
336		FULTON CO., ILLINOIS
337		FULTON CO., ILLINOIS
338		FULTON CO., ILLINOIS
339		FULTON CO., ILLINOIS
340		FULTON CO., ILLINOIS
341		FULTON CO., ILLINOIS
342		FULTON CO., ILLINOIS
343		FULTON CO., ILLINOIS
344		FULTON CO., ILLINOIS
345		FULTON CO., ILLINOIS
346		FULTON CO., ILLINOIS
347		FULTON CO., ILLINOIS
348		FULTON CO., ILLINOIS
349		FULTON CO., ILLINOIS
350		FULTON CO., ILLINOIS
351		FULTON CO., ILLINOIS
352		FULTON CO., ILLINOIS
353		FULTON CO., ILLINOIS
354		FULTON CO., ILLINOIS
355		FULTON CO., ILLINOIS
356		FULTON CO., ILLINOIS
357		FULTON CO., ILLINOIS
358		FULTON CO., ILLINOIS
359		FULTON CO., ILLINOIS
360		FULTON CO., ILLINOIS
361		FULTON CO., ILLINOIS
362		FULTON CO., ILLINOIS
363		FULTON CO., ILLINOIS
364		FULTON CO., ILLINOIS
365		FULTON CO., ILLINOIS
366		FULTON CO., ILLINOIS
367		FULTON CO., ILLINOIS
368		FULTON CO., ILLINOIS
369		FULTON CO., ILLINOIS
370		FULTON CO., ILLINOIS

TABLE F-2 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
371	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53	679	454
372	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
373	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
374	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
375	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
376	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
377	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
378	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
379	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
380	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
381	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71	775	460
382	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53	679	454

TABLE F-2 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
371	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
372	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
373	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
374	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
375	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
376	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
377	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
378	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
379	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
380	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
381	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
382	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3

TABLE F-2 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg
371	33.6	497.2	0	STRIP MINE SPOIL						
372	64.3	321.9	0	STRIP MINE SPOIL						
373	79.7	401.6	0	STRIP MINE SPOIL						
374	69.8	471.4	0	STRIP MINE SPOIL						
375	45.5	516.9	0	STRIP MINE SPOIL						
376	68.8	585.7	0	STRIP MINE SPOIL						
377	71.7	657.4	0	STRIP MINE SPOIL						
378	67.2	724.6	0	STRIP MINE SPOIL						
379	67.2	791.8	0	STRIP MINE SPOIL						
380	67.2	859	0	STRIP MINE SPOIL						
381	67.2	926.2	0	STRIP MINE SPOIL						
382	67.2	993.4	0	STRIP MINE SPOIL						

TABLE F-2 (cont.)

	SOIL OC %	SOIL pH	CUMM CU LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL CU CONCENTRTN mg/kg	PLANT CU CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %
371	1.9	7.5	774	0.1 M HCl	131	8	LEAF	FIELD, SLUDGE, MATURITY	43.7
372	1.22	7.5	560	0.1 M HCl	63.7	11	LEAF	FIELD, SLUDGE, MATURITY	23
373	3.02	7.5	700	0.1 M HCl	74.2	18	LEAF	FIELD, SLUDGE, MATURITY	NA
374	3.02	7.5	824	0.1 M HCl	203	19	LEAF	FIELD, SLUDGE, MATURITY	0
375	1.58	7.5	912	0.1 M HCl	176	17	LEAF	FIELD, SLUDGE, MATURITY	0
376	1.58	7.5	1056	0.1 M HCl	140	15	LEAF	FIELD, SLUDGE, MATURITY	0
377	2.38	7.5	1156	0.1 M HCl	204	13	LEAF	FIELD, SLUDGE, MATURITY	0
378	2.38	7.5	1252	0.1 M HCl	200	17	LEAF	FIELD, SLUDGE, MATURITY	0
379	3.47	7.5	1336	0.1 M HCl	262	12	LEAF	FIELD, SLUDGE, MATURITY	0
380	3.47	7.5	1404	0.1 M HCl	240	14	LEAF	FIELD, SLUDGE, MATURITY	0
381	2.77	7.5	1492	0.1 M HCl	229	6	LEAF	FIELD, SLUDGE, MATURITY	0
382	2.77	7.5	1548	0.1 M HCl	201	7	LEAF	FIELD, SLUDGE, MATURITY	59.2

TABLE F-2 (cont.)

	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
371	GRAIN	0	STOVER	
372	GRAIN	0	STOVER	
373	GRAIN	NA	STOVER	
374	GRAIN	0	STOVER	
375	GRAIN	0	STOVER	
376	GRAIN	0	STOVER	
377	GRAIN	0	STOVER	
378	GRAIN	0	STOVER	
379	GRAIN	0	STOVER	
380	GRAIN	0	STOVER	
381	GRAIN	0	STOVER	
382	GRAIN	0	STOVER	

TABLE F-2 (cont.)

	COMMENTS	LOCATION
371		FULTON CO., ILLINOIS
372		FULTON CO., ILLINOIS
373		FULTON CO., ILLINOIS
374		FULTON CO., ILLINOIS
375		FULTON CO., ILLINOIS
376		FULTON CO., ILLINOIS
377		FULTON CO., ILLINOIS
378		FULTON CO., ILLINOIS
379		FULTON CO., ILLINOIS
380		FULTON CO., ILLINOIS
381		FULTON CO., ILLINOIS
382		FULTON CO., ILLINOIS

TABLE F-3. NICKEL DATA

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
1	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
2	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
3	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
4	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
5	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
6	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
7	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
8	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
9	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
10	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
11	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
12	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
13	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
14	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
15	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
16	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
17	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
18	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
19	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
20	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
21	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
22	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
23	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
24	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
25	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
26	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
27	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
28	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40	400	520
29	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
30	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
31	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
32	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
33	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
34	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
35	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
36	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
37	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
38	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
1	1.5	2.1	40	1.3	1600	1800			
2	1.5	2.1	40	1.3	1600	1800			
3	1.5	2.1	40	1.3	1600	1800			
4	1.5	2.1	40	1.3	1600	1800			
5	1.5	2.1	40	1.3	1600	1800			
6	1.5	2.1	40	1.3	1600	1800			
7	1.5	2.1	40	1.3	1600	1800			
8	1.5	2.1	40	1.3	1600	1800			
9	1.5	2.1	40	1.3	1600	1800			
10	1.5	2.1	40	1.3	1600	1800			
11	1.5	2.1	40	1.3	1600	1800			
12	1.5	2.1	40	1.3	1600	1800			
13	1.5	2.1	40	1.3	1600	1800			
14	1.5	2.1	40	1.3	1600	1800			
15	1.5	2.1	40	1.3	1600	1800			
16	1.5	2.1	40	1.3	1600	1800			
17	1.5	2.1	40	1.3	1600	1800			
18	1.5	2.1	40	1.3	1600	1800			
19	1.5	2.1	40	1.3	1600	1800			
20	1.5	2.1	40	1.3	1600	1800			
21	1.5	2.1	40	1.3	1600	1800			
22	1.5	2.1	40	1.3	1600	1800			
23	1.5	2.1	40	1.3	1600	1800			
24	1.5	2.1	40	1.3	1600	1800			
25	1.5	2.1	40	1.3	1600	1800			
26	1.5	2.1	40	1.3	1600	1800			
27	1.5	2.1	40	1.3	1600	1800			
28	1.5	2.1	40	1.3	1600	1800			
29	1.5	2.1	40	1.3	1600	1800			
30	1.5	2.1	40	1.3	1600	1800			
31	1.5	2.1	40	1.3	1600	1800			
32	1.5	2.1	40	1.3	1600	1800			
33	1.5	2.1	40	1.3	1600	1800			
34	1.5	2.1	40	1.3	1600	1800			
35	1.5	2.1	40	1.3	1600	1800			
36	1.5	2.1	40	1.3	1600	1800			
37	1.5	2.1	40	1.3	1600	1800			
38	1.5	2.1	40	1.3	1600	1800			

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
1	0	0			SANGO	SiL			
2	50	50	0		SANGO	SiL			
3	100	100	0		SANGO	SiL			
4	200	200	0		SANGO	SiL			
5	0	0			SANGO	SiL			
6	0	0			SANGO	SiL			
7	50	50	1		SANGO	SiL			
8	100	100	1		SANGO	SiL			
9	200	200	1		SANGO	SiL			
10	50	100	0		SANGO	SiL			
11	100	200	0		SANGO	SiL			
12	200	400	0		SANGO	SiL			
13	0	0			SANGO	SiL			
14	0	0			SANGO	SiL			
15	50	50	2		SANGO	SiL			
16	100	100	2		SANGO	SiL			
17	200	200	2		SANGO	SiL			
18	50	150	0		SANGO	SiL			
19	100	300	0		SANGO	SiL			
20	200	600	0		SANGO	SiL			
21	0	0			SANGO	SiL			
22	0	0			SANGO	SiL			
23	50	50	3		SANGO	SiL			
24	100	100	3		SANGO	SiL			
25	200	200	3		SANGO	SiL			
26	50	200	0		SANGO	SiL			
27	100	400	0		SANGO	SiL			
28	200	800	0		SANGO	SiL			
29	0	0			SANGO	SiL			
30	50	50	0		SANGO	SiL			
31	100	100	0		SANGO	SiL			
32	200	200	0		SANGO	SiL			
33	0	0			SANGO	SiL			
34	0	0			SANGO	SiL			
35	50	50	1		SANGO	SiL			
36	100	100	1		SANGO	SiL			
37	200	200	1		SANGO	SiL			
38	50	100	0		SANGO	SiL			

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
1			4.9	0	0.5 M HCl	1.1	4.4	FORAGE	FIELD, SLUDGE, MATURITY
2			5.3	2	0.5 M HCl	1.8	2.[illegible]	FORAGE	FIELD, SLUDGE, MATURITY
3			5.3	4	0.5 M HCl	1.4	4.5	FORAGE	FIELD, SLUDGE, MATURITY
4			5.6	8	0.5 M HCl	2.1	3.1	FORAGE	FIELD, SLUDGE, MATURITY
5			4.9	0	0.5 M HCl	0.8	1.5	FORAGE	FIELD, SLUDGE, MATURITY
6			4.9	0	0.5 M HCl	0.7	1.4	FORAGE	FIELD, SLUDGE, MATURITY
7			5.3	2	0.5 M HCl	1	2.3	FORAGE	FIELD, SLUDGE, MATURITY
8			5.3	4	0.5 M HCl	1.5	1.7	FORAGE	FIELD, SLUDGE, MATURITY
9			5.6	8	0.5 M HCl	1.8	2.2	FORAGE	FIELD, SLUDGE, MATURITY
10			5.6	4	0.5 M HCl	1.9	2	FORAGE	FIELD, SLUDGE, MATURITY
11			5.6	8	0.5 M HCl	1.9	1.7	FORAGE	FIELD, SLUDGE, MATURITY
12			5.6	16	0.5 M HCl	4.5	1.6	FORAGE	FIELD, SLUDGE, MATURITY
13			6.5	0	0.5 M HCl	1.2	1.1	FORAGE	FIELD, SLUDGE, MATURITY
14			6.5	0	0.5 M HCl	1.3	1.4	FORAGE	FIELD, SLUDGE, MATURITY
15			5.2	2	0.5 M HCl	1.7	1.3	FORAGE	FIELD, SLUDGE, MATURITY
16			5.6	4	0.5 M HCl	1.9	1.2	FORAGE	FIELD, SLUDGE, MATURITY
17			5.9	8	0.5 M HCl	2.3	1.2	FORAGE	FIELD, SLUDGE, MATURITY
18			6	6	0.5 M HCl	2.3	1.2	FORAGE	FIELD, SLUDGE, MATURITY
19			5.9	12	0.5 M HCl	3	1.6	FORAGE	FIELD, SLUDGE, MATURITY
20			6.3	24	0.5 M HCl	6.3	1.2	FORAGE	FIELD, SLUDGE, MATURITY
21			6.3	0	DTPA	0.1	0.8	FORAGE	FIELD, SLUDGE, MATURITY
22			5.8	0	DTPA	0.1	0.8	FORAGE	FIELD, SLUDGE, MATURITY
23			5.5	2	DTPA	0.3	0.9	FORAGE	FIELD, SLUDGE, MATURITY
24			5.7	4	DTPA	0.4	1	FORAGE	FIELD, SLUDGE, MATURITY
25			6.1	8	DTPA	0.5	1.2	FORAGE	FIELD, SLUDGE, MATURITY
26			5	8	DTPA	0.6	0.8	FORAGE	FIELD, SLUDGE, MATURITY
27			5.3	16	DTPA	0.7	0.9	FORAGE	FIELD, SLUDGE, MATURITY
28			5.7	32	DTPA	1.5	1.2	FORAGE	FIELD, SLUDGE, MATURITY
29			4.9	0	0.5 M HCl	1.1	5	VINES	FIELD, SLUDGE, MATURITY
30			5.3	2	0.5 M HCl	1.8	6.7	VINES	FIELD, SLUDGE, MATURITY
31			5.3	4	0.5 M HCl	1.4	5.5	VINES	FIELD, SLUDGE, MATURITY
32			5.6	8	0.5 M HCl	2.1	5.8	VINES	FIELD, SLUDGE, MATURITY
33			4.9	0	0.5 M HCl	0.8	2.9	VINES	FIELD, SLUDGE, MATURITY
34			4.9	0	0.5 M HCl	0.7	2	VINES	FIELD, SLUDGE, MATURITY
35			5.3	2	0.5 M HCl	1	6.7	VINES	FIELD, SLUDGE, MATURITY
36			5.3	4	0.5 M HCl	1.5	6.4	VINES	FIELD, SLUDGE, MATURITY
37			5.6	8	0.5 M HCl	1.8	5.3	VINES	FIELD, SLUDGE, MATURITY
38			5.6	4	0.5 M HCl	1.9	4.5	VINES	FIELD, SLUDGE, MATURITY

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
1	0	STOVER			NO
2	0	STOVER			NO
3	0	STOVER			NO
4	0	STOVER			NO
5	0	STOVER			NO
6	0	STOVER			NO
7	0	STOVER			NO
8	0	STOVER			NO
9	0	STOVER			NO
10	0	STOVER			NO
11	0	STOVER			NO
12	0	STOVER			NO
13	0	STOVER			NO
14	0	STOVER			NO
15	0	STOVER			NO
16	0	STOVER			NO
17	0	STOVER			NO
18	0	STOVER			NO
19	0	STOVER			NO
20	0	STOVER			NO
21	0	STOVER			NO
22	0	STOVER			NO
23	11.3*	STOVER			*NO
24	0	STOVER			NO
25	0	STOVER			NO
26	14.2*	STOVER			*NO
27	17.6*	STOVER			*NO
28	0	STOVER			NO
29	0	VINES	0	PODS	NO
30	0	VINES	17.7*	PODS	*NO
31	0	VINES	35.3*	PODS	*NO
32	0	VINES	55*	PODS	*NO
33	0	VINES	0	PODS	NO
34	0	VINES	0	PODS	NO
35	0	VINES	25.4*	PODS	*NO
36	0	VINES	0	PODS	NO
37	0	VINES	28.5*	PODS	*NO
38	0	VINES	0	PODS	NO

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
1		MUSCLE SCHOALES, AL
2		MUSCLE SCHOALES, AL
3		MUSCLE SCHOALES, AL
4		MUSCLE SCHOALES, AL
5		MUSCLE SCHOALES, AL
6		MUSCLE SCHOALES, AL
7		MUSCLE SCHOALES, AL
8		MUSCLE SCHOALES, AL
9		MUSCLE SCHOALES, AL
10		MUSCLE SCHOALES, AL
11		MUSCLE SCHOALES, AL
12		MUSCLE SCHOALES, AL
13		MUSCLE SCHOALES, AL
14		MUSCLE SCHOALES, AL
15		MUSCLE SCHOALES, AL
16		MUSCLE SCHOALES, AL
17		MUSCLE SCHOALES, AL
18		MUSCLE SCHOALES, AL
19		MUSCLE SCHOALES, AL
20		MUSCLE SCHOALES, AL
21		MUSCLE SCHOALES, AL
22		MUSCLE SCHOALES, AL
23	* DOSE RESPONSE & TISSUE NI NOT CONSISTENT	MUSCLE SCHOALES, AL
24		MUSCLE SCHOALES, AL
25		MUSCLE SCHOALES, AL
26	*TISSUE NI INCONSISTENT, ANNUAL LOADING EXCEEDS AGRONOMIC RATES, SOIL PH<5.5	MUSCLE SCHOALES, AL
27	*TISSUE NI INCONSISTENT, ANNUAL LOADING EXCEEDS AGRONOMIC RATES, SOIL PH<5.5	MUSCLE SCHOALES, AL
28		MUSCLE SCHOALES, AL
29		MUSCLE SCHOALES, AL
30	*TISSUE NI CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA	MUSCLE SCHOALES, AL
31	*TISSUE NI CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA	MUSCLE SCHOALES, AL
32	*TISSUE NI CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA	MUSCLE SCHOALES, AL
33		MUSCLE SCHOALES, AL
34		MUSCLE SCHOALES, AL
35	*DOSE RESPONSE & TISSUE NI CONCENTRATION INCONSISTANT	MUSCLE SCHOALES, AL
36		MUSCLE SCHOALES, AL
37	*DOSE RESPONSE & TISSUE NI CONCENTRATION INCONSISTANT	MUSCLE SCHOALES, AL
38		MUSCLE SCHOALES, AL

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
39	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
40	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
41	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
42	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
43	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
44	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
45	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
46	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
47	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
48	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
49	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
50	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
51	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
52	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
53	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
54	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
55	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
56	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40	400	520
57	GIORDANO & MAYS 1977	BEANS								
58	GIORDANO & MAYS 1977	BEANS		6.6			2.5	50	350	730
59	GIORDANO & MAYS 1977	BEANS		6.1			1.7	40	400	520
60	GIORDANO & MAYS 1977	OKRA								
61	GIORDANO & MAYS 1977	OKRA		6.6			2.5	50	350	730
62	GIORDANO & MAYS 1977	OKRA		6.1			1.7	40	400	520
63	GIORDANO & MAYS 1977	PEPPERS								
64	GIORDANO & MAYS 1977	PEPPERS		6.6			2.5	50	350	730
65	GIORDANO & MAYS 1977	PEPPERS		6.1			1.7	40	400	520
66	GIORDANO & MAYS 1977	TOMATO								
67	GIORDANO & MAYS 1977	TOMATO		6.6			2.5	50	350	730
68	GIORDANO & MAYS 1977	TOMATO		6.1			1.7	40	400	520
69	GIORDANO & MAYS 1977	SQUASH								
70	GIORDANO & MAYS 1977	SQUASH		6.6			2.5	50	350	730
71	GIORDANO & MAYS 1977	SQUASH		6.1			1.7	40	400	520
72	GIORDANO & MAYS 1977	TURNIP								
73	GIORDANO & MAYS 1977	TURNIP		6.6			2.5	50	350	730
74	GIORDANO & MAYS 1977	TURNIP		6.1			1.7	40	400	520
75	GIORDANO & MAYS 1977	KALE								
76	GIORDANO & MAYS 1977	KALE		6.6			2.5	50	350	730

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
39	1.5	2.1	40	1.3	1600	1800			
40	1.5	2.1	40	1.3	1600	1800			
41	1.5	2.1	40	1.3	1600	1800			
42	1.5	2.1	40	1.3	1600	1800			
43	1.5	2.1	40	1.3	1600	1800			
44	1.5	2.1	40	1.3	1600	1800			
45	1.5	2.1	40	1.3	1600	1800			
46	1.5	2.1	40	1.3	1600	1800			
47	1.5	2.1	40	1.3	1600	1800			
48	1.5	2.1	40	1.3	1600	1800			
49	1.5	2.1	40	1.3	1600	1800			
50	1.5	2.1	40	1.3	1600	1800			
51	1.5	2.1	40	1.3	1600	1800			
52	1.5	2.1	40	1.3	1600	1800			
53	1.5	2.1	40	1.3	1600	1800			
54	1.5	2.1	40	1.3	1600	1800			
55	1.5	2.1	40	1.3	1600	1800			
56	1.5	2.1	40	1.3	1600	1800			
57									
58	1.7	2.3	20	1.6	530	1800			
59	1.5	2.1	40	1.3	1600	1800			
60									
61	1.7	2.3	20	1.6	530	1800			
62	1.5	2.1	40	1.3	1600	1800			
63									
64	1.7	2.3	20	1.6	530	1800			
65	1.5	2.1	40	1.3	1600	1800			
66									
67	1.7	2.3	20	1.6	530	1800			
68	1.5	2.1	40	1.3	1600	1800			
69									
70	1.7	2.3	20	1.6	530	1800			
71	1.5	2.1	40	1.3	1600	1800			
72									
73	1.7	2.3	20	1.6	530	1800			
74	1.5	2.1	40	1.3	1600	1800			
75									
76	1.7	2.3	20	1.6	530	1800			

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
39	100	200	0		SANGO	SiL			
40	200	400	0		SANGO	SiL			
41	0	0			SANGO	SiL			
42	0	0			SANGO	SiL			
43	50	50	2		SANGO	SiL			
44	100	100	2		SANGO	SiL			
45	200	200	2		SANGO	SiL			
46	50	150	0		SANGO	SiL			
47	100	300	0		SANGO	SiL			
48	200	600	0		SANGO	SiL			
49	0	0			SANGO	SiL			
50	0	0			SANGO	SiL			
51	50	50	3		SANGO	SiL			
52	100	100	3		SANGO	SiL			
53	200	200	3		SANGO	SiL			
54	50	200	0		SANGO	SiL			
55	100	400	0		SANGO	SiL			
56	200	800	0		SANGO	SiL			
57	0	0			SANGO	SiL			
58	112	112	0		SANGO	SiL			
59	112	112	0		SANGO	SiL			
60	0	0			SANGO	SiL			
61	112	112	0		SANGO	SiL			
62	112	112	0		SANGO	SiL			
63	0	0			SANGO	SiL			
64	112	112	0		SANGO	SiL			
65	112	112	0		SANGO	SiL			
66	0	0			SANGO	SiL			
67	112	112	0		SANGO	SiL			
68	112	112	0		SANGO	SiL			
69	0	0			SANGO	SiL			
70	112	112	0		SANGO	SiL			
71	112	112	0		SANGO	SiL			
72	0	0			SANGO	SiL			
73	112	112	0		SANGO	SiL			
74	112	112	0		SANGO	SiL			
75	0	0			SANGO	SiL			
76	112	112	0		SANGO	SiL			

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
39			5.6	8	0.5 M HCl	1.9	4.8	VINES	FIELD, SLUDGE, MATURITY
40			5.6	16	0.5 M HCl	4.5	7.[illegible]	VINES	FIELD, SLUDGE, MATURITY
41			6.5	0	0.5 M HCl	1.2	2.9	VINES	FIELD, SLUDGE, MATURITY
42			6.5	0	0.5 M HCl	1.3	2.5	VINES	FIELD, SLUDGE, MATURITY
43			5.2	2	0.5 M HCl	1.7	5.3	VINES	FIELD, SLUDGE, MATURITY
44			5.6	4	0.5 M HCl	1.9	4.7	VINES	FIELD, SLUDGE, MATURITY
45			5.9	8	0.5 M HCl	2.3	5	VINES	FIELD, SLUDGE, MATURITY
46			6	6	0.5 M HCl	2.3	5.5	VINES	FIELD, SLUDGE, MATURITY
47			5.9	12	0.5 M HCl	3	5.9	VINES	FIELD, SLUDGE, MATURITY
48			6.3	24	0.5 M HCl	6.3	5.7	VINES	FIELD, SLUDGE, MATURITY
49			6.3	0	DTPA	0.1	2.2	VINES	FIELD, SLUDGE, MATURITY
50			5.8	0	DTPA	0.1	2.2	VINES	FIELD, SLUDGE, MATURITY
51			5.5	2	DTPA	0.3	4.5	VINES	FIELD, SLUDGE, MATURITY
52			5.7	4	DTPA	0.4	4.9	VINES	FIELD, SLUDGE, MATURITY
53			6.1	8	DTPA	0.5	3.7	VINES	FIELD, SLUDGE, MATURITY
54			5	8	DTPA	0.6	4.4	VINES	FIELD, SLUDGE, MATURITY
55			5.3	16	DTPA	0.7	4.6	VINES	FIELD, SLUDGE, MATURITY
56			5.7	32	DTPA	1.5	5.5	VINES	FIELD, SLUDGE, MATURITY
57			6.4	0	0.5 M HCL	1	2.6	LEAF	FIELD, SLUDGE, MATURITY
58			6.4	2.2	0.5 M HCL	2.7	3.5	LEAF	FIELD, SLUDGE, MATURITY
59			6.4	4.4	0.5 M HCL	1.8	2.4	LEAF	FIELD, SLUDGE, MATURITY
60			6.4	0	0.5 M HCL	1	1.9	LEAF	FIELD, SLUDGE, MATURITY
61			6.4	2.2	0.5 M HCL	2.7	2.8	LEAF	FIELD, SLUDGE, MATURITY
62			6.4	4.4	0.5 M HCL	1.8	1.8	LEAF	FIELD, SLUDGE, MATURITY
63			6.4	0	0.5 M HCL	1	1.7	LEAF	FIELD, SLUDGE, MATURITY
64			6.4	2.2	0.5 M HCL	2.7	2.7	LEAF	FIELD, SLUDGE, MATURITY
65			6.4	4.4	0.5 M HCL	1.8	2.1	LEAF	FIELD, SLUDGE, MATURITY
66			6.4	0	0.5 M HCL	1	1.5	LEAF	FIELD, SLUDGE, MATURITY
67			6.4	2.2	0.5 M HCL	2.7	2.3	LEAF	FIELD, SLUDGE, MATURITY
68			6.4	4.4	0.5 M HCL	1.8	1.6	LEAF	FIELD, SLUDGE, MATURITY
69			6.4	0	0.5 M HCL	1	1.7	LEAF	FIELD, SLUDGE, MATURITY
70			6.4	2.2	0.5 M HCL	2.7	4	LEAF	FIELD, SLUDGE, MATURITY
71			6.4	4.4	0.5 M HCL	1.8	2.2	LEAF	FIELD, SLUDGE, MATURITY
72			6.4	0	0.5 M HCL	1	2.9	LEAF	FIELD, SLUDGE, MATURITY
73			6.4	2.2	0.5 M HCL	2.7	4	LEAF	FIELD, SLUDGE, MATURITY
74			6.4	4.4	0.5 M HCL	1.8	2.9	LEAF	FIELD, SLUDGE, MATURITY
75			6.4	0	0.5 M HCL	1	1.8	LEAF	FIELD, SLUDGE, MATURITY
76			6.4	2.2	0.5 M HCL	2.7	3.5	LEAF	FIELD, SLUDGE, MATURITY

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
39	0	VINES	0	PODS	NO
40	0	VINES	60.4*	PODS	*NO
41	0	VINES	0	PODS	NO
42	0	VINES	0	PODS	NO
43	30.8*	VINES	37.5*	PODS	*NO
44	0	VINES	0	PODS	NO
45	0	VINES	0	PODS	NO
46	0	VINES	0	PODS	NO
47	0	VINES	0	PODS	NO
48	0	VINES	0	PODS	NO
49	0	VINES	0	PODS	NO
50	0	VINES	0	PODS	NO
51	26.2*	VINES	0	PODS	*NO
52	14.5*	VINES	0	PODS	*NO
53	0	VINES	0	PODS	NO
54	27*	VINES	0	PODS	*NO
55	36*	VINES	36.8*	PODS	*NO
56	32.8*	VINES	42.8*	PODS	*NO
57	0	EDIBLE PART			NO
58	0	EDIBLE PART			NO
59	14.3*	EDIBLE PART			*NO
60	0	EDIBLE PART			NO
61	8.3*	EDIBLE PART			*NO
62	8.3*	EDIBLE PART			*NO
63	0	EDIBLE PART			NO
64	0	EDIBLE PART			NO
65	13*	EDIBLE PART			*NO
66	0	EDIBLE PART			NO
67	0	EDIBLE PART			NO
68	0	EDIBLE PART			NO
69	0	EDIBLE PART			NO
70	0	EDIBLE PART			NO
71	0	EDIBLE PART			NO
72	0	EDIBLE PART			NO
73	0	EDIBLE PART			NO
74	0	EDIBLE PART			NO
75	0	EDIBLE PART			NO
76	0	EDIBLE PART			NO

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
381			NO	
382			NO	
383			NO	
384			NO	
385			NO	
386			NO	
387			NO	
388			NO	
389			NO	
390			NO	
391			NO	
392			NO	
393			NO	
394			NO	
395			NO	
396			NO	
397			NO	
398			NO	
399			NO	
400			NO	
401			NO	
402			NO	
403			NO	
404			NO	
405			NO	
406			NO	
407			NO	
408			NO	
409			NO	
410			NO	
411			NO	
412			NO	
413			NO	
414			NO	
415			NO	
416			NO	
417			NO	
418			NO	

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
381			212	Leaf	SLUDGE, FIELD, MATURITY	0	Grain
382		68	14.5		SLUDGE, FIELD, MATURITY	NOT REPORTED	
383		68	18		SLUDGE, FIELD, MATURITY	NOT REPORTED	
384		68	18.5		SLUDGE, FIELD, MATURITY	NOT REPORTED	
385		68	16		SLUDGE, FIELD, MATURITY	NOT REPORTED	
386		68	28.3		SLUDGE, FIELD, MATURITY	NOT REPORTED	
387		68	14.6		SLUDGE, FIELD, MATURITY	NOT REPORTED	
388		68	22.4		SLUDGE, FIELD, MATURITY	NOT REPORTED	
389		68	17.5		SLUDGE, FIELD, MATURITY	NOT REPORTED	
390		68	17.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
391		68	20		SLUDGE, FIELD, MATURITY	NOT REPORTED	
392		68	19.8		SLUDGE, FIELD, MATURITY	NOT REPORTED	
393		68	17.4		SLUDGE, FIELD, MATURITY	NOT REPORTED	
394		68	16.8		SLUDGE, FIELD, MATURITY	NOT REPORTED	
395		68	17.1		SLUDGE, FIELD, MATURITY	NOT REPORTED	
396		68	16.7		SLUDGE, FIELD, MATURITY	NOT REPORTED	
397		68	18.8		SLUDGE, FIELD, MATURITY	NOT REPORTED	
398		68	15.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
399		68	12.9		SLUDGE, FIELD, MATURITY	NOT REPORTED	
400		68	16		SLUDGE, FIELD, MATURITY	NOT REPORTED	
401		68	15.4		SLUDGE, FIELD, MATURITY	NOT REPORTED	
402		188	78.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
403		188	84.4		SLUDGE, FIELD, MATURITY	NOT REPORTED	
404		188	63.6		SLUDGE, FIELD, MATURITY	NOT REPORTED	
405		188	43.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
406		188	64.7		SLUDGE, FIELD, MATURITY	NOT REPORTED	
407		188	50.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
408		188	54.5		SLUDGE, FIELD, MATURITY	NOT REPORTED	
409		188	58.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
410		188	51.5		SLUDGE, FIELD, MATURITY	NOT REPORTED	
411		188	40.3		SLUDGE, FIELD, MATURITY	NOT REPORTED	
412		188	48.8		SLUDGE, FIELD, MATURITY	NOT REPORTED	
413		188	48.4		SLUDGE, FIELD, MATURITY	NOT REPORTED	
414		188	37.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
415		188	32.5		SLUDGE, FIELD, MATURITY	NOT REPORTED	
416		188	35.4		SLUDGE, FIELD, MATURITY	NOT REPORTED	
417		188	40.8		SLUDGE, FIELD, MATURITY	NOT REPORTED	
418		188	35.6		SLUDGE, FIELD, MATURITY	NOT REPORTED	

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
381							1201
382							
383							
384							
385							
386							
387							
388							
389							
390							
391							
392							
393							
394							
395							
396							
397							
398							
399							
400							
401							
402							
403							
404							
405							
406							
407							
408							
409							
410							
411							
412							
413							
414							
415							
416							
417							
418							

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
381		53	153	0	Aeric Ochraqualf	Blount	silt loam
382		0		7	Aeric Ochraqualf	Blount	silt loam
383		0		7	Aeric Ochraqualf	Blount	silt loam
384		0		7	Aeric Ochraqualf	Blount	silt loam
385		0		7	Aeric Ochraqualf	Blount	silt loam
386		0		7	Aeric Ochraqualf	Blount	silt loam
387		0		7	Aeric Ochraqualf	Blount	silt loam
388		0		7	Aeric Ochraqualf	Blount	silt loam
389		0		7	Aeric Ochraqualf	Blount	silt loam
390		0		7	Aeric Ochraqualf	Blount	silt loam
391		0		7	Aeric Ochraqualf	Blount	silt loam
392		0		7	Aeric Ochraqualf	Blount	silt loam
393		0		7	Aeric Ochraqualf	Blount	silt loam
394		0		7	Aeric Ochraqualf	Blount	silt loam
395		0		7	Aeric Ochraqualf	Blount	silt loam
396		0		7	Aeric Ochraqualf	Blount	silt loam
397		0		7	Aeric Ochraqualf	Blount	silt loam
398		0		7	Aeric Ochraqualf	Blount	silt loam
399		0		7	Aeric Ochraqualf	Blount	silt loam
400		0		7	Aeric Ochraqualf	Blount	silt loam
401		0		7	Aeric Ochraqualf	Blount	silt loam
402		17.75		7	Aeric Ochraqualf	Blount	silt loam
403		17.75		7	Aeric Ochraqualf	Blount	silt loam
404		17.75		7	Aeric Ochraqualf	Blount	silt loam
405		17.75		7	Aeric Ochraqualf	Blount	silt loam
406		17.75		7	Aeric Ochraqualf	Blount	silt loam
407		17.75		7	Aeric Ochraqualf	Blount	silt loam
408		17.75		7	Aeric Ochraqualf	Blount	silt loam
409		17.75		7	Aeric Ochraqualf	Blount	silt loam
410		17.75		7	Aeric Ochraqualf	Blount	silt loam
411		17.75		7	Aeric Ochraqualf	Blount	silt loam
412		17.75		7	Aeric Ochraqualf	Blount	silt loam
413		17.75		7	Aeric Ochraqualf	Blount	silt loam
414		17.75		7	Aeric Ochraqualf	Blount	silt loam
415		17.75		7	Aeric Ochraqualf	Blount	silt loam
416		17.75		7	Aeric Ochraqualf	Blount	silt loam
417		17.75		7	Aeric Ochraqualf	Blount	silt loam
418		17.75		7	Aeric Ochraqualf	Blount	silt loam

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
381										Liquid digested sludge
382										Control
383										Control
384										Control
385										Control
386										Control
387										Control
388										Control
389										Control
390										Control
391										Control
392										Control
393										Control
394										Control
395										Control
396										Control
397										Control
398										Control
399										Control
400										Control
401										Control
402										One-quarter maximum
403										One-quarter maximum
404										One-quarter maximum
405										One-quarter maximum
406										One-quarter maximum
407										One-quarter maximum
408										One-quarter maximum
409										One-quarter maximum
410										One-quarter maximum
411										One-quarter maximum
412										One-quarter maximum
413										One-quarter maximum
414										One-quarter maximum
415										One-quarter maximum
416										One-quarter maximum
417										One-quarter maximum
418										One-quarter maximum

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
381	Hinesly, T.D. et al., 1977. #94	Corn						
382	Hinesly, T.D. et al., 1978. #95	Corn	Oh43					
383	Hinesly, T.D. et al., 1978. #95	Corn	R806					
384	Hinesly, T.D. et al., 1978. #95	Corn	H98					
385	Hinesly, T.D. et al., 1978. #95	Corn	A619					
386	Hinesly, T.D. et al., 1978. #95	Corn	Mo17					
387	Hinesly, T.D. et al., 1978. #95	Corn	Oh545					
388	Hinesly, T.D. et al., 1978. #95	Corn	B37					
389	Hinesly, T.D. et al., 1978. #95	Corn	R805					
390	Hinesly, T.D. et al., 1978. #95	Corn	Va26					
391	Hinesly, T.D. et al., 1978. #95	Corn	H100					
392	Hinesly, T.D. et al., 1978. #95	Corn	B73					
393	Hinesly, T.D. et al., 1978. #95	Corn	B14					
394	Hinesly, T.D. et al., 1978. #95	Corn	A632					
395	Hinesly, T.D. et al., 1978. #95	Corn	N28					
396	Hinesly, T.D. et al., 1978. #95	Corn	W64A					
397	Hinesly, T.D. et al., 1978. #95	Corn	R802A					
398	Hinesly, T.D. et al., 1978. #95	Corn	H99					
399	Hinesly, T.D. et al., 1978. #95	Corn	H96					
400	Hinesly, T.D. et al., 1978. #95	Corn	R177					
401	Hinesly, T.D. et al., 1978. #95	Corn	B77					
402	Hinesly, T.D. et al., 1978. #95	Corn	Oh43					
403	Hinesly, T.D. et al., 1978. #95	Corn	R806					
404	Hinesly, T.D. et al., 1978. #95	Corn	H98					
405	Hinesly, T.D. et al., 1978. #95	Corn	A619					
406	Hinesly, T.D. et al., 1978. #95	Corn	Mo17					
407	Hinesly, T.D. et al., 1978. #95	Corn	Oh545					
408	Hinesly, T.D. et al., 1978. #95	Corn	B37					
409	Hinesly, T.D. et al., 1978. #95	Corn	R805					
410	Hinesly, T.D. et al., 1978. #95	Corn	Va26					
411	Hinesly, T.D. et al., 1978. #95	Corn	H100					
412	Hinesly, T.D. et al., 1978. #95	Corn	B73					
413	Hinesly, T.D. et al., 1978. #95	Corn	B14					
414	Hinesly, T.D. et al., 1978. #95	Corn	A632					
415	Hinesly, T.D. et al., 1978. #95	Corn	N28					
416	Hinesly, T.D. et al., 1978. #95	Corn	W64A					
417	Hinesly, T.D. et al., 1978. #95	Corn	R802A					
418	Hinesly, T.D. et al., 1978. #95	Corn	H99					

TABLE F-4 (cont.)

	LOCATION OF STUDY
343	India
344	Canada
345	Canada
346	Canada
347	Canada
348	Canada
349	Canada
350	Canada
351	Beltsville, MD
352	Beltsville, MD
353	Beltsville, MD
354	Beltsville, MD
355	Beltsville, MD
356	Beltsville, MD
357	Beltsville, MD
358	Beltsville, MD
359	Beltsville, MD
360	Beltsville, MD
361	Beltsville, MD
362	Beltsville, MD
363	Beltsville, MD
364	Beltsville, MD
365	Beltsville, MD
366	Beltsville, MD
367	Beltsville, MD
368	Beltsville, MD
369	Beltsville, MD
370	
371	
372	
373	
374	
375	
376	
377	
378	
379	Joliet, Ill.
380	Joliet, Ill.

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
343	0	GRAIN	NO	
344			NO	
345			NO	
346			NO	
347			NO	
348			NO	
349			NO	
350			NO	
351			NO	
352			NO	
353			NO	
354			NO	
355			NO	
356			NO	
357			NO	
358			NO	
359			NO	
360			NO	
361			NO	
362			NO	
363			NO	
364			NO	
365			NO	
366			NO	
367			NO	
368			NO	
369			NO	
370			NO	
371			NO	
372			NO	
373			NO	
374			NO	
375			NO	
376			NO	
377			NO	
378			NO	
379			NO	
380			NO	

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
343	HCLO4/HNO3	81.8	88.14	Earhead	SLUDGE, FIELD, MATURITY	0	Whole Plant
344		42.8	30	Stem		0	GRAIN
345		81.4	43	Stem		0	GRAIN
346		25.2	15	Stem		0	GRAIN
347			28.4	Leaf		0	Leaf
348			42.6	Leaf		0	Leaf
349			51.9	Leaf		0	Leaf
350			78.7	Leaf		0	Leaf
351			46	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
352			40	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
353			35	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
354			45	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
355			44	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
356			34	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
357			31	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
358			37	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
359			54	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
360			50	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
361			46	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
362			40	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
363			48	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
364			57	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
365			62	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
366			62	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
367			85	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
368			106	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
369			153	Shoots	SLUDGE, FIELD, MATURITY	0	Shoots
370					SLUDGE, FIELD, MATURITY	0	GRAIN
371					SLUDGE, FIELD, MATURITY	0	GRAIN
372					SLUDGE, FIELD, MATURITY	0	GRAIN
373					SLUDGE, FIELD, MATURITY	0	GRAIN
374					SLUDGE, FIELD, MATURITY	0	GRAIN
375					SLUDGE, FIELD, MATURITY	0	GRAIN
376					SLUDGE, FIELD, MATURITY	0	GRAIN
377					SLUDGE, FIELD, MATURITY	0	GRAIN
378					SLUDGE, FIELD, MATURITY	0	GRAIN
379					SLUDGE, FIELD, MATURITY	0	Grain
380					SLUDGE, FIELD, MATURITY	0	Grain

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
343					0.7	8	
344				36.7			
345				35.7			
346				28			
347					2-2.5	5.9-6.2	6.7
348					2-2.5	5.9-6.2	20.1
349					2-2.5	5.9-6.2	26.8
350					2-2.5	5.9-6.2	40.2
351						7	
352						7.4	
353						7.6	
354						7.7	
355						7.6	
356						6.9	
357						7.4	
358						7.6	
359						5.8	
360						6.1	
361						6.8	
362						7	
363						7.1	
364						5.8	
365						5.7	
366						6	
367						5.2	
368						5.3	
369						5.1	
370							0
371							0
372							0
373							80
374							197
375							300
376							159
377							394
378							600
379							317
380							787

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
343		20	20	0			Clayey
344		75	75				
345		150	150				
346		0	0				
347				1981	Orthic Podzol	Lyndale	Sandy Loam
348				1981	Orthic Podzol	Lyndale	Sandy Loam
349				1981	Orthic Podzol	Lyndale	Sandy Loam
350				1981	Orthic Podzol	Lyndale	Sandy Loam
351		56	56	1976	Typic Paleudults	Christiana	fine sandy loam
352		112	112	1976	Typic Paleudults	Christiana	fine sandy loam
353		224	224	1976	Typic Paleudults	Christiana	fine sandy loam
354		336	336	1976	Typic Paleudults	Christiana	fine sandy loam
355		448	448	1976	Typic Paleudults	Christiana	fine sandy loam
356		56	56	1976	Typic Paleudults	Christiana	fine sandy loam
357		112	112	1976	Typic Paleudults	Christiana	fine sandy loam
358		224	224	1976	Typic Paleudults	Christiana	fine sandy loam
359		56	56	1976	Typic Paleudults	Christiana	fine sandy loam
360		112	112	1976	Typic Paleudults	Christiana	fine sandy loam
361		224	224	1976	Typic Paleudults	Christiana	fine sandy loam
362		448	448	1976	Typic Paleudults	Christiana	fine sandy loam
363		672	672	1976	Typic Paleudults	Christiana	fine sandy loam
364		56	56	1976	Typic Paleudults	Christiana	fine sandy loam
365		112	112	1976	Typic Paleudults	Christiana	fine sandy loam
366		224	224	1976	Typic Paleudults	Christiana	fine sandy loam
367		56	56	1976	Typic Paleudults	Christiana	fine sandy loam
368		112	112	1976	Typic Paleudults	Christiana	fine sandy loam
369		224	224	1976	Typic Paleudults	Christiana	fine sandy loam
370		0	0	0	Aeric Ochraqualf	Blount	silt loam
371		0	0	0	Aeric Ochraqualf	Blount	silt loam
372		0	0	0	Aeric Ochraqualf	Blount	silt loam
373		13	13	0	Aeric Ochraqualf	Blount	silt loam
374		12	25	0	Aeric Ochraqualf	Blount	silt loam
375		14	38	0	Aeric Ochraqualf	Blount	silt loam
376		26	26	0	Aeric Ochraqualf	Blount	silt loam
377		24	50	0	Aeric Ochraqualf	Blount	silt loam
378		27	77	0	Aeric Ochraqualf	Blount	silt loam
379		52	52	0	Aeric Ochraqualf	Blount	silt loam
380		48	100	0	Aeric Ochraqualf	Blount	silt loam

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
343	45	428						562		Well Water + 20 t/ha sludge
344	191	143			26.3	27200	194	420		Sludge
345	191	143			26.3	27200	194	420		Sludge
346	0.05	0.073			0.086	23.8	0.094	0.313		Irrigation Water
347										N.P.K.S. Fertilizer
348										N.P.K.S. Fertilizer
349										N.P.K.S. Fertilizer
350										N.P.K.S. Fertilizer
351		259			15		217	639		Limed-digested
352		259			15		217	639		Limed-digested
353		259			15		217	639		Limed-digested
354		259			15		217	639		Limed-digested
355		259			15		217	639		Limed-digested
356		277			17		215	599		Limed-Raw
357		277			17		215	599		Limed-Raw
358		277			17		215	599		Limed-Raw
359		274			201		272	731		Limed-Compost
360		274			201		272	731		Limed-Compost
361		274			201		272	731		Limed-Compost
362		274			201		272	731		Limed-Compost
363		274			201		272	731		Limed-Compost
364		404			37		360	1330		Heat-Treated, High pH
365		404			37		360	1330		Heat-Treated, High pH
366		404			37		360	1330		Heat-Treated, High pH
367		404			37		360	1330		Heat-Treated, Low pH
368		404			37		360	1330		Heat-Treated, Low pH
369		404			37		360	1330		Heat-Treated, Low pH
370										Liquid digested sludge
371										Liquid digested sludge
372										Liquid digested sludge
373										Liquid digested sludge
374										Liquid digested sludge
375										Liquid digested sludge
376										Liquid digested sludge
377										Liquid digested sludge
378										Liquid digested sludge
379										Liquid digested sludge
380										Liquid digested sludge

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
343	Chakrabarti, C. and T. Chakrabarti, 1988. #29	Wheat	HDM 1553					
344	Gillies, J.A. et al., 1989. #73	Oat	Harmon					4.6
345	Gillies, J.A. et al., 1989. #73	Oat	Harmon					4.6
346	Gillies, J.A. et al., 1989. #73	Oat	Harmon					0.014
347	Gupta, Umesh C., and W.J. Arsenault, 1986. #80	Tobacco						
348	Gupta, Umesh C., and W.J. Arsenault, 1986. #80	Tobacco						
349	Gupta, Umesh C., and W.J. Arsenault, 1986. #80	Tobacco						
350	Gupta, Umesh C., and W.J. Arsenault, 1986. #80	Tobacco						
351	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					5.9
352	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					5.9
353	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					5.9
354	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					5.9
355	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					5.9
356	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					4.9
357	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					4.9
358	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					4.9
359	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					7.2
360	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					7.2
361	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					7.2
362	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					7.2
363	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					7.2
364	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					8.3
365	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					8.3
366	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					8.3
367	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					8.3
368	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					8.3
369	Heckman, J.R. et al., 1987. #89	Soybean	Merr.					8.3
370	Hinesly, T.D. et al., 1977. #94	CORN						
371	Hinesly, T.D. et al., 1977. #94	CORN						
372	Hinesly, T.D. et al., 1977. #94	CORN						
373	Hinesly, T.D. et al., 1977. #94	CORN						
374	Hinesly, T.D. et al., 1977. #94	CORN						
375	Hinesly, T.D. et al., 1977. #94	CORN						
376	Hinesly, T.D. et al., 1977. #94	CORN						
377	Hinesly, T.D. et al., 1977. #94	CORN						
378	Hinesly, T.D. et al., 1977. #94	CORN						
379	Hinesly, T.D. et al., 1977. #94	Corn						
380	Hinesly, T.D. et al., 1977. #94	Corn						

TABLE F-4 (cont.)

	LOCATION OF STUDY
305	JOLIET, ILLINOIS
306	JOLIET, ILLINOIS
307	JOLIET, ILLINOIS
308	JOLIET, ILLINOIS
309	JOLIET, ILLINOIS
310	JOLIET, ILLINOIS
311	JOLIET, ILLINOIS
312	JOLIET, ILLINOIS
313	JOLIET, ILLINOIS
314	JOLIET, ILLINOIS
315	JOLIET, ILLINOIS
316	JOLIET, ILLINOIS
317	JOLIET, ILLINOIS
318	JOLIET, ILLINOIS
319	JOLIET, ILLINOIS
320	JOLIET, ILLINOIS
321	JOLIET, ILLINOIS
322	JOLIET, ILLINOIS
323	JOLIET, ILLINOIS
324	JOLIET, ILLINOIS
325	JOLIET, ILLINOIS
326	JOLIET, ILLINOIS
327	JOLIET, ILLINOIS
328	JOLIET, ILLINOIS
329	JOLIET, ILLINOIS
330	JOLIET, ILLINOIS
331	JOLIET, ILLINOIS
332	JOLIET, ILLINOIS
333	JOLIET, ILLINOIS
334	JOLIET, ILLINOIS
335	JOLIET, ILLINOIS
336	JOLIET, ILLINOIS
337	JOLIET, ILLINOIS
338	JOLIET, ILLINOIS
339	JOLIET, ILLINOIS
340	JOLIET, ILLINOIS
341	India
342	India

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
305	0	STOVER	NO	
306	0	STOVER	NO	
307	0	STOVER	NO	
308	NA	STOVER	NO	
309	0	STOVER	NO	
310	0	STOVER	NO	
311	0	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT
312	0	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT
313	0	STOVER	NO	
314	0	STOVER	NO	
315	0	STOVER	NO	
316	0	STOVER	NO	
317	0	STOVER	NO	
318	0	STOVER	NO	
319	NA	STOVER	NO	
320	0	STOVER	NO	
321	0	STOVER	NO	
322	0	STOVER	NO	
323	0	STOVER	NO	
324	0	STOVER	NO	
325	0	STOVER	NO	
326	0	STOVER	NO	
327	0	STOVER	NO	
328	0	STOVER	NO	
329	0	STOVER	NO	
330	NA	STOVER	NO	
331	0	STOVER	NO	
332	0	STOVER	NO	
333	0	STOVER	NO	
334	0	STOVER	NO	
335	0	STOVER	NO	
336	0	STOVER	NO	
337	0	STOVER	NO	
338	0	STOVER	NO	
339	0	STOVER	NO	
340	0	STOVER	NO	
341	0	GRAIN	NO	
342	0	GRAIN	NO	

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
305	HCL-HF	77	52	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
306	HCL-HF	81	39	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
307	HCL-HF	90	NA	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
308	HCL-HF	61	38	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
309	HCL-HF	88	42	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
310	HCL-HF	125	94	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
311	HCL-HF	111	92	LEAF	SLUDGE, FIELD, MATURITY	60*	GRAIN
312	HCL-HF	165	11	LEAF	SLUDGE, FIELD, MATURITY	60*	GRAIN
313	HCL-HF	149	151	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
314	HCL-HF	193	102	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
315	HCL-HF	238	76	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
316	HCL-HF	314	93	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
317	HCL-HF	305	57	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
318	HCL-HF	234	NA	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
319	HCL-HF	60	52	LEAF	SLUDGE, FIELD, MATURITY	NA	GRAIN
320	HCL-HF	122	80	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
321	HCL-HF	192	171	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
322	HCL-HF	243	96	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
323	HCL-HF	238	176	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
324	HCL-HF	336	435	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
325	HCL-HF	335	188	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
326	HCL-HF	320	154	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
327	HCL-HF	544	153	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
328	HCL-HF	462	119	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
329	HCL-HF	431	NA	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
330	HCL-HF	265	87	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
331	HCL-HF	133	124	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
332	HCL-HF	227	133	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
333	HCL-HF	293	136	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
334	HCL-HF	506	396	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
335	HCL-HF	500	540	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
336	HCL-HF	589	356	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
337	HCL-HF	623	192	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
338	HCL-HF	623	310	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
339	HCL-HF	723	225	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
340	HCL-HF	753	NA	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
341	HCL04/HNO3	22.2	43.32	Earhead	SLUDGE, FIELD, MATURITY	0	Whole Plant
342	HCL04/HNO3	47	60.54	Earhead	SLUDGE, FIELD, MATURITY	0	Whole Plant

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
305					0.76	7	0
306					1.21	6.9	0
307					0.84	7.1	0
308					0.31	NA	225
309					0.44	7.2	259
310					0.63	7.3	314
311					0.67	7.5	402
312					0.78	7	463
313					0.8	7	531
314					0.99	6.6	531
315					1.42	7.1	531
316					1.71	7.2	531
317					1.82	7.2	531
318					1.96	7.1	531
319					0.43	NA	449
320					0.51	7.1	517
321					0.94	7	628
322					1.16	7.2	804
323					1.4	7	926
324					1.75	6.4	1063
325					2	6.3	1063
326					2.16	6.8	1063
327					2.02	6.8	1063
328					2.33	7.1	1063
329					1.66	7	1063
330					0.73	NA	898
331					0.57	6.8	1033
332					1.3	6.7	1257
333					1.42	6.6	1607
334					2.4	6.4	1852
335					2.76	6.1	2130
336					3.44	5.8	2130
337					3.16	5.9	2130
338					3.28	6.2	2130
339					3.1	6.4	2130
340					3.15	6.5	2130
341					0.7	8	
342					0.7	8	

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
305	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
306	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
307	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
308	CENT POLY, FECL3	26.2	40.1	0		PLAINFIELD	LS
309	CENT POLY, FECL3	8.1	48.2	0		PLAINFIELD	LS
310	CENT POLY, FECL3	14.7	62.9	0		PLAINFIELD	LS
311	CENT POLY, FECL3	17.7	80.6	0		PLAINFIELD	LS
312	CENT POLY, FECL3	13.1	93.7	0		PLAINFIELD	LS
313	CENT POLY, FECL3	17.8	111.5	0		PLAINFIELD	LS
314	CENT POLY, FECL3	0	111.5	1		PLAINFIELD	LS
315	CENT POLY, FECL3	0	111.5	2		PLAINFIELD	LS
316	CENT POLY, FECL3	0	111.5	3		PLAINFIELD	LS
317	CENT POLY, FECL3	0	111.5	4		PLAINFIELD	LS
318	CENT POLY, FECL3	0	111.5	5		PLAINFIELD	LS
319	CENT POLY, FECL3	52.4	80.2	0		PLAINFIELD	LS
320	CENT POLY, FECL3	16.2	96.4	0		PLAINFIELD	LS
321	CENT POLY, FECL3	29.4	125.8	0		PLAINFIELD	LS
322	CENT POLY, FECL3	35.4	161.2	0		PLAINFIELD	LS
323	CENT POLY, FECL3	26.2	187.4	0		PLAINFIELD	LS
324	CENT POLY, FECL3	35.6	223	0		PLAINFIELD	LS
325	CENT POLY, FECL3	0	223	1		PLAINFIELD	LS
326	CENT POLY, FECL3	0	223	2		PLAINFIELD	LS
327	CENT POLY, FECL3	0	223	3		PLAINFIELD	LS
328	CENT POLY, FECL3	0	223	4		PLAINFIELD	LS
329	CENT POLY, FECL3	0	223	5		PLAINFIELD	LS
330	CENT POLY, FECL3	104.8	160.4	0		PLAINFIELD	LS
331	CENT POLY, FECL3	32.4	192.8	0		PLAINFIELD	LS
332	CENT POLY, FECL3	58.8	251.6	0		PLAINFIELD	LS
333	CENT POLY, FECL3	70.8	322.4	0		PLAINFIELD	LS
334	CENT POLY, FECL3	52.4	374.8	0		PLAINFIELD	LS
335	CENT POLY, FECL3	71.2	446	0		PLAINFIELD	LS
336	CENT POLY, FECL3	0	446	1		PLAINFIELD	LS
337	CENT POLY, FECL3	0	446	2		PLAINFIELD	LS
338	CENT POLY, FECL3	0	446	3		PLAINFIELD	LS
339	CENT POLY, FECL3	0	446	4		PLAINFIELD	LS
340	CENT POLY, FECL3	0	446	5		PLAINFIELD	LS
341							Clayey
342		10	10	0			Clayey

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
305	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
306	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
307	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
308	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
309	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
310	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
311	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
312	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
313	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
314	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
315	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
316	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
317	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
318	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
319	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
320	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
321	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
322	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
323	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
324	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
325	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
326	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
327	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
328	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
329	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
330	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
331	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
332	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
333	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
334	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
335	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
336	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
337	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
338	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
339	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
340	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
341	N/D	10						30		Well Water(Control)
342	45	428						562		Well Water + 10 t/ha sludge

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
305	HINESLY 1985	CORN					3.2	265
306	HINESLY 1985	CORN					3.2	265
307	HINESLY 1985	CORN					3.2	265
308	HINESLY 1985	CORN					3.2	265
309	HINESLY 1985	CORN					3.2	265
310	HINESLY 1985	CORN					3.2	265
311	HINESLY 1985	CORN					3.2	265
312	HINESLY 1985	CORN					3.2	265
313	HINESLY 1985	CORN					3.2	265
314	HINESLY 1985	CORN					3.2	265
315	HINESLY 1985	CORN					3.2	265
316	HINESLY 1985	CORN					3.2	265
317	HINESLY 1985	CORN					3.2	265
318	HINESLY 1985	CORN					3.2	265
319	HINESLY 1985	CORN					3.2	265
320	HINESLY 1985	CORN					3.2	265
321	HINESLY 1985	CORN					3.2	265
322	HINESLY 1985	CORN					3.2	265
323	HINESLY 1985	CORN					3.2	265
324	HINESLY 1985	CORN					3.2	265
325	HINESLY 1985	CORN					3.2	265
326	HINESLY 1985	CORN					3.2	265
327	HINESLY 1985	CORN					3.2	265
328	HINESLY 1985	CORN					3.2	265
329	HINESLY 1985	CORN					3.2	265
330	HINESLY 1985	CORN					3.2	265
331	HINESLY 1985	CORN					3.2	265
332	HINESLY 1985	CORN					3.2	265
333	HINESLY 1985	CORN					3.2	265
334	HINESLY 1985	CORN					3.2	265
335	HINESLY 1985	CORN					3.2	265
336	HINESLY 1985	CORN					3.2	265
337	HINESLY 1985	CORN					3.2	265
338	HINESLY 1985	CORN					3.2	265
339	HINESLY 1985	CORN					3.2	265
340	HINESLY 1985	CORN					3.2	265
341	Chakrabarti, C. and T. Chakrabarti, 1988. #29	Wheat	HDM 1553	8.4				
342	Chakrabarti, C. and T. Chakrabarti, 1988. #29	Wheat	HDM 1553					

TABLE F-4 (cont.)

	LOCATION OF STUDY
267	JOLIET, ILLINOIS
268	JOLIET, ILLINOIS
269	JOLIET, ILLINOIS
270	JOLIET, ILLINOIS
271	JOLIET, ILLINOIS
272	JOLIET, ILLINOIS
273	JOLIET, ILLINOIS
274	JOLIET, ILLINOIS
275	JOLIET, ILLINOIS
276	JOLIET, ILLINOIS
277	JOLIET, ILLINOIS
278	JOLIET, ILLINOIS
279	JOLIET, ILLINOIS
280	JOLIET, ILLINOIS
281	JOLIET, ILLINOIS
282	JOLIET, ILLINOIS
283	JOLIET, ILLINOIS
284	JOLIET, ILLINOIS
285	JOLIET, ILLINOIS
286	JOLIET, ILLINOIS
287	JOLIET, ILLINOIS
288	JOLIET, ILLINOIS
289	JOLIET, ILLINOIS
290	JOLIET, ILLINOIS
291	JOLIET, ILLINOIS
292	JOLIET, ILLINOIS
293	JOLIET, ILLINOIS
294	JOLIET, ILLINOIS
295	JOLIET, ILLINOIS
296	JOLIET, ILLINOIS
297	JOLIET, ILLINOIS
298	JOLIET, ILLINOIS
299	JOLIET, ILLINOIS
300	JOLIET, ILLINOIS
301	JOLIET, ILLINOIS
302	JOLIET, ILLINOIS
303	JOLIET, ILLINOIS
304	JOLIET, ILLINOIS

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
267	0	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT
268	0	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT
269	0	STOVER	NO	
270	0	STOVER	NO	
271	0	STOVER	NO	
272	0	STOVER	NO	
273	0	STOVER	NO	
274	0	STOVER	NO	
275	NA	STOVER	NO	
276	0	STOVER	NO	
277	0	STOVER	NO	
278	0	STOVER	NO	
279	0	STOVER	NO	
280	0	STOVER	NO	
281	0	STOVER	NO	
282	0	STOVER	NO	
283	0	STOVER	NO	
284	0	STOVER	NO	
285	0	STOVER	NO	
286	NA	STOVER	NO	
287	0	STOVER	NO	
288	0	STOVER	NO	
289	0	STOVER	NO	
290	0	STOVER	NO	
291	0	STOVER	NO	
292	0	STOVER	NO	
293	0	STOVER	NO	
294	0	STOVER	NO	
295	0	STOVER	NO	
296	0	STOVER	NO	
297	NA	STOVER	NO	
298	0	STOVER	NO	
299	0	STOVER	NO	
300	0	STOVER	NO	
301	0	STOVER	NO	
302	0	STOVER	NO	
303	0	STOVER	NO	
304	0	STOVER	NO	

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
267	HCL-HF	138	70	LEAF	SLUDGE, FIELD, MATURITY	60*	GRAIN
268	HCL-HF	156	192	LEAF	SLUDGE, FIELD, MATURITY	28*	GRAIN
269	HCL-HF	206	92	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
270	HCL-HF	180	89	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
271	HCL-HF	202	43	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
272	HCL-HF	215	44	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
273	HCL-HF	219	27	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
274	HCL-HF	167	NA	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
275	HCL-HF	159	72	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
276	HCL-HF	131	97	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
277	HCL-HF	143	89	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
278	HCL-HF	171	112	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
279	HCL-HF	216	139	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
280	HCL-HF	270	191	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
281	HCL-HF	294	163	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
282	HCL-HF	394	115	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
283	HCL-HF	351	107	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
284	HCL-HF	287	70	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
285	HCL-HF	303	NA	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
286	HCL-HF	215	97	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
287	HCL-HF	215	160	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
288	HCL-HF	193	175	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
289	HCL-HF	333	149	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
290	HCL-HF	368	268	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
291	HCL-HF	553	294	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
292	HCL-HF	543	278	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
293	HCL-HF	594	204	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
294	HCL-HF	442	171	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
295	HCL-HF	482	141	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
296	HCL-HF	331	NA	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
297	HCL-HF	55	19	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
298	HCL-HF	24	17	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
299	HCL-HF	22	23	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
300	HCL-HF	32	22	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
301	HCL-HF	43	20	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
302	HCL-HF	46	32	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
303	HCL-HF	55	17	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
304	HCL-HF	75	34	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
267					1.58	7.4	402
268					1.54	7.1	463
269					1.64	6.9	531
270					1.69	6.9	531
271					1.91	7	531
272					1.66	7.3	531
273					2.05	7.1	531
274					1.95	7.2	531
275					1.71	NA	449
276					1.57	6.9	517
277					1.57	7.3	628
278					1.79	7.1	804
279					1.93	6.9	926
280					2.09	6.6	1063
281					2.37	6.4	1063
282					2.4	6.4	1063
283					2.4	6.8	1063
284					2.38	6.8	1063
285					2.48	7.2	1063
286					2.06	NA	898
287					2	6.4	1033
288					1.76	6.4	1257
289					2.67	6.2	1607
290					2.72	6.1	1852
291					3.53	5.4	2130
292					3.35	5.5	2130
293					3.29	5.8	2130
294					2.68	6	2130
295					3.02	6	2130
296					2.2	6.3	2130
297					0.36	NA	0
298					0.17	7	0
299					0.21	7.2	0
300					0.42	7.1	0
301					0.44	7	0
302					0.56	6.9	0
303					0.48	7	0
304					0.75	7	0

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
267	CENT POLY, FECL3	17.7	80.6	0		ELLIOT	SiL
268	CENT POLY, FECL3	13.1	93.7	0		ELLIOT	SiL
269	CENT POLY, FECL3	17.8	111.5	0		ELLIOT	SiL
270	CENT POLY, FECL3	0	111.5	1		ELLIOT	SiL
271	CENT POLY, FECL3	0	111.5	2		ELLIOT	SiL
272	CENT POLY, FECL3	0	111.5	3		ELLIOT	SiL
273	CENT POLY, FECL3	0	111.5	4		ELLIOT	SiL
274	CENT POLY, FECL3	0	111.5	5		ELLIOT	SiL
275	CENT POLY, FECL3	52.4	80.2	0		ELLIOT	SiL
276	CENT POLY, FECL3	16.2	96.4	0		ELLIOT	SiL
277	CENT POLY, FECL3	29.4	125.8	0		ELLIOT	SiL
278	CENT POLY, FECL3	35.4	161.2	0		ELLIOT	SiL
279	CENT POLY, FECL3	26.2	187.4	0		ELLIOT	SiL
280	CENT POLY, FECL3	35.6	223	0		ELLIOT	SiL
281	CENT POLY, FECL3	0	223	1		ELLIOT	SiL
282	CENT POLY, FECL3	0	223	2		ELLIOT	SiL
283	CENT POLY, FECL3	0	223	3		ELLIOT	SiL
284	CENT POLY, FECL3	0	223	4		ELLIOT	SiL
285	CENT POLY, FECL3	0	223	5		ELLIOT	SiL
286	CENT POLY, FECL3	104.8	160.4	0		ELLIOT	SiL
287	CENT POLY, FECL3	32.4	192.8	0		ELLIOT	SiL
288	CENT POLY, FECL3	58.8	251.6	0		ELLIOT	SiL
289	CENT POLY, FECL3	70.8	322.4	0		ELLIOT	SiL
290	CENT POLY, FECL3	52.4	374.8	0		ELLIOT	SiL
291	CENT POLY, FECL3	71.2	446	0		ELLIOT	SiL
292	CENT POLY, FECL3	0	446	1		ELLIOT	SiL
293	CENT POLY, FECL3	0	446	2		ELLIOT	SiL
294	CENT POLY, FECL3	0	446	3		ELLIOT	SiL
295	CENT POLY, FECL3	0	446	4		ELLIOT	SiL
296	CENT POLY, FECL3	0	446	5		ELLIOT	SiL
297	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
298	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
299	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
300	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
301	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
302	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
303	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
304	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
267	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
268	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
269	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
270	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
271	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
272	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
273	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
274	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
275	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
276	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
277	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
278	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
279	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
280	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
281	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
282	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
283	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
284	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
285	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
286	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
287	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
288	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
289	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
290	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
291	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
292	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
293	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
294	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
295	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
296	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
297	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
298	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
299	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
300	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
301	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
302	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
303	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
304	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
267	HINESLY 1985	CORN					3.2	265
268	HINESLY 1985	CORN					3.2	265
269	HINESLY 1985	CORN					3.2	265
270	HINESLY 1985	CORN					3.2	265
271	HINESLY 1985	CORN					3.2	265
272	HINESLY 1985	CORN					3.2	265
273	HINESLY 1985	CORN					3.2	265
274	HINESLY 1985	CORN					3.2	265
275	HINESLY 1985	CORN					3.2	265
276	HINESLY 1985	CORN					3.2	265
277	HINESLY 1985	CORN					3.2	265
278	HINESLY 1985	CORN					3.2	265
279	HINESLY 1985	CORN					3.2	265
280	HINESLY 1985	CORN					3.2	265
281	HINESLY 1985	CORN					3.2	265
282	HINESLY 1985	CORN					3.2	265
283	HINESLY 1985	CORN					3.2	265
284	HINESLY 1985	CORN					3.2	265
285	HINESLY 1985	CORN					3.2	265
286	HINESLY 1985	CORN					3.2	265
287	HINESLY 1985	CORN					3.2	265
288	HINESLY 1985	CORN					3.2	265
289	HINESLY 1985	CORN					3.2	265
290	HINESLY 1985	CORN					3.2	265
291	HINESLY 1985	CORN					3.2	265
292	HINESLY 1985	CORN					3.2	265
293	HINESLY 1985	CORN					3.2	265
294	HINESLY 1985	CORN					3.2	265
295	HINESLY 1985	CORN					3.2	265
296	HINESLY 1985	CORN					3.2	265
297	HINESLY 1985	CORN					3.2	265
298	HINESLY 1985	CORN					3.2	265
299	HINESLY 1985	CORN					3.2	265
300	HINESLY 1985	CORN					3.2	265
301	HINESLY 1985	CORN					3.2	265
302	HINESLY 1985	CORN					3.2	265
303	HINESLY 1985	CORN					3.2	265
304	HINESLY 1985	CORN					3.2	265

TABLE F-4 (cont.)

	LOCATION OF STUDY
229	JOLIET, ILLINOIS
230	JOLIET, ILLINOIS
231	JOLIET, ILLINOIS
232	JOLIET, ILLINOIS
233	JOLIET, ILLINOIS
234	JOLIET, ILLINOIS
235	JOLIET, ILLINOIS
236	JOLIET, ILLINOIS
237	JOLIET, ILLINOIS
238	JOLIET, ILLINOIS
239	JOLIET, ILLINOIS
240	JOLIET, ILLINOIS
241	JOLIET, ILLINOIS
242	JOLIET, ILLINOIS
243	JOLIET, ILLINOIS
244	JOLIET, ILLINOIS
245	JOLIET, ILLINOIS
246	JOLIET, ILLINOIS
247	JOLIET, ILLINOIS
248	JOLIET, ILLINOIS
249	JOLIET, ILLINOIS
250	JOLIET, ILLINOIS
251	JOLIET, ILLINOIS
252	JOLIET, ILLINOIS
253	JOLIET, ILLINOIS
254	JOLIET, ILLINOIS
255	JOLIET, ILLINOIS
256	JOLIET, ILLINOIS
257	JOLIET, ILLINOIS
258	JOLIET, ILLINOIS
259	JOLIET, ILLINOIS
260	JOLIET, ILLINOIS
261	JOLIET, ILLINOIS
262	JOLIET, ILLINOIS
263	JOLIET, ILLINOIS
264	JOLIET, ILLINOIS
265	JOLIET, ILLINOIS
266	JOLIET, ILLINOIS

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
229	0	STOVER	NO	
230	0	STOVER	NO	
231	0	STOVER	NO	
232	0	STOVER	NO	
233	NA	STOVER	NO	
234	0	STOVER	NO	
235	0	STOVER	NO	
236	0	STOVER	NO	
237	0	STOVER	NO	
238	NA	STOVER	NO	
239	0	STOVER	NO	
240	37*	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT
241	0	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT
242	0	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT
243	NA	STOVER	NO	
244	0	STOVER	NO	
245	22*	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENTRATION NOT CONSISTENT
246	0	STOVER	NO	
247	0	STOVER	NO	
248	NA	STOVER	NO	
249	0	STOVER	NO	
250	0	STOVER	NO	
251	0	STOVER	NO	
252	0	STOVER	NO	
253	NA	STOVER	NO	
254	0	STOVER	NO	
255	0	STOVER	NO	
256	0	STOVER	NO	
257	0	STOVER	NO	
258	0	STOVER	NO	
259	0	STOVER	NO	
260	0	STOVER	NO	
261	0	STOVER	NO	
262	0	STOVER	NO	
263	0	STOVER	NO	
264	NA	STOVER	NO	
265	0.	STOVER	NO	
266	0	STOVER	NO	

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
229	HCL-HF	472	260	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
230	HCL-HF	804	246	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
231	HCL-HF	442	382	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
232	HCL-HF	639	124	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
233	HCL-HF	73	27	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
234	HCL-HF	72	18	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
235	HCL-HF	67	20	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
236	HCL-HF	72	22	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
237	HCL-HF	69	14	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
238	HCL-HF	106	42	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
239	HCL-HF	103	43	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
240	HCL-HF	113	45	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
241	HCL-HF	147	64	LEAF	SLUDGE, FIELD, MATURITY	60*	GRAIN
242	HCL-HF	150	70	LEAF	SLUDGE, FIELD, MATURITY	28*	GRAIN
243	HCL-HF	174	57	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
244	HCL-HF	122	67	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
245	HCL-HF	166	88	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
246	HCL-HF	196	83	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
247	HCL-HF	250	112	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
248	HCL-HF	241	72	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
249	HCL-HF	220	115	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
250	HCL-HF	270	130	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
251	HCL-HF	308	117	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
252	HCL-HF	432	179	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
253	HCL-HF	85	28	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
254	HCL-HF	68	22	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
255	HCL-HF	84	22	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
256	HCL-HF	70	31	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
257	HCL-HF	74	19	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
258	HCL-HF	79	25	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
259	HCL-HF	80	21	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
260	HCL-HF	74	24	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
261	HCL-HF	81	27	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
262	HCL-HF	77	22	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
263	HCL-HF	81	NA	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
264	HCL-HF	102	55	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
265	HCL-HF	105	52	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
266	HCL-HF	96	63	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
229					2.84	6	2167
230					3.35	5.9	2167
231					2.1	6.2	2167
232					3.03	6.1	2167
233					1.19	NA	0
234					1.01	7.1	0
235					0.93	7.5	0
236					1.05	7.7	0
237					1.07	7.3	0
238					1.29	NA	225
239					1.06	7.2	259
240					1.1	7.6	314
241					1.29	7.6	402
242					1.17	7.6	463
243					1.38	NA	449
244					1.15	7.1	517
245					1.29	7.6	628
246					1.58	7.6	804
247					1.75	7.5	926
248					1.63	NA	898
249					1.28	6.9	1033
250					1.59	7.5	1257
251					1.9	7.5	1607
252					2.56	7.3	1852
253					1.51	NA	0
254					1.34	7	0
255					1.29	7.2	0
256					1.45	7.1	0
257					1.3	7.6	0
258					1.3	7	0
259					1.41	7.2	0
260					1.32	6.7	0
261					1.38	7	0
262					1.69	7	0
263					1.48	7.4	0
264					1.52	NA	225
265					1.4	6.9	259
266					1.35	7.2	314

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
229	CENT POLY, FECL3	0	428.3	1		PLAINFIELD	LS
230	CENT POLY, FECL3	0	428.3	2		PLAINFIELD	LS
231	CENT POLY, FECL3	0	428.3	3		PLAINFIELD	LS
232	CENT POLY, FECL3	0	428.3	4		PLAINFIELD	LS
233	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
234	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
235	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
236	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
237	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
238	CENT POLY, FECL3	26.2	40.1	0		BLOUNT	SiL
239	CENT POLY, FECL3	8.1	48.2	0		BLOUNT	SiL
240	CENT POLY, FECL3	14.7	62.9	0		BLOUNT	SiL
241	CENT POLY, FECL3	17.7	80.6	0		BLOUNT	SiL
242	CENT POLY, FECL3	13.1	93.7	0		BLOUNT	SiL
243	CENT POLY, FECL3	52.4	80.2	0		BLOUNT	SiL
244	CENT POLY, FECL3	16.2	96.4	0		BLOUNT	SiL
245	CENT POLY, FECL3	29.4	125.8	0		BLOUNT	SiL
246	CENT POLY, FECL3	35.4	161.2	0		BLOUNT	SiL
247	CENT POLY, FECL3	26.2	187.4	0		BLOUNT	SiL
248	CENT POLY, FECL3	104.8	160.4	0		BLOUNT	SiL
249	CENT POLY, FECL3	32.4	192.8	0		BLOUNT	SiL
250	CENT POLY, FECL3	58.8	251.6	0		BLOUNT	SiL
251	CENT POLY, FECL3	70.8	322.4	0		BLOUNT	SiL
252	CENT POLY, FECL3	52.4	374.8	0		BLOUNT	SiL
253	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
254	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
255	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
256	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
257	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
258	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
259	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
260	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
261	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
262	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
263	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
264	CENT POLY, FECL3	26.2	40.1	0		ELLIOT	SiL
265	CENT POLY, FECL3	8.1	48.2	0		ELLIOT	SiL
266	CENT POLY, FECL3	14.7	62.9	0		ELLIOT	SiL

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
229	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
230	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
231	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
232	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
233	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
234	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
235	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
236	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
237	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
238	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
239	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
240	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
241	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
242	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
243	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
244	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
245	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
246	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
247	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
248	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
249	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
250	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
251	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
252	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
253	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
254	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
255	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
256	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
257	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
258	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
259	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
260	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
261	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
262	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
263	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
264	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
265	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
266	2846	1311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
229	HINESLY 1985	CORN					3.4	263
230	HINESLY 1985	CORN					3.4	263
231	HINESLY 1985	CORN					3.4	263
232	HINESLY 1985	CORN					3.4	263
233	HINESLY 1985	CORN					3.2	265
234	HINESLY 1985	CORN					3.2	265
235	HINESLY 1985	CORN					3.2	265
236	HINESLY 1985	CORN					3.2	265
237	HINESLY 1985	CORN					3.2	265
238	HINESLY 1985	CORN					3.2	265
239	HINESLY 1985	CORN					3.2	265
240	HINESLY 1985	CORN					3.2	265
241	HINESLY 1985	CORN					3.2	265
242	HINESLY 1985	CORN					3.2	265
243	HINESLY 1985	CORN					3.2	265
244	HINESLY 1985	CORN					3.2	265
245	HINESLY 1985	CORN					3.2	265
246	HINESLY 1985	CORN					3.2	265
247	HINESLY 1985	CORN					3.2	265
248	HINESLY 1985	CORN					3.2	265
249	HINESLY 1985	CORN					3.2	265
250	HINESLY 1985	CORN					3.2	265
251	HINESLY 1985	CORN					3.2	265
252	HINESLY 1985	CORN					3.2	265
253	HINESLY 1985	CORN					3.2	265
254	HINESLY 1985	CORN					3.2	265
255	HINESLY 1985	CORN					3.2	265
256	HINESLY 1985	CORN					3.2	265
257	HINESLY 1985	CORN					3.2	265
258	HINESLY 1985	CORN					3.2	265
259	HINESLY 1985	CORN					3.2	265
260	HINESLY 1985	CORN					3.2	265
261	HINESLY 1985	CORN					3.2	265
262	HINESLY 1985	CORN					3.2	265
263	HINESLY 1985	CORN					3.2	265
264	HINESLY 1985	CORN					3.2	265
265	HINESLY 1985	CORN					3.2	265
266	HINESLY 1985	CORN					3.2	265

TABLE F-4 (cont.)

	LOCATION OF STUDY
191	JOLIET, ILLINOIS
192	JOLIET, ILLINOIS
193	JOLIET, ILLINOIS
194	JOLIET, ILLINOIS
195	JOLIET, ILLINOIS
196	JOLIET, ILLINOIS
197	JOLIET, ILLINOIS
198	JOLIET, ILLINOIS
199	JOLIET, ILLINOIS
200	JOLIET, ILLINOIS
201	JOLIET, ILLINOIS
202	JOLIET, ILLINOIS
203	JOLIET, ILLINOIS
204	JOLIET, ILLINOIS
205	JOLIET, ILLINOIS
206	JOLIET, ILLINOIS
207	JOLIET, ILLINOIS
208	JOLIET, ILLINOIS
209	JOLIET, ILLINOIS
210	JOLIET, ILLINOIS
211	JOLIET, ILLINOIS
212	JOLIET, ILLINOIS
213	JOLIET, ILLINOIS
214	JOLIET, ILLINOIS
215	JOLIET, ILLINOIS
216	JOLIET, ILLINOIS
217	JOLIET, ILLINOIS
218	JOLIET, ILLINOIS
219	JOLIET, ILLINOIS
220	JOLIET, ILLINOIS
221	JOLIET, ILLINOIS
222	JOLIET, ILLINOIS
223	JOLIET, ILLINOIS
224	JOLIET, ILLINOIS
225	JOLIET, ILLINOIS
226	JOLIET, ILLINOIS
227	JOLIET, ILLINOIS
228	JOLIET, ILLINOIS

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
191	0	STOVER	NO	
192	0	STOVER	NO	
193	0	STOVER	NO	
194	0	STOVER	NO	
195	0	STOVER	NO	
196	0	STOVER	NO	
197	0	STOVER	NO	
198	0	STOVER	NO	
199	0	STOVER	NO	
200	0	STOVER	NO	
201	0	STOVER	NO	
202	0	STOVER	NO	
203	NA	STOVER	NO	
204	0	STOVER	NO	
205	0	STOVER	NO	
206	0	STOVER	NO	
207	0	STOVER	NO	
208	0	STOVER	NO	
209	0	STOVER	NO	
210	0	STOVER	NO	
211	0	STOVER	NO	
212	0	STOVER	NO	
213	NA	STOVER	NO	
214	0	STOVER	NO	
215	0	STOVER	NO	
216	0	STOVER	NO	
217	0	STOVER	NO	
218	0	STOVER	NO	
219	0	STOVER	NO	
220	0	STOVER	NO	
221	0	STOVER	NO	
222	0	STOVER	NO	
223	NA	STOVER	NO	
224	0	STOVER	NO	
225	0	STOVER	NO	
226	0	STOVER	NO	
227	0	STOVER	NO	
228	0	STOVER	NO	

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
191	HCL-HF	428	212	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
192	HCL-HF	551	148	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
193	HCL-HF	40	22	LEAF	SLUDGE, FIELD, MATURITY	NA	GRAIN
194	HCL-HF	30	14	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
195	HCL-HF	33	18	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
196	HCL-HF	23	19	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
197	HCL-HF	33	24	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
198	HCL-HF	21	24	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
199	HCL-HF	24	15	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
200	HCL-HF	35	20	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
201	HCL-HF	51	31	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
202	HCL-HF	58	28	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
203	HCL-HF	130	70	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
204	HCL-HF	70	46	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
205	HCL-HF	102	66	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
206	HCL-HF	158	43	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
207	HCL-HF	104	36	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
208	HCL-HF	104	44	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
209	HCL-HF	93	30	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
210	HCL-HF	137	45	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
211	HCL-HF	143	73	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
212	HCL-HF	129	42	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
213	HCL-HF	244	111	LEAF	SLUDGE, FIELD, MATURITY	NA	GRAIN
214	HCL-HF	117	80	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
215	HCL-HF	168	164	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
216	HCL-HF	175	103	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
217	HCL-HF	165	66	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
218	HCL-HF	139	90	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
219	HCL-HF	166	41	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
220	HCL-HF	199	51	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
221	HCL-HF	203	100	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
222	HCL-HF	139	52	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
223	HCL-HF	500	138	LEAF	SLUDGE, FIELD, MATURITY	NA	GRAIN
224	HCL-HF	180	155	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
225	HCL-HF	449	239	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
226	HCL-HF	248	143	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
227	HCL-HF	323	307	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
228	HCL-HF	374	513	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
191					2.6	6.1	2167
192					3.2	6.1	2167
193					0.39	7.8	0
194					0.17	7.1	0
195					0.26	7.3	0
196					0.27	6.8	0
197					0.33	7.6	0
198					0.27	7.5	0
199					0.29	7.5	0
200					0.42	7.4	0
201					0.49	7.4	0
202					0.64	7.3	0
203					0.36	7.6	213
204					0.28	7.1	261
205					0.61	7.4	323
206					0.91	7.3	323
207					0.56	7.4	323
208					0.58	7.1	323
209					0.45	7.5	323
210					0.34	7.7	323
211					0.47	7.4	323
212					0.83	7.4	323
213					0.58	7.5	425
214					0.44	6.9	521
215					0.81	7.1	645
216					0.95	6.8	645
217					0.75	7.1	645
218					0.96	7.1	645
219					0.59	6.9	645
220					0.89	7	645
221					0.81	7.1	645
222					0.52	7.1	645
223					0.9	7.6	850
224					0.6	6.6	1042
225					2.4	6.8	1290
226					1.85	6.5	1649
227					1.78	6.1	1894
228					1.96	6.2	2167

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
191	CENT POLY, FECL3	0	428.3	3		ELLIOT	SiL
192	CENT POLY, FECL3	0	428.3	4		ELLIOT	SiL
193	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
194	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
195	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
196	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
197	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
198	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
199	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
200	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
201	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
202	CENT POLY, FECL3	0	0	NA		PLAINFIELD	LS
203	CENT POLY, FECL3	14.5	31.8	0		PLAINFIELD	LS
204	CENT POLY, FECL3	11.1	42.9	0		PLAINFIELD	LS
205	CENT POLY, FECL3	15.3	58.2	0		PLAINFIELD	LS
206	CENT POLY, FECL3	0	58.2	1		PLAINFIELD	LS
207	CENT POLY, FECL3	0	58.2	2		PLAINFIELD	LS
208	CENT POLY, FECL3	0	58.2	3		PLAINFIELD	LS
209	CENT POLY, FECL3	0	58.2	4		PLAINFIELD	LS
210	CENT POLY, FECL3	0	58.2	5		PLAINFIELD	LS
211	CENT POLY, FECL3	0	58.2	6		PLAINFIELD	LS
212	CENT POLY, FECL3	0	58.2	7		PLAINFIELD	LS
213	CENT POLY, FECL3	29	63.6	0		PLAINFIELD	LS
214	CENT POLY, FECL3	22.2	85.8	0		PLAINFIELD	LS
215	CENT POLY, FECL3	30.6	116.4	0		PLAINFIELD	LS
216	CENT POLY, FECL3	0	116.4	1		PLAINFIELD	LS
217	CENT POLY, FECL3	0	116.4	2		PLAINFIELD	LS
218	CENT POLY, FECL3	0	116.4	3		PLAINFIELD	LS
219	CENT POLY, FECL3	0	116.4	4		PLAINFIELD	LS
220	CENT POLY, FECL3	0	116.4	5		PLAINFIELD	LS
221	CENT POLY, FECL3	0	116.4	6		PLAINFIELD	LS
222	CENT POLY, FECL3	0	116.4	7		PLAINFIELD	LS
223	CENT POLY, FECL3	57.8	127	0		PLAINFIELD	LS
224	CENT POLY, FECL3	44.4	171.4	0		PLAINFIELD	LS
225	CENT POLY, FECL3	61.1	232.5	0		PLAINFIELD	LS
226	CENT POLY, FECL3	69.8	302.3	0		PLAINFIELD	LS
227	CENT POLY, FECL3	54	356.3	0		PLAINFIELD	LS
228	CENT POLY, FECL3	72	428.3	0		PLAINFIELD	LS

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
191	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
192	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
193	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
194	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
195	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
196	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
197	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
198	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
199	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
200	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
201	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
202	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
203	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
204	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
205	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
206	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
207	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
208	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
209	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
210	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
211	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
212	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
213	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
214	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
215	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
216	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
217	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
218	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
219	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
220	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
221	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
222	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
223	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
224	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
225	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
226	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
227	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
228	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
191	HINESLY 1985	CORN					3.4	263
192	HINESLY 1985	CORN					3.4	263
193	HINESLY 1985	CORN					3.4	263
194	HINESLY 1985	CORN					3.4	263
195	HINESLY 1985	CORN					3.4	263
196	HINESLY 1985	CORN					3.4	263
197	HINESLY 1985	CORN					3.4	263
198	HINESLY 1985	CORN					3.4	263
199	HINESLY 1985	CORN					3.4	263
200	HINESLY 1985	CORN					3.4	263
201	HINESLY 1985	CORN					3.4	263
202	HINESLY 1985	CORN					3.4	263
203	HINESLY 1985	CORN					3.4	263
204	HINESLY 1985	CORN					3.4	263
205	HINESLY 1985	CORN					3.4	263
206	HINESLY 1985	CORN					3.4	263
207	HINESLY 1985	CORN					3.4	263
208	HINESLY 1985	CORN					3.4	263
209	HINESLY 1985	CORN					3.4	263
210	HINESLY 1985	CORN					3.4	263
211	HINESLY 1985	CORN					3.4	263
212	HINESLY 1985	CORN					3.4	263
213	HINESLY 1985	CORN					3.4	263
214	HINESLY 1985	CORN					3.4	263
215	HINESLY 1985	CORN					3.4	263
216	HINESLY 1985	CORN					3.4	263
217	HINESLY 1985	CORN					3.4	263
218	HINESLY 1985	CORN					3.4	263
219	HINESLY 1985	CORN					3.4	263
220	HINESLY 1985	CORN					3.4	263
221	HINESLY 1985	CORN					3.4	263
222	HINESLY 1985	CORN					3.4	263
223	HINESLY 1985	CORN					3.4	263
224	HINESLY 1985	CORN					3.4	263
225	HINESLY 1985	CORN					3.4	263
226	HINESLY 1985	CORN					3.4	263
227	HINESLY 1985	CORN					3.4	263
228	HINESLY 1985	CORN					3.4	263

TABLE F-4 (cont.)

	LOCATION OF STUDY
153	JOLIET, ILLINOIS
154	JOLIET, ILLINOIS
155	JOLIET, ILLINOIS
156	JOLIET, ILLINOIS
157	JOLIET, ILLINOIS
158	JOLIET, ILLINOIS
159	JOLIET, ILLINOIS
160	JOLIET, ILLINOIS
161	JOLIET, ILLINOIS
162	JOLIET, ILLINOIS
163	JOLIET, ILLINOIS
164	JOLIET, ILLINOIS
165	JOLIET, ILLINOIS
166	JOLIET, ILLINOIS
167	JOLIET, ILLINOIS
168	JOLIET, ILLINOIS
169	JOLIET, ILLINOIS
170	JOLIET, ILLINOIS
171	JOLIET, ILLINOIS
172	JOLIET, ILLINOIS
173	JOLIET, ILLINOIS
174	JOLIET, ILLINOIS
175	JOLIET, ILLINOIS
176	JOLIET, ILLINOIS
177	JOLIET, ILLINOIS
178	JOLIET, ILLINOIS
179	JOLIET, ILLINOIS
180	JOLIET, ILLINOIS
181	JOLIET, ILLINOIS
182	JOLIET, ILLINOIS
183	JOLIET, ILLINOIS
184	JOLIET, ILLINOIS
185	JOLIET, ILLINOIS
186	JOLIET, ILLINOIS
187	JOLIET, ILLINOIS
188	JOLIET, ILLINOIS
189	JOLIET, ILLINOIS
190	JOLIET, ILLINOIS

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
153	0	STOVER	NO	
154	0	STOVER	NO	
155	0	STOVER	NO	
156	0	STOVER	NO	
157	0	STOVER	NO	
158	0	STOVER	NO	
159	0	STOVER	NO	
160	0	STOVER	NO	
161	0	STOVER	NO	
162	0	STOVER	NO	
163	NA	STOVER	NO	
164	0	STOVER	NO	
165	0	STOVER	NO	
166	0	STOVER	NO	
167	0	STOVER	NO	
168	0	STOVER	NO	
169	0	STOVER	NO	
170	0	STOVER	NO	
171	0	STOVER	NO	
172	0	STOVER	NO	
173	NA	STOVER	NO	
174	0	STOVER	NO	
175	0	STOVER	NO	
176	0	STOVER	NO	
177	0	STOVER	NO	
178	0	STOVER	NO	
179	0	STOVER	NO	
180	0	STOVER	NO	
181	0	STOVER	NO	
182	0	STOVER	NO	
183	NA	STOVER	NO	
184	0	STOVER	NO	
185	0	STOVER	NO	
186	0	STOVER	NO	
187	0	STOVER	NO	
188	0	STOVER	NO	
189	0	STOVER	NO	
190	0	STOVER	NO	

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
153	HCL-HF	64	51	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
154	HCL-HF	81	28	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
155	HCL-HF	75	20	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
156	HCL-HF	75	28	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
157	HCL-HF	73	29	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
158	HCL-HF	70	26	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
159	HCL-HF	66	16	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
160	HCL-HF	79	19	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
161	HCL-HF	80	28	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
162	HCL-HF	84	26	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
163	HCL-HF	127	105	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
164	HCL-HF	136	67	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
165	HCL-HF	132	40	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
166	HCL-HF	185	63	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
167	HCL-HF	152	68	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
168	HCL-HF	143	38	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
169	HCL-HF	151	37	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
170	HCL-HF	187	30	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
171	HCL-HF	144	72	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
172	HCL-HF	187	42	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
173	HCL-HF	226	124	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
174	HCL-HF	179	102	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
175	HCL-HF	207	84	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
176	HCL-HF	228	64	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
177	HCL-HF	210	78	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
178	HCL-HF	214	46	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
179	HCL-HF	200	43	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
180	HCL-HF	263	27	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
181	HCL-HF	196	67	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
182	HCL-HF	184	56	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
183	HCL-HF	418	168	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
184	HCL-HF	259	187	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
185	HCL-HF	315	147	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
186	HCL-HF	386	95	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
187	HCL-HF	375	205	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
188	HCL-HF	468	323	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
189	HCL-HF	582	193	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
190	HCL-HF	673	279	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
153					1.64	7.6	0
154					1.61	6.8	0
155					1.54	7.2	0
156					1.53	7.2	0
157					1.54	7	0
158					1.51	7	0
159					1.58	7.4	0
160					1.54	7.2	0
161					1.51	7	0
162					1.62	7	0
163					1.64	7.3	213
164					1.84	6.8	261
165					1.74	7.1	323
166					2.18	7.1	323
167					1.86	7.2	323
168					1.67	7.2	323
169					1.83	7.5	323
170					1.55	7.2	323
171					1.68	7	323
172					1.89	7.1	323
173					1.97	7.8	425
174					1.81	7	521
175					1.88	7.3	645
176					2.21	7.3	645
177					1.99	7.4	645
178					1.89	7.3	645
179					1.94	7.4	645
180					1.72	7.4	645
181					1.79	7.2	645
182					1.87	7.2	645
183					2.23	7.5	850
184					2.22	6.4	1042
185					2.28	6.5	1290
186					2.61	6.5	1649
187					2.74	6.5	1894
188					2.94	5.9	2167
189					3.92	5.9	2167
190					3.77	5.8	2167

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
153	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
154	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
155	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
156	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
157	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
158	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
159	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
160	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
161	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
162	CENT POLY, FECL3	0	0	NA		ELLIOT	SiL
163	CENT POLY, FECL3	14.5	31.8	0		ELLIOT	SiL
164	CENT POLY, FECL3	11.1	42.9	0		ELLIOT	SiL
165	CENT POLY, FECL3	15.3	58.2	0		ELLIOT	SiL
166	CENT POLY, FECL3	0	58.2	1		ELLIOT	SiL
167	CENT POLY, FECL3	0	58.2	2		ELLIOT	SiL
168	CENT POLY, FECL3	0	58.2	3		ELLIOT	SiL
169	CENT POLY, FECL3	0	58.2	4		ELLIOT	SiL
170	CENT POLY, FECL3	0	58.2	5		ELLIOT	SiL
171	CENT POLY, FECL3	0	58.2	6		ELLIOT	SiL
172	CENT POLY, FECL3	0	58.2	7		ELLIOT	SiL
173	CENT POLY, FECL3	29	63.6	0		ELLIOT	SiL
174	CENT POLY, FECL3	22.2	85.8	0		ELLIOT	SiL
175	CENT POLY, FECL3	30.6	116.4	0		ELLIOT	SiL
176	CENT POLY, FECL3	0	116.4	1		ELLIOT	SiL
177	CENT POLY, FECL3	0	116.4	2		ELLIOT	SiL
178	CENT POLY, FECL3	0	116.4	3		ELLIOT	SiL
179	CENT POLY, FECL3	0	116.4	4		ELLIOT	SiL
180	CENT POLY, FECL3	0	116.4	5		ELLIOT	SiL
181	CENT POLY, FECL3	0	116.4	6		ELLIOT	SiL
182	CENT POLY, FECL3	0	116.4	7		ELLIOT	SiL
183	CENT POLY, FECL3	57.8	127	0		ELLIOT	SiL
184	CENT POLY, FECL3	44.4	171.4	0		ELLIOT	SiL
185	CENT POLY, FECL3	61.1	232.5	0		ELLIOT	SiL
186	CENT POLY, FECL3	69.8	302.3	0		ELLIOT	SiL
187	CENT POLY, FECL3	54	356.3	0		ELLIOT	SiL
188	CENT POLY, FECL3	72	428.3	0		ELLIOT	SiL
189	CENT POLY, FECL3	0	428.3	1		ELLIOT	SiL
190	CENT POLY, FECL3	0	428.3	2		ELLIOT	SiL

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
153	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
154	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
155	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
156	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
157	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
158	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
159	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
160	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
161	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
162	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
163	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
164	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
165	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
166	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
167	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
168	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
169	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
170	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
171	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
172	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
173	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
174	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
175	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
176	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
177	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
178	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
179	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
180	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
181	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
182	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
183	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
184	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
185	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
186	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
187	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
188	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
189	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
190	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
153	HINESLY 1985	CORN					3.4	263
154	HINESLY 1985	CORN					3.4	263
155	HINESLY 1985	CORN					3.4	263
156	HINESLY 1985	CORN					3.4	263
157	HINESLY 1985	CORN					3.4	263
158	HINESLY 1985	CORN					3.4	263
159	HINESLY 1985	CORN					3.4	263
160	HINESLY 1985	CORN					3.4	263
161	HINESLY 1985	CORN					3.4	263
162	HINESLY 1985	CORN					3.4	263
163	HINESLY 1985	CORN					3.4	263
164	HINESLY 1985	CORN					3.4	263
165	HINESLY 1985	CORN					3.4	263
166	HINESLY 1985	CORN					3.4	263
167	HINESLY 1985	CORN					3.4	263
168	HINESLY 1985	CORN					3.4	263
169	HINESLY 1985	CORN					3.4	263
170	HINESLY 1985	CORN					3.4	263
171	HINESLY 1985	CORN					3.4	263
172	HINESLY 1985	CORN					3.4	263
173	HINESLY 1985	CORN					3.4	263
174	HINESLY 1985	CORN					3.4	263
175	HINESLY 1985	CORN					3.4	263
176	HINESLY 1985	CORN					3.4	263
177	HINESLY 1985	CORN					3.4	263
178	HINESLY 1985	CORN					3.4	263
179	HINESLY 1985	CORN					3.4	263
180	HINESLY 1985	CORN					3.4	263
181	HINESLY 1985	CORN					3.4	263
182	HINESLY 1985	CORN					3.4	263
183	HINESLY 1985	CORN					3.4	263
184	HINESLY 1985	CORN					3.4	263
185	HINESLY 1985	CORN					3.4	263
186	HINESLY 1985	CORN					3.4	263
187	HINESLY 1985	CORN					3.4	263
188	HINESLY 1985	CORN					3.4	263
189	HINESLY 1985	CORN					3.4	263
190	HINESLY 1985	CORN					3.4	263

TABLE F-4 (cont.)

	LOCATION OF STUDY
115	JOLIET, ILLINOIS
116	JOLIET, ILLINOIS
117	JOLIET, ILLINOIS
118	JOLIET, ILLINOIS
119	JOLIET, ILLINOIS
120	JOLIET, ILLINOIS
121	JOLIET, ILLINOIS
122	JOLIET, ILLINOIS
123	JOLIET, ILLINOIS
124	JOLIET, ILLINOIS
125	JOLIET, ILLINOIS
126	JOLIET, ILLINOIS
127	JOLIET, ILLINOIS
128	JOLIET, ILLINOIS
129	JOLIET, ILLINOIS
130	JOLIET, ILLINOIS
131	JOLIET, ILLINOIS
132	JOLIET, ILLINOIS
133	JOLIET, ILLINOIS
134	JOLIET, ILLINOIS
135	JOLIET, ILLINOIS
136	JOLIET, ILLINOIS
137	JOLIET, ILLINOIS
138	JOLIET, ILLINOIS
139	JOLIET, ILLINOIS
140	JOLIET, ILLINOIS
141	JOLIET, ILLINOIS
142	JOLIET, ILLINOIS
143	JOLIET, ILLINOIS
144	JOLIET, ILLINOIS
145	JOLIET, ILLINOIS
146	JOLIET, ILLINOIS
147	JOLIET, ILLINOIS
148	JOLIET, ILLINOIS
149	JOLIET, ILLINOIS
150	JOLIET, ILLINOIS
151	JOLIET, ILLINOIS
152	JOLIET, ILLINOIS

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
115	0	STOVER	NO	
116	0	STOVER	NO	
117	0	STOVER	NO	
118	0	STOVER	NO	
119	0	STOVER	NO	
120	0	STOVER	NO	
121	0	STOVER	NO	
122	0	STOVER	NO	
123	NA	STOVER	NO	
124	0	STOVER	NO	
125	0	STOVER	NO	
126	0	STOVER	NO	
127	0	STOVER	NO	
128	0	STOVER	NO	
129	0	STOVER	NO	
130	0	STOVER	NO	
131	0	STOVER	NO	
132	0	STOVER	NO	
133	NA	STOVER	NO	
134	0	STOVER	NO	
135	0	STOVER	NO	
136	0	STOVER	NO	
137	0	STOVER	NO	
138	0	STOVER	NO	
139	0	STOVER	NO	
140	0	STOVER	NO	
141	0	STOVER	NO	
142	0	STOVER	NO	
143	NA	STOVER	NO	
144	0	STOVER	NO	
145	0	STOVER	NO	
146	0	STOVER	NO	
147	0	STOVER	NO	
148	0	STOVER	NO	
149	0	STOVER	NO	
150	0	STOVER	NO	
151	0	STOVER	NO	
152	0	STOVER	NO	

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
115	HCL-HF	82	21	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
116	HCL-HF	79	28	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
117	HCL-HF	84	22	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
118	HCL-HF	73	35	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
119	HCL-HF	66	21	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
120	HCL-HF	81	20	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
121	HCL-HF	89	32	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
122	HCL-HF	87	25	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
123	HCL-HF	138	80	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
124	HCL-HF	124	57	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
125	HCL-HF	130	47	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
126	HCL-HF	169	46	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
127	HCL-HF	143	31	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
128	HCL-HF	154	28	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
129	HCL-HF	147	22	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
130	HCL-HF	180	26	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
131	HCL-HF	134	46	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
132	HCL-HF	159	34	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
133	HCL-HF	195	112	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
134	HCL-HF	167	85	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
135	HCL-HF	168	58	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
136	HCL-HF	270	55	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
137	HCL-HF	201	63	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
138	HCL-HF	200	38	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
139	HCL-HF	215	33	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
140	HCL-HF	267	25	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
141	HCL-HF	178	50	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
142	HCL-HF	240	43	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
143	HCL-HF	319	145	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
144	HCL-HF	257	108	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
145	HCL-HF	327	112	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
146	HCL-HF	451	113	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
147	HCL-HF	314	84	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
148	HCL-HF	319	57	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
149	HCL-HF	351	45	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
150	HCL-HF	379	34	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
151	HCL-HF	236	62	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
152	HCL-HF	313	43	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
115					0.94	7.6	0
116					0.93	7.6	0
117					0.92	7.8	0
118					0.87	7.5	0
119					0.9	7.6	0
120					0.88	7.5	0
121					0.73	7.6	0
122					1	7.4	0
123					1.06	7.7	213
124					1.11	6.9	261
125					1.18	7.5	323
126					1.4	7.5	323
127					1.16	7.6	323
128					1.08	7.5	323
129					1.18	7.7	323
130					1.23	7.6	323
131					1.09	7.5	323
132					1.32	7.3	323
133					1.38	7.6	425
134					1.12	7	521
135					1.29	7.4	645
136					1.83	7.3	645
137					1.36	7.5	645
138					1.34	7.2	645
139					1.6	7.4	645
140					1.31	7.3	645
141					1.54	7.1	645
142					1.62	7.1	645
143					1.62	7.6	850
144					1.63	6.8	1042
145					1.94	7.3	1290
146					2.5	7.2	1290
147					1.83	7.3	1290
148					1.88	7.2	1290
149					2.03	7.3	1290
150					1.6	7.1	1290
151					1.54	7.1	1290
152					1.84	7	1290

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
115	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
116	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
117	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
118	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
119	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
120	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
121	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
122	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
123	CENT POLY, FECL3	14.5	31.8	0		BLOUNT	SiL
124	CENT POLY, FECL3	11.1	42.9	0		BLOUNT	SiL
125	CENT POLY, FECL3	15.3	58.2	0		BLOUNT	SiL
126	CENT POLY, FECL3	0	58.2	1		BLOUNT	SiL
127	CENT POLY, FECL3	0	58.2	2		BLOUNT	SiL
128	CENT POLY, FECL3	0	58.2	3		BLOUNT	SiL
129	CENT POLY, FECL3	0	58.2	4		BLOUNT	SiL
130	CENT POLY, FECL3	0	58.2	5		BLOUNT	SiL
131	CENT POLY, FECL3	0	58.2	6		BLOUNT	SiL
132	CENT POLY, FECL3	0	58.2	7		BLOUNT	SiL
133	CENT POLY, FECL3	29	63.6	0		BLOUNT	SiL
134	CENT POLY, FECL3	22.2	85.8	0		BLOUNT	SiL
135	CENT POLY, FECL3	30.6	116.4	0		BLOUNT	SiL
136	CENT POLY, FECL3	0	116.4	1		BLOUNT	SiL
137	CENT POLY, FECL3	0	116.4	2		BLOUNT	SiL
138	CENT POLY, FECL3	0	116.4	3		BLOUNT	SiL
139	CENT POLY, FECL3	0	116.4	4		BLOUNT	SiL
140	CENT POLY, FECL3	0	116.4	5		BLOUNT	SiL
141	CENT POLY, FECL3	0	116.4	6		BLOUNT	SiL
142	CENT POLY, FECL3	0	116.4	7		BLOUNT	SiL
143	CENT POLY, FECL3	57.8	127	0		BLOUNT	SiL
144	CENT POLY, FECL3	44.4	171.4	0		BLOUNT	SiL
145	CENT POLY, FECL3	61.1	232.5	0		BLOUNT	SiL
146	CENT POLY, FECL3	0	232.5	1		BLOUNT	SiL
147	CENT POLY, FECL3	0	232.5	1		BLOUNT	SiL
148	CENT POLY, FECL3	0	232.5	1		BLOUNT	SiL
149	CENT POLY, FECL3	0	232.5	1		BLOUNT	SiL
150	CENT POLY, FECL3	0	232.5	1		BLOUNT	SiL
151	CENT POLY, FECL3	0	232.5	1		BLOUNT	SiL
152	CENT POLY, FECL3	0	232.5	1		BLOUNT	SiL

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
115	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
116	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
117	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
118	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
119	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
120	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
121	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
122	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
123	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
124	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
125	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
126	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
127	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
128	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
129	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
130	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
131	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
132	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
133	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
134	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
135	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
136	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
137	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
138	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
139	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
140	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
141	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
142	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
143	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
144	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
145	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
146	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
147	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
148	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
149	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
150	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
151	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
152	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
115	HINESLY 1985	CORN					3.4	263
116	HINESLY 1985	CORN					3.4	263
117	HINESLY 1985	CORN					3.4	263
118	HINESLY 1985	CORN					3.4	263
119	HINESLY 1985	CORN					3.4	263
120	HINESLY 1985	CORN					3.4	263
121	HINESLY 1985	CORN					3.4	263
122	HINESLY 1985	CORN					3.4	263
123	HINESLY 1985	CORN					3.4	263
124	HINESLY 1985	CORN					3.4	263
125	HINESLY 1985	CORN					3.4	263
126	HINESLY 1985	CORN					3.4	263
127	HINESLY 1985	CORN					3.4	263
128	HINESLY 1985	CORN					3.4	263
129	HINESLY 1985	CORN					3.4	263
130	HINESLY 1985	CORN					3.4	263
131	HINESLY 1985	CORN					3.4	263
132	HINESLY 1985	CORN					3.4	263
133	HINESLY 1985	CORN					3.4	263
134	HINESLY 1985	CORN					3.4	263
135	HINESLY 1985	CORN					3.4	263
136	HINESLY 1985	CORN					3.4	263
137	HINESLY 1985	CORN					3.4	263
138	HINESLY 1985	CORN					3.4	263
139	HINESLY 1985	CORN					3.4	263
140	HINESLY 1985	CORN					3.4	263
141	HINESLY 1985	CORN					3.4	263
142	HINESLY 1985	CORN					3.4	263
143	HINESLY 1985	CORN					3.4	263
144	HINESLY 1985	CORN					3.4	263
145	HINESLY 1985	CORN					3.4	263
146	HINESLY 1985	CORN					3.4	263
147	HINESLY 1985	CORN					3.4	263
148	HINESLY 1985	CORN					3.4	263
149	HINESLY 1985	CORN					3.4	263
150	HINESLY 1985	CORN					3.4	263
151	HINESLY 1985	CORN					3.4	263
152	HINESLY 1985	CORN					3.4	263

TABLE F-4 (cont.)

	LOCATION OF STUDY
77	MUSCLE SCHOALES, AL
78	MUSCLE SCHOALES, AL
79	MUSCLE SCHOALES, AL
80	MUSCLE SCHOALES, AL
81	MUSCLE SCHOALES, AL
82	MUSCLE SCHOALES, AL
83	MUSCLE SCHOALES, AL
84	MUSCLE SCHOALES, AL
85	MUSCLE SCHOALES, AL
86	MUSCLE SCHOALES, AL
87	MUSCLE SCHOALES, AL
88	MUSCLE SCHOALES, AL
89	MUSCLE SCHOALES, AL
90	MUSCLE SCHOALES, AL
91	MUSCLE SCHOALES, AL
92	MUSCLE SCHOALES, AL
93	MUSCLE SCHOALES, AL
94	MUSCLE SCHOALES, AL
95	MUSCLE SCHOALES, AL
96	MUSCLE SCHOALES, AL
97	MUSCLE SCHOALES, AL
98	MUSCLE SCHOALES, AL
99	MUSCLE SCHOALES, AL
100	MUSCLE SCHOALES, AL
101	MUSCLE SCHOALES, AL
102	MUSCLE SCHOALES, AL
103	MUSCLE SCHOALES, AL
104	MUSCLE SCHOALES, AL
105	MUSCLE SCHOALES, AL
106	MUSCLE SCHOALES, AL
107	MUSCLE SCHOALES, AL
108	MUSCLE SCHOALES, AL
109	MUSCLE SCHOALES, AL
110	MUSCLE SCHOALES, AL
111	MUSCLE SCHOALES, AL
112	MUSCLE SCHOALES, AL
113	JOLIET, ILLINOIS
114	JOLIET, ILLINOIS

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
77			NO	
78			NO	
79			NO	
80			NO	
81			NO	
82			NO	
83			*NO	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS
84			NO	
85			NO	
86			NO	
87			NO	
88			NO	
89			*NO	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS
90			NO	
91			NO	
92			NO	
93			NO	
94			NO	
95			*NO	*AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS
96			NO	
97			NO	
98			NO	
99			*NO	*AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS
100			NO	
101			NO	
102			NO	
103			*NO	*AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS
104			NO	
105			NO	
106			NO	
107			NO	
108			NO	
109			NO	
110			NO	
111			NO	
112			NO	
113	0	STOVER	NO	
114	0	STOVER	NO	

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
77	0.5 M HCL	89	113	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
78	0.5 M HCL	5	56	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
79	0.5 M HCL	97	53	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
80	0.5 M HCL	89	76	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
81	0.5 M HCL	5	61	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
82	0.5 M HCL	97	153	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
83	0.5 M HCL	89	130	LEAF	FIELD, SLUDGE, MATURITY	25*	EDIBLE PART
84	0.5 M HCL	5	36	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
85	0.5 M HCL	97	79	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
86	0.5 M HCL	89	61	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
87	0.5 M HCL	5	112	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
88	0.5 M HCL	97	233	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
89	0.5 M HCL	89	287	LEAF	FIELD, SLUDGE, MATURITY	21.1*	EDIBLE PART
90	0.5 M HCL	5	109	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
91	0.5 M HCL	97	166	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
92	0.5 M HCL	89	316	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
93	.5 M HCL	2	54	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
94	.5 M HCL	2.9	44	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
95	.5 M HCL	112.8	142	LEAF	FIELD, SLUDGE, MATURITY	15.4*	TOTAL PLANT
96	.5 M HCL	74.2	131	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
97	.5 M HCL	2	71	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
98	.5 M HCL	2.9	64	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
99	.5 M HCL	112.8	96	LEAF	FIELD, SLUDGE, MATURITY	10*	TOTAL PLANT
100	.5 M HCL	74.2	109	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
101	.5 M HCL	2	37	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
102	.5 M HCL	2.9	46	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
103	.5 M HCL	112.8	62	LEAF	FIELD, SLUDGE, MATURITY	12.5*	TOTAL PLANT
104	.5 M HCL	74.2	71	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
105	.5 M HCL	2	52	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
106	.5 M HCL	2.9	54	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
107	.5 M HCL	112.8	178	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
108	.5 M HCL	74.2	142	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
109	.5 M HCL	2	48	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
110	.5 M HCL	2.9	88	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
111	.5 M HCL	112.8	121	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
112	.5 M HCL	74.2	120	LEAF	FIELD, SLUDGE, MATURITY	0	TOTAL PLANT
113	HCL-HF	72	42	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
114	HCL-HF	83	24	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
77						6.4	202
78						5.8	0
79						5.8	202
80						5.8	202
81						5.8	0
82						5.8	202
83						5.8	202
84						5.8	0
85						5.8	202
86						5.8	202
87						5.8	0
88						5.8	202
89						5.8	202
90						5.8	0
91						5.8	202
92						5.8	202
93						5.1	0
94						5.1	0
95						5.1	403
96						5.1	403
97						5.1	0
98						5.1	0
99						5.1	403
100						5.1	403
101						5.1	0
102						5.1	0
103						5.1	403
104						5.1	403
105						5.1	0
106						5.1	0
107						5.1	403
108						5.1	403
109						5.1	0
110						5.1	0
111						5.1	403
112						5.1	403
113					0.85	7.8	0
114					0.9	6.9	0

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
77		112	112	0		SANGO	SiL
78		0	0			SANGO	SiL
79		112	112	1		SANGO	SiL
80		112	112	1		SANGO	SiL
81		0	0			SANGO	SiL
82		112	112	1		SANGO	SiL
83		112	112	1		SANGO	SiL
84		0	0			SANGO	SiL
85		112	112	1		SANGO	SiL
86		112	112	1		SANGO	SiL
87		0	0			SANGO	SiL
88		112	112	1		SANGO	SiL
89		112	112	1		SANGO	SiL
90		0	0			SANGO	SiL
91		112	112	1		SANGO	SiL
92		112	112	1		SANGO	SiL
93		0	0			SANGO	SiL
94		0	0			SANGO	SiL
95		224	224	0		SANGO	SiL
96		224	224	0		SANGO	SiL
97		0	0			SANGO	SiL
98		0	0			SANGO	SiL
99		224	224	0		SANGO	SiL
100		224	224	0		SANGO	SiL
101		0	0			SANGO	SiL
102		0	0			SANGO	SiL
103		224	224	0		SANGO	SiL
104		224	224	0		SANGO	SiL
105		0	0			SANGO	SiL
106		0	0			SANGO	SiL
107		224	224	0		SANGO	SiL
108		224	224	0		SANGO	SiL
109		0	0			SANGO	SiL
110		0	0			SANGO	SiL
111		224	224	0		SANGO	SiL
112		224	224	0		SANGO	SiL
113	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL
114	CENT POLY, FECL3	0	0	NA		BLOUNT	SiL

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
77	400	520	1.5	2.1	40	1.3	1600	1800		
78										
79	350	730	1.7	2.3	20	1.6	530	1800		
80	400	520	1.5	2.1	40	1.3	1600	1800		
81										
82	350	730	1.7	2.3	20	1.6	530	1800		
83	400	520	1.5	2.1	40	1.3	1600	1800		
84										
85	350	730	1.7	2.3	20	1.6	530	1800		
86	400	520	1.5	2.1	40	1.3	1600	1800		
87										
88	350	730	1.7	2.3	20	1.6	530	1800		
89	400	520	1.5	2.1	40	1.3	1600	1800		
90										
91	350	730	1.7	2.3	20	1.6	530	1800		
92	400	520	1.5	2.1	40	1.3	1600	1800		
93	350	730	1.7	2.3	20	16000	530	1800		
94	350	730	1.7	2.3	20	16000	530	1800		
95	350	730	1.7	2.3	20	16000	530	1800		
96	350	730	1.7	2.3	20	16000	530	1800		
97	350	730	1.7	2.3	20	16000	530	1800		
98	350	730	1.7	2.3	20	16000	530	1800		
99	350	730	1.7	2.3	20	16000	530	1800		
100	350	730	1.7	2.3	20	16000	530	1800		
101	350	730	1.7	2.3	20	16000	530	1800		
102	350	730	1.7	2.3	20	16000	530	1800		
103	350	730	1.7	2.3	20	16000	530	1800		
104	350	730	1.7	2.3	20	16000	530	1800		
105	350	730	1.7	2.3	20	16000	530	1800		
106	350	730	1.7	2.3	20	16000	530	1800		
107	350	730	1.7	2.3	20	16000	530	1800		
108	350	730	1.7	2.3	20	16000	530	1800		
109	350	730	1.7	2.3	20	16000	530	1800		
110	350	730	1.7	2.3	20	16000	530	1800		
111	350	730	1.7	2.3	20	16000	530	1800		
112	350	730	1.7	2.3	20	16000	530	1800		
113	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION
114	2963	1422	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
77	GIORDANO & MAYS 1977	KALE		6.1			1.7	40
78	GIORDANO & MAYS 1977	OKRA						
79	GIORDANO & MAYS 1977	OKRA		6.6			2.5	50
80	GIORDANO & MAYS 1977	OKRA		6.1			1.7	40
81	GIORDANO & MAYS 1977	PEPPER						
82	GIORDANO & MAYS 1977	PEPPER		6.6			2.5	50
83	GIORDANO & MAYS 1977	PEPPER		6.1			1.7	40
84	GIORDANO & MAYS 1977	TOMATO						
85	GIORDANO & MAYS 1977	TOMATO		6.6			2.5	50
86	GIORDANO & MAYS 1977	TOMATO		6.1			1.7	40
87	GIORDANO & MAYS 1977	SQUASH						
88	GIORDANO & MAYS 1977	SQUASH		6.6			2.5	50
89	GIORDANO & MAYS 1977	SQUASH		6.1			1.7	40
90	GIORDANO & MAYS 1977	LETTUCE						
91	GIORDANO & MAYS 1977	LETTUCE		6.6			2.5	50
92	GIORDANO & MAYS 1977	LETTUCE		6.1			1.7	40
93	GIORDANO&MAYS 1977	LETTUCE		6.6			2.5	50
94	GIORDANO&MAYS 1977	LETTUCE		6.6			2.5	50
95	GIORDANO&MAYS 1977	LETTUCE		6.6			2.5	50
96	GIORDANO&MAYS 1977	LETTUCE		6.6			2.5	50
97	GIORDANO&MAYS 1977	PEPPER		6.6			2.5	50
98	GIORDANO&MAYS 1977	PEPPER		6.6			2.5	50
99	GIORDANO&MAYS 1977	PEPPER		6.6			2.5	50
100	GIORDANO&MAYS 1977	PEPPER		6.6			2.5	50
101	GIORDANO&MAYS 1977	BEAN		6.6			2.5	50
102	GIORDANO&MAYS 1977	BEAN		6.6			2.5	50
103	GIORDANO&MAYS 1977	BEAN		6.6			2.5	50
104	GIORDANO&MAYS 1977	BEAN		6.6			2.5	50
105	GIORDANO&MAYS 1977	CORN		6.6			2.5	50
106	GIORDANO&MAYS 1977	CORN		6.6			2.5	50
107	GIORDANO&MAYS 1977	CORN		6.6			2.5	50
108	GIORDANO&MAYS 1977	CORN		6.6			2.5	50
109	GIORDANO&MAYS 1977	SQUASH		6.6			2.5	50
110	GIORDANO&MAYS 1977	SQUASH		6.6			2.5	50
111	GIORDANO&MAYS 1977	SQUASH		6.6			2.5	50
112	GIORDANO&MAYS 1977	SQUASH		6.6			2.5	50
113	HINESLY 1985	CORN					3.4	263
114	HINESLY 1985	CORN					3.4	263

TABLE F-4 (cont.)

	LOCATION OF STUDY
39	MUSCLE SCHOALES, AL
40	MUSCLE SCHOALES, AL
41	MUSCLE SCHOALES, AL
42	MUSCLE SCHOALES, AL
43	MUSCLE SCHOALES, AL
44	MUSCLE SCHOALES, AL
45	MUSCLE SCHOALES, AL
46	MUSCLE SCHOALES, AL
47	MUSCLE SCHOALES, AL
48	MUSCLE SCHOALES, AL
49	MUSCLE SCHOALES, AL
50	MUSCLE SCHOALES, AL
51	MUSCLE SCHOALES, AL
52	MUSCLE SCHOALES, AL
53	MUSCLE SCHOALES, AL
54	MUSCLE SCHOALES, AL
55	MUSCLE SCHOALES, AL
56	MUSCLE SCHOALES, AL
57	MUSCLE SCHOALES, AL
58	MUSCLE SCHOALES, AL
59	MUSCLE SCHOALES, AL
60	MUSCLE SCHOALES, AL
61	MUSCLE SCHOALES, AL
62	MUSCLE SCHOALES, AL
63	MUSCLE SCHOALES, AL
64	MUSCLE SCHOALES, AL
65	MUSCLE SCHOALES, AL
66	MUSCLE SCHOALES, AL
67	MUSCLE SCHOALES, AL
68	MUSCLE SCHOALES, AL
69	MUSCLE SCHOALES, AL
70	MUSCLE SCHOALES, AL
71	MUSCLE SCHOALES, AL
72	MUSCLE SCHOALES, AL
73	MUSCLE SCHOALES, AL
74	MUSCLE SCHOALES, AL
75	MUSCLE SCHOALES, AL
76	MUSCLE SCHOALES, AL

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
39	0	PODS	NO	
40	60.4*	PODS	*NO	*DOSE RESPONSE & TISSUE CONCENTRATION INCONSISTANT
41	0	PODS	NO	
42	0	PODS	NO	
43	37.5*	PODS	*NO	*DOSE RESPONSE NOT CONSISTANT, PH<5.5
44	0	PODS	NO	
45	0	PODS	NO	
46	0	PODS	NO	
47	0	PODS	NO	
48	0	PODS	NO	
49	0	PODS	NO	
50	0	PODS	NO	
51	0	PODS	*NO	*DOSE RESPONSE & TISSUE ZN CONCENTRATION NOT CONSISTANT
52	0	PODS	*NO	*DOSE RESPONSE & TISSUE ZN CONCENTRATION NOT CONSISTANT
53	0	PODS	NO	
54	0	PODS	POSSIBLE	SOIL PH<5.5, SLUDGE LOADING EXCEEDS AGRONOMIC RATES
55	36.8	PODS	POSSIBLE	SOIL PH<5.5, SLUDGE LOADING EXCEEDS AGRONOMIC RATES
56	42.8	PODS	POSSIBLE	SLUDGE LOADING EXCEEDS AGRONOMIC RATES
57			NO	
58			NO	
59			*NO	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS
60			NO	
61			*NO	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS
62			*NO	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS
63			NO	
64			NO	
65			*NO	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS
66			NO	
67			NO	
68			NO	
69			NO	
70			NO	
71			NO	
72			NO	
73			NO	
74			NO	
75			NO	
76			NO	

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
39	0.5 M HCl	75	230	VINES	FIELD, SLUDGE, MATURITY	0	VINES
40	0.5 M HCl	206	211	VINES	FIELD, SLUDGE, MATURITY	0	VINES
41	0.5 M HCl	7	53	VINES	FIELD, SLUDGE, MATURITY	0	VINES
42	0.5 M HCl	7	63	VINES	FIELD, SLUDGE, MATURITY	0	VINES
43	0.5 M HCl	20	282	VINES	FIELD, SLUDGE, MATURITY	30.8*	VINES
44	0.5 M HCl	40	254	VINES	FIELD, SLUDGE, MATURITY	0	VINES
45	0.5 M HCl	62	296	VINES	FIELD, SLUDGE, MATURITY	0	VINES
46	0.5 M HCl	143	404	VINES	FIELD, SLUDGE, MATURITY	0	VINES
47	0.5 M HCl	261	410	VINES	FIELD, SLUDGE, MATURITY	0	VINES
48	0.5 M HCl	774	338	VINES	FIELD, SLUDGE, MATURITY	0	VINES
49	DTPA	2	42	VINES	FIELD, SLUDGE, MATURITY	0	VINES
50	DTPA	2	36	VINES	FIELD, SLUDGE, MATURITY	0	VINES
51	DTPA	9	128	VINES	FIELD, SLUDGE, MATURITY	26.2*	VINES
52	DTPA	19	141	VINES	FIELD, SLUDGE, MATURITY	14.5*	VINES
53	DTPA	25	128	VINES	FIELD, SLUDGE, MATURITY	0	VINES
54	DTPA	69	304	VINES	FIELD, SLUDGE, MATURITY	27	VINES
55	DTPA	77	325	VINES	FIELD, SLUDGE, MATURITY	36	VINES
56	DTPA	157	308	VINES	FIELD, SLUDGE, MATURITY	32.8	VINES
57	0.5 M HCL	5	40	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
58	0.5 M HCL	97	179	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
59	0.5 M HCL	89	95	LEAF	FIELD, SLUDGE, MATURITY	14.3*	EDIBLE PART
60	0.5 M HCL	5	41	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
61	0.5 M HCL	97	94	LEAF	FIELD, SLUDGE, MATURITY	8.3*	EDIBLE PART
62	0.5 M HCL	89	55	LEAF	FIELD, SLUDGE, MATURITY	8.3*	EDIBLE PART
63	0.5 M HCL	5	68	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
64	0.5 M HCL	97	143	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
65	0.5 M HCL	89	92	LEAF	FIELD, SLUDGE, MATURITY	13*	EDIBLE PART
66	0.5 M HCL	5	49	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
67	0.5 M HCL	97	77	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
68	0.5 M HCL	89	55	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
69	0.5 M HCL	5	93	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
70	0.5 M HCL	97	233	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
71	0.5 M HCL	89	226	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
72	0.5 M HCL	5	52	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
73	0.5 M HCL	97	194	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
74	0.5 M HCL	89	96	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
75	0.5 M HCL	5	33	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART
76	0.5 M HCL	97	161	LEAF	FIELD, SLUDGE, MATURITY	0	EDIBLE PART

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
39						5.6	360
40						5.6	720
41						6.5	0
42						6.5	0
43						5.2	90
44						5.6	180
45						5.9	360
46						6	270
47						5.9	540
48						6.3	1080
49						6.3	0
50						5.8	0
51						5.5	90
52						5.7	180
53						6.1	360
54						5	360
55						5.3	720
56						5.7	1440
57						6.4	0
58						6.4	202
59						6.4	202
60						6.4	0
61						6.4	202
62						6.4	202
63						6.4	0
64						6.4	202
65						6.4	202
66						6.4	0
67						6.4	202
68						6.4	202
69						6.4	0
70						6.4	202
71						6.4	202
72						6.4	0
73						6.4	202
74						6.4	202
75						6.4	0
76						6.4	202

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
39		100	200	0		SANGO	SiL
40		200	400	0		SANGO	SiL
41		0	0			SANGO	SiL
42		0	0			SANGO	SiL
43		50	50	2		SANGO	SiL
44		100	100	2		SANGO	SiL
45		200	200	2		SANGO	SiL
46		50	150	0		SANGO	SiL
47		100	300	0		SANGO	SiL
48		200	600	0		SANGO	SiL
49		0	0			SANGO	SiL
50		0	0			SANGO	SiL
51		50	50	3		SANGO	SiL
52		100	100	3		SANGO	SiL
53		200	200	3		SANGO	SiL
54		50	200	0		SANGO	SiL
55		100	400	0		SANGO	SiL
56		200	800	0		SANGO	SiL
57		0	0			SANGO	SiL
58		112	112	0		SANGO	SiL
59		112	112	0		SANGO	SiL
60		0	0			SANGO	SiL
61		112	112	0		SANGO	SiL
62		112	112	0		SANGO	SiL
63		0	0			SANGO	SiL
64		112	112	0		SANGO	SiL
65		112	112	0		SANGO	SiL
66		0	0			SANGO	SiL
67		112	112	0		SANGO	SiL
68		112	112	0		SANGO	SiL
69		0	0			SANGO	SiL
70		112	112	0		SANGO	SiL
71		112	112	0		SANGO	SiL
72		0	0			SANGO	SiL
73		112	112	0		SANGO	SiL
74		112	112	0		SANGO	SiL
75		0	0			SANGO	SiL
76		112	112	0		SANGO	SiL

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
39	400	520	1.5	2.1	40	1.3	1600	1800		
40	400	520	1.5	2.1	40	1.3	1600	1800		
41	400	520	1.5	2.1	40	1.3	1600	1800		
42	400	520	1.5	2.1	40	1.3	1600	1800		
43	400	520	1.5	2.1	40	1.3	1600	1800		
44	400	520	1.5	2.1	40	1.3	1600	1800		
45	400	520	1.5	2.1	40	1.3	1600	1800		
46	400	520	1.5	2.1	40	1.3	1600	1800		
47	400	520	1.5	2.1	40	1.3	1600	1800		
48	400	520	1.5	2.1	40	1.3	1600	1800		
49	400	520	1.5	2.1	40	1.3	1600	1800		
50	400	520	1.5	2.1	40	1.3	1600	1800		
51	400	520	1.5	2.1	40	1.3	1600	1800		
52	400	520	1.5	2.1	40	1.3	1600	1800		
53	400	520	1.5	2.1	40	1.3	1600	1800		
54	400	520	1.5	2.1	40	1.3	1600	1800		
55	400	520	1.5	2.1	40	1.3	1600	1800		
56	400	520	1.5	2.1	40	1.3	1600	1800		
57										
58	350	730	1.7	2.3	20	1.6	530	1800		
59	400	520	1.5	2.1	40	1.3	1600	1800		
60										
61	350	730	1.7	2.3	20	1.6	530	1800		
62	400	520	1.5	2.1	40	1.3	1600	1800		
63										
64	350	730	1.7	2.3	20	1.6	530	1800		
65	400	520	1.5	2.1	40	1.3	1600	1800		
66										
67	350	730	1.7	2.3	20	1.6	530	1800		
68	400	520	1.5	2.1	40	1.3	1600	1800		
69										
70	350	730	1.7	2.3	20	1.6	530	1800		
71	400	520	1.5	2.1	40	1.3	1600	1800		
72										
73	350	730	1.7	2.3	20	1.6	530	1800		
74	400	520	1.5	2.1	40	1.3	1600	1800		
75										
76	350	730	1.7	2.3	20	1.6	530	1800		

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
39	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
40	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
41	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
42	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
43	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
44	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
45	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
46	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
47	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
48	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
49	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
50	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
51	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
52	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
53	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
54	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
55	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
56	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
57	GIORDANO & MAYS 1977	BEANS						
58	GIORDANO & MAYS 1977	BEANS		6.6			2.5	50
59	GIORDANO & MAYS 1977	BEANS		6.1			1.7	40
60	GIORDANO & MAYS 1977	OKRA						
61	GIORDANO & MAYS 1977	OKRA		6.6			2.5	50
62	GIORDANO & MAYS 1977	OKRA		6.1			1.7	40
63	GIORDANO & MAYS 1977	PEPPERS						
64	GIORDANO & MAYS 1977	PEPPERS		6.6			2.5	50
65	GIORDANO & MAYS 1977	PEPPERS		6.1			1.7	40
66	GIORDANO & MAYS 1977	TOMATO						
67	GIORDANO & MAYS 1977	TOMATO		6.6			2.5	50
68	GIORDANO & MAYS 1977	TOMATO		6.1			1.7	40
69	GIORDANO & MAYS 1977	SQUASH						
70	GIORDANO & MAYS 1977	SQUASH		6.6			2.5	50
71	GIORDANO & MAYS 1977	SQUASH		6.1			1.7	40
72	GIORDANO & MAYS 1977	TURNIP						
73	GIORDANO & MAYS 1977	TURNIP		6.6			2.5	50
74	GIORDANO & MAYS 1977	TURNIP		6.1			1.7	40
75	GIORDANO & MAYS 1977	KALE						
76	GIORDANO & MAYS 1977	KALE		6.6			2.5	50

TABLE F-4 (cont.)

	LOCATION OF STUDY
1	MUSCLE SCHOALES, AL
2	MUSCLE SCHOALES, AL
3	MUSCLE SCHOALES, AL
4	MUSCLE SCHOALES, AL
5	MUSCLE SCHOALES, AL
6	MUSCLE SCHOALES, AL
7	MUSCLE SCHOALES, AL
8	MUSCLE SCHOALES, AL
9	MUSCLE SCHOALES, AL
10	MUSCLE SCHOALES, AL
11	MUSCLE SCHOALES, AL
12	MUSCLE SCHOALES, AL
13	MUSCLE SCHOALES, AL
14	MUSCLE SCHOALES, AL
15	MUSCLE SCHOALES, AL
16	MUSCLE SCHOALES, AL
17	MUSCLE SCHOALES, AL
18	MUSCLE SCHOALES, AL
19	MUSCLE SCHOALES, AL
20	MUSCLE SCHOALES, AL
21	MUSCLE SCHOALES, AL
22	MUSCLE SCHOALES, AL
23	MUSCLE SCHOALES, AL
24	MUSCLE SCHOALES, AL
25	MUSCLE SCHOALES, AL
26	MUSCLE SCHOALES, AL
27	MUSCLE SCHOALES, AL
28	MUSCLE SCHOALES, AL
29	MUSCLE SCHOALES, AL
30	MUSCLE SCHOALES, AL
31	MUSCLE SCHOALES, AL
32	MUSCLE SCHOALES, AL
33	MUSCLE SCHOALES, AL
34	MUSCLE SCHOALES, AL
35	MUSCLE SCHOALES, AL
36	MUSCLE SCHOALES, AL
37	MUSCLE SCHOALES, AL
38	MUSCLE SCHOALES, AL

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
1			NO	
2			NO	
3			NO	
4			NO	
5			NO	
6			NO	
7			NO	
8			NO	
9			NO	
10			NO	
11			NO	
12			NO	
13			NO	
14			NO	
15			NO	
16			NO	
17			NO	
18			NO	
19			NO	
20			NO	
21			NO	
22			NO	
23			*NO	*YIELD REDUCTION NOT CONSISTANT WITH DOSE RESPONCE RELATIONSHIP
24			NO	
25			NO	
26			POSSIBLE	ANNUAL LOADING EXCEEDS AGRONOMIC RATES, SOIL PH<5.5
27			POSSIBLE	ANNUAL LOADING EXCEEDS AGRONOMIC RATES, SOIL PH<5.5
28			NO	
29	0	PODS	NO	
30	17.7*	PODS	*NO	*TISSUE ZN CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA
31	35.3*	PODS	*NO	*TISSUE ZN CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA
32	55*	PODS	*NO	*TISSUE ZN CONCENTRATION NOT COMMENSURATE WITH PHYTOTOXICITY CRITERIA
33	0	PODS	NO	
34	0	PODS	NO	
35	25.4*	PODS	*NO	*DOSE RESPONSE & TISSUE CONCENTRATION INCONSISTANT
36	0	PODS	NO	
37	28.5*	PODS	*NO	*DOSE RESPONSE & TISSUE CONCENTRATION INCONSISTANT
38	0	PODS	NO	

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
1	0.5 M HCl	4	41	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
2	0.5 M HCl	29	94	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
3	0.5 M HCl	53	95	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
4	0.5 M HCl	93	97	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
5	0.5 M HCl	6	47	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
6	0.5 M HCl	6	53	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
7	0.5 M HCl	18	153	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
8	0.5 M HCl	54	184	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
9	0.5 M HCl	73	207	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
10	0.5 M HCl	68	225	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
11	0.5 M HCl	75	202	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
12	0.5 M HCl	206	241	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
13	0.5 M HCl	7	28	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
14	0.5 M HCl	7	28	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
15	0.5 M HCl	20	98	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
16	0.5 M HCl	40	94	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
17	0.5 M HCl	62	130	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
18	0.5 M HCl	143	172	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
19	0.5 M HCl	261	221	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
20	0.5 M HCl	774	250	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
21	DTPA	2	30	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
22	DTPA	2	46	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
23	DTPA	9	130	FORAGE	FIELD, SLUDGE, MATURITY	11.3*	STOVER
24	DTPA	19	158	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
25	DTPA	25	172	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
26	DTPA	69	313	FORAGE	FIELD, SLUDGE, MATURITY	14.2	STOVER
27	DTPA	77	450	FORAGE	FIELD, SLUDGE, MATURITY	17.6	STOVER
28	DTPA	157	400	FORAGE	FIELD, SLUDGE, MATURITY	0	STOVER
29	0.5 M HCl	4	60	VINES	FIELD, SLUDGE, MATURITY	0	VINES
30	0.5 M HCl	29	158	VINES	FIELD, SLUDGE, MATURITY	0	VINES
31	0.5 M HCl	53	189	VINES	FIELD, SLUDGE, MATURITY	0	VINES
32	0.5 M HCl	93	164	VINES	FIELD, SLUDGE, MATURITY	0	VINES
33	0.5 M HCl	6	44	VINES	FIELD, SLUDGE, MATURITY	0	VINES
34	0.5 M HCl	6	48	VINES	FIELD, SLUDGE, MATURITY	0	VINES
35	0.5 M HCl	18	171	VINES	FIELD, SLUDGE, MATURITY	0	VINES
36	0.5 M HCl	54	184	VINES	FIELD, SLUDGE, MATURITY	0	VINES
37	0.5 M HCl	73	187	VINES	FIELD, SLUDGE, MATURITY	0	VINES
38	0.5 M HCl	68	225	VINES	FIELD, SLUDGE, MATURITY	0	VINES

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
1						4.9	0
2						5.3	90
3						5.3	180
4						5.6	360
5						4.9	0
6						4.9	0
7						5.3	90
8						5.3	180
9						5.6	360
10						5.6	180
11						5.6	360
12						5.6	720
13						6.5	0
14						6.5	0
15						5.2	90
16						5.6	180
17						5.9	360
18						6	270
19						5.9	540
20						6.3	1080
21						6.3	0
22						5.8	0
23						5.5	90
24						5.7	180
25						6.1	360
26						5	360
27						5.3	720
28						5.7	1440
29						4.9	0
30						5.3	90
31						5.3	180
32						5.6	360
33						4.9	0
34						4.9	0
35						5.3	90
36						5.3	180
37						5.6	360
38						5.6	180

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
1		0	0			SANGO	SiL
2		50	50	0		SANGO	SiL
3		100	100	0		SANGO	SiL
4		200	200	0		SANGO	SiL
5		0	0			SANGO	SiL
6		0	0			SANGO	SiL
7		50	50	1		SANGO	SiL
8		100	100	1		SANGO	SiL
9		200	200	1		SANGO	SiL
10		50	100	0		SANGO	SiL
11		100	200	0		SANGO	SiL
12		200	400	0		SANGO	SiL
13		0	0			SANGO	SiL
14		0	0			SANGO	SiL
15		50	50	2		SANGO	SiL
16		100	100	2		SANGO	SiL
17		200	200	2		SANGO	SiL
18		50	150	0		SANGO	SiL
19		100	300	0		SANGO	SiL
20		200	600	0		SANGO	SiL
21		0	0			SANGO	SiL
22		0	0			SANGO	SiL
23		50	50	3		SANGO	SiL
24		100	100	3		SANGO	SiL
25		200	200	3		SANGO	SiL
26		50	200	0		SANGO	SiL
27		100	400	0		SANGO	SiL
28		200	800	0		SANGO	SiL
29		0	0			SANGO	SiL
30		50	50	0		SANGO	SiL
31		100	100	0		SANGO	SiL
32		200	200	0		SANGO	SiL
33		0	0			SANGO	SiL
34		0	0			SANGO	SiL
35		50	50	1		SANGO	SiL
36		100	100	1		SANGO	SiL
37		200	200	1		SANGO	SiL
38		50	100	0		SANGO	SiL

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
1	400	520	1.5	2.1	40	1.3	1600	1800		
2	400	520	1.5	2.1	40	1.3	1600	1800		
3	400	520	1.5	2.1	40	1.3	1600	1800		
4	400	520	1.5	2.1	40	1.3	1600	1800		
5	400	520	1.5	2.1	40	1.3	1600	1800		
6	400	520	1.5	2.1	40	1.3	1600	1800		
7	400	520	1.5	2.1	40	1.3	1600	1800		
8	400	520	1.5	2.1	40	1.3	1600	1800		
9	400	520	1.5	2.1	40	1.3	1600	1800		
10	400	520	1.5	2.1	40	1.3	1600	1800		
11	400	520	1.5	2.1	40	1.3	1600	1800		
12	400	520	1.5	2.1	40	1.3	1600	1800		
13	400	520	1.5	2.1	40	1.3	1600	1800		
14	400	520	1.5	2.1	40	1.3	1600	1800		
15	400	520	1.5	2.1	40	1.3	1600	1800		
16	400	520	1.5	2.1	40	1.3	1600	1800		
17	400	520	1.5	2.1	40	1.3	1600	1800		
18	400	520	1.5	2.1	40	1.3	1600	1800		
19	400	520	1.5	2.1	40	1.3	1600	1800		
20	400	520	1.5	2.1	40	1.3	1600	1800		
21	400	520	1.5	2.1	40	1.3	1600	1800		
22	400	520	1.5	2.1	40	1.3	1600	1800		
23	400	520	1.5	2.1	40	1.3	1600	1800		
24	400	520	1.5	2.1	40	1.3	1600	1800		
25	400	520	1.5	2.1	40	1.3	1600	1800		
26	400	520	1.5	2.1	40	1.3	1600	1800		
27	400	520	1.5	2.1	40	1.3	1600	1800		
28	400	520	1.5	2.1	40	1.3	1600	1800		
29	400	520	1.5	2.1	40	1.3	1600	1800		
30	400	520	1.5	2.1	40	1.3	1600	1800		
31	400	520	1.5	2.1	40	1.3	1600	1800		
32	400	520	1.5	2.1	40	1.3	1600	1800		
33	400	520	1.5	2.1	40	1.3	1600	1800		
34	400	520	1.5	2.1	40	1.3	1600	1800		
35	400	520	1.5	2.1	40	1.3	1600	1800		
36	400	520	1.5	2.1	40	1.3	1600	1800		
37	400	520	1.5	2.1	40	1.3	1600	1800		
38	400	520	1.5	2.1	40	1.3	1600	1800		

TABLE F-4. ZINC DATA

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
1	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
2	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
3	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
4	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
5	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
6	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
7	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
8	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
9	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
10	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
11	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
12	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
13	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
14	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
15	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
16	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
17	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
18	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
19	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
20	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
21	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
22	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
23	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
24	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
25	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
26	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
27	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
28	GIORDANO&MAYS 1977	CORN	SILVER QUEEN	6.1			1.7	40
29	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
30	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
31	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
32	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
33	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
34	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
35	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
36	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
37	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40
38	GIORDANO&MAYS 1977	BEANS	WHITE HALF RUNNER	6.1			1.7	40

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
533		FULTON COUNTY, ILLINOIS
534		FULTON COUNTY, ILLINOIS
535		FULTON COUNTY, ILLINOIS
536		FULTON COUNTY, ILLINOIS
537		FULTON COUNTY, ILLINOIS
538		FULTON COUNTY, ILLINOIS
539		FULTON COUNTY, ILLINOIS
540		FULTON COUNTY, ILLINOIS
541		FULTON COUNTY, ILLINOIS
542		FULTON COUNTY, ILLINOIS
543		FULTON COUNTY, ILLINOIS
544		FULTON COUNTY, ILLINOIS
545		FULTON COUNTY, ILLINOIS
546		FULTON COUNTY, ILLINOIS
547		FULTON COUNTY, ILLINOIS
548		FULTON COUNTY, ILLINOIS
549		FULTON COUNTY, ILLINOIS
550		FULTON COUNTY, ILLINOIS
551		FULTON COUNTY, ILLINOIS
552		FULTON COUNTY, ILLINOIS
553		FULTON COUNTY, ILLINOIS

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
533	NA	GRAIN	NA	STOVER	
534	0	GRAIN	0	STOVER	
535	0	GRAIN	0	STOVER	
536	0	GRAIN	0	STOVER	
537	0	GRAIN	0	STOVER	
538	0	GRAIN	0	STOVER	
539	0	GRAIN	0	STOVER	
540	0	GRAIN	0	STOVER	
541	0	GRAIN	0	STOVER	
542	43.7	GRAIN	0	STOVER	
543	23	GRAIN	0	STOVER	
544	NA	GRAIN	NA	STOVER	
545	0	GRAIN	0	STOVER	
546	0	GRAIN	0	STOVER	
547	0	GRAIN	0	STOVER	
548	0	GRAIN	0	STOVER	
549	0	GRAIN	0	STOVER	
550	0	GRAIN	0	STOVER	
551	0	GRAIN	0	STOVER	
552	0	GRAIN	0	STOVER	
553	59.2	GRAIN	0	STOVER	

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
533		0.94	7.5	84	0.1 M HCl	12.9	0.6	LEAF	FIELD, SLUDGE, MATURITY
534		1.56	7.5	100	0.1 M HCl	21.5	0.8	LEAF	FIELD, SLUDGE, MATURITY
535		1.56	7.5	110	0.1 M HCl	23.9	3	LEAF	FIELD, SLUDGE, MATURITY
536		1.04	7.5	126	0.1 M HCl	21.2	1.4	LEAF	FIELD, SLUDGE, MATURITY
537		1.04	7.5	140	0.1 M HCl	24.9	2.8	LEAF	FIELD, SLUDGE, MATURITY
538		1.48	7.5	154	0.1 M HCl	23.6	3.3	LEAF	FIELD, SLUDGE, MATURITY
539		1.48	7.5	162	0.1 M HCl	22.5	1.3	LEAF	FIELD, SLUDGE, MATURITY
540		2.15	7.5	170	0.1 M HCl	33.1	1.9	LEAF	FIELD, SLUDGE, MATURITY
541		2.15	7.5	180	0.1 M HCl	25.8	0.7	LEAF	FIELD, SLUDGE, MATURITY
542		1.9	7.5	186	0.1 M HCl	31	1	LEAF	FIELD, SLUDGE, MATURITY
543		1.22	7.5	148	0.1 M HCl	18.8	0.9	LEAF	FIELD, SLUDGE, MATURITY
544		3.02	7.5	168	0.1 M HCl	18.8	0.9	LEAF	FIELD, SLUDGE, MATURITY
545		3.02	7.5	200	0.1 M HCl	42.4	1.1	LEAF	FIELD, SLUDGE, MATURITY
546		1.58	7.5	220	0.1 M HCl	39.9	3	LEAF	FIELD, SLUDGE, MATURITY
547		1.58	7.5	252	0.1 M HCl	31.4	0.6	LEAF	FIELD, SLUDGE, MATURITY
548		2.38	7.5	280	0.1 M HCl	44.8	2.3	LEAF	FIELD, SLUDGE, MATURITY
549		2.38	7.5	308	0.1 M HCl	39.1	12	LEAF	FIELD, SLUDGE, MATURITY
550		3.47	7.5	324	0.1 M HCl	47.4	1.6	LEAF	FIELD, SLUDGE, MATURITY
551		3.47	7.5	340	0.1 M HCl	49.3	1.9	LEAF	FIELD, SLUDGE, MATURITY
552		2.77	7.5	360	0.1 M HCl	46.4	1.1	LEAF	FIELD, SLUDGE, MATURITY
553		2.77	7.5	372	0.1 M HCl	43.8	1	LEAF	FIELD, SLUDGE, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
533	39.8	200.9	0	STRIP MINE SPOIL					
534	34.8	235.7	0	STRIP MINE SPOIL					
535	22.8	258.5	0	STRIP MINE SPOIL					
536	34.9	293.4	0	STRIP MINE SPOIL					
537	35.8	329.2	0	STRIP MINE SPOIL					
538	33.6	362.8	0	STRIP MINE SPOIL					
539	33.6	396.4	0	STRIP MINE SPOIL					
540	33.6	430	0	STRIP MINE SPOIL					
541	33.6	463.6	0	STRIP MINE SPOIL					
542	33.6	497.2	0	STRIP MINE SPOIL					
543	64.3	321.9	0	STRIP MINE SPOIL					
544	79.7	401.6	0	STRIP MINE SPOIL					
545	69.8	471.4	0	STRIP MINE SPOIL					
546	45.5	516.9	0	STRIP MINE SPOIL					
547	68.8	585.7	0	STRIP MINE SPOIL					
548	71.7	657.4	0	STRIP MINE SPOIL					
549	67.2	724.6	0	STRIP MINE SPOIL					
550	67.2	791.8	0	STRIP MINE SPOIL					
551	67.2	859	0	STRIP MINE SPOIL					
552	67.2	926.2	0	STRIP MINE SPOIL					
553	67.2	993.4	0	STRIP MINE SPOIL					

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
533	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
534	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
535	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
536	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
537	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
538	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
539	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
540	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
541	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
542	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
543	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
544	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
545	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
546	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
547	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
548	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
549	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
550	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
551	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
552	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
553	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
533	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
534	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
535	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
536	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
537	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
538	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
539	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
540	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
541	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71	775	460
542	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53	679	454
543	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
544	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
545	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265.	3505	1471
546	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
547	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
548	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
549	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
550	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
551	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
552	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71	775	460
553	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53	679	454

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
495		FULTON COUNTY, ILLINOIS
496		FULTON COUNTY, ILLINOIS
497		FULTON COUNTY, ILLINOIS
498		FULTON COUNTY, ILLINOIS
499		FULTON COUNTY, ILLINOIS
500		FULTON COUNTY, ILLINOIS
501		FULTON COUNTY, ILLINOIS
502		FULTON COUNTY, ILLINOIS
503		FULTON COUNTY, ILLINOIS
504		FULTON COUNTY, ILLINOIS
505		FULTON COUNTY, ILLINOIS
506		FULTON COUNTY, ILLINOIS
507		FULTON COUNTY, ILLINOIS
508		FULTON COUNTY, ILLINOIS
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514		FULTON COUNTY, ILLINOIS
515		FULTON COUNTY, ILLINOIS
516		FULTON COUNTY, ILLINOIS
517		FULTON COUNTY, ILLINOIS
518		FULTON COUNTY, ILLINOIS
519		FULTON COUNTY, ILLINOIS
520		FULTON COUNTY, ILLINOIS
521		FULTON COUNTY, ILLINOIS
522		FULTON COUNTY, ILLINOIS
523		FULTON COUNTY, ILLINOIS
524		FULTON COUNTY, ILLINOIS
525		FULTON COUNTY, ILLINOIS
526		FULTON COUNTY, ILLINOIS
527		FULTON COUNTY, ILLINOIS
528		FULTON COUNTY, ILLINOIS
529		FULTON COUNTY, ILLINOIS
530		FULTON COUNTY, ILLINOIS
531		FULTON COUNTY, ILLINOIS
532		FULTON COUNTY, ILLINOIS

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
495	0	GRAIN	0	STOVER	
496	0	GRAIN	0	STOVER	
497	0	GRAIN	0	STOVER	
498	0	GRAIN	0	STOVER	
499	0	GRAIN	0	STOVER	
500	0	GRAIN	0	STOVER	
501	0	GRAIN	0	STOVER	
502	0	GRAIN	0	STOVER	
503	0	GRAIN	0	STOVER	
504	0	GRAIN	0	STOVER	
505	0	GRAIN	0	STOVER	
506	0	GRAIN	0	STOVER	
507	0	GRAIN	0	STOVER	
508	0	GRAIN	0	STOVER	
509	0	GRAIN	0	STOVER	
510	0	GRAIN	0	STOVER	
511	0	GRAIN	0	STOVER	
512	0	GRAIN	0	STOVER	
513	0	GRAIN	0	STOVER	
514	0	GRAIN	0	STOVER	
515	0	GRAIN	0	STOVER	
516	0	GRAIN	0	STOVER	
517	0	GRAIN	0	STOVER	
518	0	GRAIN	0	STOVER	
519	0	GRAIN	0	STOVER	
520	0	GRAIN	0	STOVER	
521	29.5	GRAIN	0	STOVER	
522	NA	GRAIN	NA	STOVER	
523	0	GRAIN	0	STOVER	
524	0	GRAIN	0	STOVER	
525	0	GRAIN	0	STOVER	
526	0	GRAIN	0	STOVER	
527	0	GRAIN	0	STOVER	
528	0	GRAIN	0	STOVER	
529	0	GRAIN	0	STOVER	
530	0	GRAIN	0	STOVER	
531	0	GRAIN	0	STOVER	
532	21.5	GRAIN	0	STOVER	

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
495	12.6	0.33	7.8	0.8	0.1 M HCl	3.9	1.8	LEAF	FIELD, SLUDGE, MATURITY
496	12.6	0.27	7.8	5.1	0.1 M HCl	5.4	0.8	LEAF	FIELD, SLUDGE, MATURITY
497	12.6	0.41	7.8	11	0.1 M HCl	5.7	0.5	LEAF	FIELD, SLUDGE, MATURITY
498	12.6	0.41	7.8	18	0.1 M HCl	7.5	0.8	LEAF	FIELD, SLUDGE, MATURITY
499	12.6	0.59	7.8	28	0.1 M HCl	5.3	0.7	LEAF	FIELD, SLUDGE, MATURITY
500	12.6	0.35	7.8	1.6	0.1 M HCl	5.4	2.6	LEAF	FIELD, SLUDGE, MATURITY
501	12.6	0.3	7.8	10.2	0.1 M HCl	5.7	0.7	LEAF	FIELD, SLUDGE, MATURITY
502	12.6	0.3	7.8	22	0.1 M HCl	8.3	0.8	LEAF	FIELD, SLUDGE, MATURITY
503	12.6	0.5	7.8	36	0.1 M HCl	8.9	0.7	LEAF	FIELD, SLUDGE, MATURITY
504	12.6	0.5	7.8	56	0.1 M HCl	7.1	0.9	LEAF	FIELD, SLUDGE, MATURITY
505	12.6	0.33	7.8	3.2	0.1 M HCl	4.8	1.6	LEAF	FIELD, SLUDGE, MATURITY
506	12.6	0.33	7.8	20.4	0.1 M HCl	6	0.5	LEAF	FIELD, SLUDGE, MATURITY
507	12.6	0.76	7.8	44	0.1 M HCl	11.3	0.8	LEAF	FIELD, SLUDGE, MATURITY
508	12.6	0.76	7.8	72	0.1 M HCl	10.8	1.1	LEAF	FIELD, SLUDGE, MATURITY
509	12.6	1.22	7.8	112	0.1 M HCl	13.2	0.9	LEAF	FIELD, SLUDGE, MATURITY
510		0.33	7.5	0	0.1 M HCl	7.9	0.6	LEAF	FIELD, SLUDGE, MATURITY
511		0.44	7.5	0	0.1 M HCl	6	0.6	LEAF	FIELD, SLUDGE, MATURITY
512		0.44	7.5	0	0.1 M HCl	7	0.6	LEAF	FIELD, SLUDGE, MATURITY
513		0.36	7.5	0	0.1 M HCl	7.7	2.9	LEAF	FIELD, SLUDGE, MATURITY
514		0.36	7.5	0	0.1 M HCl	9.1	0.9	LEAF	FIELD, SLUDGE, MATURITY
515		0.46	7.5	0	0.1 M HCl	7.6	1.8	LEAF	FIELD, SLUDGE, MATURITY
516		0.46	7.5	0	0.1 M HCl	7.7	6	LEAF	FIELD, SLUDGE, MATURITY
517		0.73	7.5	0	0.1 M HCl	7.9	1.6	LEAF	FIELD, SLUDGE, MATURITY
518		0.73	7.5	0	0.1 M HCl	9.4	1.5	LEAF	FIELD, SLUDGE, MATURITY
519		0.7	7.5	0	0.1 M HCl	7.7	1.1	LEAF	FIELD, SLUDGE, MATURITY
520		0.7	7.5	0	0.1 M HCl	9.8	1.3	LEAF	FIELD, SLUDGE, MATURITY
521		0.59	7.5	37	0.1 M HCl	11.3	0.6	LEAF	FIELD, SLUDGE, MATURITY
522		0.94	7.5	42	0.1 M HCl	11.2	0.6	LEAF	FIELD, SLUDGE, MATURITY
523		0.94	7.5	50	0.1 M HCl	15.8	0.7	LEAF	FIELD, SLUDGE, MATURITY
524		0.67	7.5	55	0.1 M HCl	13.3	3.7	LEAF	FIELD, SLUDGE, MATURITY
525		0.67	7.5	63	0.1 M HCl	9.6	1.9	LEAF	FIELD, SLUDGE, MATURITY
526		0.87	7.5	70	0.1 M HCl	15.2	2.6	LEAF	FIELD, SLUDGE, MATURITY
527		0.87	7.5	77	0.1 M HCl	12.9	5.2	LEAF	FIELD, SLUDGE, MATURITY
528		1.41	7.5	81	0.1 M HCl	12.7	1.3	LEAF	FIELD, SLUDGE, MATURITY
529		1.41	7.5	85	0.1 M HCl	18.5	2.2	LEAF	FIELD, SLUDGE, MATURITY
530		1.25	7.5	90	0.1 M HCl	18.4	0.9	LEAF	FIELD, SLUDGE, MATURITY
531		1.25	7.5	93	0.1 M HCl	18.2	0.5	LEAF	FIELD, SLUDGE, MATURITY
532		0.94	7.5	74	0.1 M HCl	14.4	0.6	LEAF	FIELD, SLUDGE, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
495	3	3		STRIP MINE SPOIL					
496	12.8	15.8	0	STRIP MINE SPOIL					
497	12.4	28.1	0	STRIP MINE SPOIL					
498	14.3	42.4	0	STRIP MINE SPOIL					
499	19.5	61.9	0	STRIP MINE SPOIL					
500	6	6	0	STRIP MINE SPOIL					
501	25.5	31.5	0	STRIP MINE SPOIL					
502	29.8	61.3	0	STRIP MINE SPOIL					
503	28.6	89.9	0	STRIP MINE SPOIL					
504	39	128.9	0	STRIP MINE SPOIL					
505	11.9	11.9	0	STRIP MINE SPOIL					
506	51	62.9	0	STRIP MINE SPOIL					
507	59.6	122.5	0	STRIP MINE SPOIL					
508	57.1	179.6	0	STRIP MINE SPOIL					
509	78	257.6	0	STRIP MINE SPOIL					
510	0	0	0	STRIP MINE SPOIL					
511	0	0	0	STRIP MINE SPOIL					
512	0	0	0	STRIP MINE SPOIL					
513	0	0	0	STRIP MINE SPOIL					
514	0	0	0	STRIP MINE SPOIL					
515	0	0	0	STRIP MINE SPOIL					
516	0	0	0	STRIP MINE SPOIL					
517	0	0	0	STRIP MINE SPOIL					
518	0	0	0	STRIP MINE SPOIL					
519	0	0	0	STRIP MINE SPOIL					
520	0	0	0	STRIP MINE SPOIL					
521	16.1	78	0	STRIP MINE SPOIL					
522	19.9	97.9	0	STRIP MINE SPOIL					
523	17.4	115.3	0	STRIP MINE SPOIL					
524	11.4	126.7	0	STRIP MINE SPOIL					
525	16.8	143.5	0	STRIP MINE SPOIL					
526	17.9	161.4	0	STRIP MINE SPOIL					
527	16.8	178.2	0	STRIP MINE SPOIL					
528	16.8	195	0	STRIP MINE SPOIL					
529	16.8	211.8	0	STRIP MINE SPOIL					
530	16.8	228.6	0	STRIP MINE SPOIL					
531	16.8	245.4	0	STRIP MINE SPOIL					
532	32.2	161.1	0	STRIP MINE SPOIL					

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
495	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
496	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
497	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
498	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
499	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
500	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
501	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
502	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
503	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
504	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
505	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
506	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
507	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
508	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
509	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
510	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
511	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
512	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
513	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
514	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
515	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
516	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
517	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
518	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
519	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
520	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
521	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
522	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
523	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
524	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
525	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
526	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
527	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
528	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
529	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
530	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
531	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
532	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
495	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
496	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
497	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307	3505	1471
498	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307	3505	1471
499	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307	3505	1471
500	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
501	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
502	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307	3505	1471
503	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307	3505	1471
504	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307	3505	1471
505	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
506	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
507	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307	3505	1471
508	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307	3505	1471
509	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307	3505	1471
510	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
511	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
512	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
513	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
514	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
515	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
516	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
517	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
518	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
519	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71	775	460
520	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53	679	454
521	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
522	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
523	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
524	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
525	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471
526	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
527	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160	3505	1471
528	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
529	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71	775	460
530	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71	775	460
531	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53	679	454
532	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265	3505	1471

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
457		WOODTHORNE, U.K.
458		WOODTHORNE, U.K.
459		WOODTHORNE, U.K.
460	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
461	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
462		WOODTHORNE, U.K.
463		WOODTHORNE, U.K.
464	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
465	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
466		MINNESOTA
467		MINNESOTA
468		MINNESOTA
469		MINNESOTA
470		MINNESOTA
471		MINNESOTA
472		MINNESOTA
473		MINNESOTA
474		MINNESOTA
475		MINNESOTA
476		LEEDS, U.K.
477		LEEDS, U.K.
478	HIGH NI SLUDGE (5100 MG/KG)BLENDED WITH LOWER NI SLUDGE WAS USED	LEEDS, U.K.
479	HIGH NI SLUDGE (5100 MG/KG)BLENDED WITH LOWER NI SLUDGE WAS USED	LEEDS, U.K.
480		LEEDS, U.K.
481		LEEDS, U.K.
482		LEEDS, U.K.
483		LEEDS, U.K.
484		LEEDS, U.K.
485	HIGH NI SLUDGE (5100 MG/KG)BLENDED WITH LOWER NI SLUDGE WAS U[illegible]	LEEDS, U.K.
486		LEEDS, U.K.
487		LEEDS, U.K.
488		
489		
490		FULTON COUNTY, ILLINOIS
491		FULTON COUNTY, ILLINOIS
492		FULTON COUNTY, ILLINOIS
493		FULTON COUNTY, ILLINOIS
494		FULTON COUNTY, ILLINOIS

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
457	0	BULB			NO
458	0	LEAF			NO
459	0	LEAF			NO
460	30	LEAF			POSSIBLE
461	96.3	LEAF			POSSIBLE
462	0	LEAF			NO
463	0	LEAF			NO
464	23.7	LEAF			POSSIBLE
465	28.4	LEAF			POSSIBLE
466	0	GRAIN			
467	0	GRAIN			
468	0	GRAIN			
469	0	GRAIN			
470	0	GRAIN			
471	0	GRAIN			
472	0	GRAIN			
473	0	GRAIN			
474	0	GRAIN			
475	0	GRAIN			
476	0	TOTAL BIOMASS			NO
477	0	TOTAL BIOMASS			NO
478	48	TOTAL BIOMASS			POSSIBLE
479	100	TOTAL BIOMASS			POSSIBLE
480	0	TOTAL BIOMASS			NO
481	0	TOTAL BIOMASS			NO
482	0	STALKS			NO
483	0	STALKS			NO
484	0	STALKS			NO
485	70	STALKS			POSSIBLE
486	0	STALKS			NO
487	0	STALKS			NO
488					
489					
490	0	GRAIN	0	STOVER	
491	0	GRAIN	0	STOVER	
492	0	GRAIN	0	STOVER	
493	0	GRAIN	0	STOVER	
494	0	GRAIN	0	STOVER	

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
457		1.2	7.2	1140	.5 M HOAC	68	NL		SLUDGE, FIELD, MATURITY
458		1.2	6.5	0	.5 M HOAC	4	NL		SLUDGE, FIELD, MATURITY
459		1.2	6.5	285	.5 M HOAC	36	NL		SLUDGE, FIELD, MATURITY
460		1.2	6.5	570	.5 M HOAC	55	NL		SLUDGE, FIELD, MATURITY
461		1.2	6.5	1140	.5 M HOAC	101	NL		SLUDGE, FIELD, MATURITY
462		1.2	7	0	.5 M HOAC	4	NL		SLUDGE, FIELD, MATURITY
463		1.2	7	285	.5 M HOAC	36	NL		SLUDGE, FIELD, MATURITY
464		1.2	7	570	.5 M HOAC	55	NL		SLUDGE, FIELD, MATURITY
465		1.2	7	1140	.5 M HOAC	101	NL		SLUDGE, FIELD, MATURITY
466			6.5	0		N.L.	NR	LEAF	SLUDGE, FIELD, MATURITY
467			6.5	11		N.L.	NR	LEAF	SLUDGE, FIELD, MATURITY
468			6.5	22		N.L.	NR	LEAF	SLUDGE, FIELD, MATURITY
469			6.5	44		N.L.	NR	LEAF	SLUDGE, FIELD, MATURITY
470			6.5	88		N.L.	NR	LEAF	SLUDGE, FIELD, MATURITY
471			6.5	0		N.L.	10	LEAF	SLUDGE, FIELD, MATURITY
472			6.5	11		N.L.	NR	LEAF	SLUDGE, FIELD, MATURITY
473			6.5	22		N.L.	13	LEAF	SLUDGE, FIELD, MATURITY
474			6.5	44		N.L.	NR	LEAF	SLUDGE, FIELD, MATURITY
475			6.5	88		N.L.	NR	LEAF	SLUDGE, FIELD, MATURITY
476			6.1	0	.5 M HOAC	2.1			SLUDGE, FIELD, MATURITY
477			NR	26	.5 M HOAC	7			SLUDGE, FIELD, MATURITY
478			NR	251	.5 M HOAC	57			SLUDGE, FIELD, MATURITY
479			NR	502	.5 M HOAC	91			SLUDGE, FIELD, MATURITY
480			NR	20	.5 M HOAC	6.2			SLUDGE, FIELD, MATURITY
481			NR	31.4	.5 M HOAC	21			SLUDGE, FIELD, MATURITY
482			6.1	0	.5 M HOAC	2.1			SLUDGE, FIELD, MATURITY
483			NR	26	.5 M HOAC	7			SLUDGE, FIELD, MATURITY
484			NR	251	.5 M HOAC	57			SLUDGE, FIELD, MATURITY
485			NR	502	.5 M HOAC	91			SLUDGE, FIELD, MATURITY
486			NR	20	.5 M HOAC	6.2			SLUDGE, FIELD, MATURITY
487			NR	31.4	.5 M HOAC	21			SLUDGE, FIELD, MATURITY
488									
489									
490	12.6	0.25	7.8	0	0.1 M HCl	4.4	2.6	LEAF	FIELD, SLUDGE, MATURITY
491	12.6	0.25	7.8	0	0.1 M HCl	5.4	0.4	LEAF	FIELD, SLUDGE, MATURITY
492	12.6	0.33	7.8	0	0.1 M HCl	4.4	0.6	LEAF	FIELD, SLUDGE, MATURITY
493	12.6	0.33	7.8	0	0.1 M HCl	5.7	0.6	LEAF	FIELD, SLUDGE, MATURITY
494	12.6	0.33	7.8	0	0.1 M HCl	2.5	0.5	LEAF	FIELD, SLUDGE, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
457	224	224	11			LS			
458	0	0	12			LS			
459	56	56	12			LS			
460	112	112	12			LS			
461	224	224	12			LS			
462	0	0	12			LS			
463	56	56	12			LS			
464	112	112	12			LS			
465	224	224	12			LS			
466	0	0	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL			
467	25	25	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL			
468	50	50	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL			
469	100	100	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL			
470	200	200	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL			
471	0	0	1	TYPIC TAPLUDOLL	WAUKEGAN	SiL			
472	25	25	1	TYPIC TAPLUDOLL	WAUKEGAN	SiL			
473	50	50	1	TYPIC TAPLUDOLL	WAUKEGAN	SiL			
474	100	100	1	TYPIC TAPLUDOLL	WAUKEGAN	SiL			
475	200	200	1	TYPIC TAPLUDOLL	WAUKEGAN	SiL			
476	0	0	0						
477	125.5	125.5	2						
478	125.5	125.5	2						
479	125.5	125.5	2						
480	31.4	94.2	0						
481	31.4	94.2	0						
482	0	0	0						
483	125.5	125.5	2						
484	125.5	125.5	2						
485	125.5	125.5	2						
486	31.4	94.2	0						
487	31.4	94.2	0						
488									
489									
490	0	0		STRIP MINE SPOIL					
491	0	0		STRIP MINE SPOIL					
492	0	0		STRIP MINE SPOIL					
493	0	0		STRIP MINE SPOIL					
494	0	0		STRIP MINE SPOIL					

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
457			5100			11400	AIR DRIED		
458			5100			11400	AIR DRIED		
459			5100			11400	AIR DRIED		
460			5100			11400	AIR DRIED		
461			5100			11400	AIR DRIED		
462			5100			11400	AIR DRIED		
463			5100			11400	AIR DRIED		
464			5100			11400	AIR DRIED		
465			5100			11400	AIR DRIED		
466	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
467	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
468	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
469	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
470	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
471	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
472	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
473	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
474	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
475	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED	
476									
477			210			3000			
478			3900			5100			
479			3900			5100			
480			210			3000			
481			3900			5100			
482									
483			210			3000			
484			3900			5100			
485			3900			5100			
486			210			3000			
487			3900			5100			
488									
489									
490	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
491	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
492	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
493	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3
494	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON	POLYMER,FECL3

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
457	WILLIAMS 1977	SWEDE								100
458	WILLIAMS 1977	LETTUCE								100
459	WILLIAMS 1977	LETTUCE								100
460	WILLIAMS 1977	LETTUCE								100
461	WILLIAMS 1977	LETTUCE								100
462	WILLIAMS 1977	LETTUCE								100
463	WILLIAMS 1977	LETTUCE								100
464	WILLIAMS 1977	LETTUCE								100
465	WILLIAMS 1977	LETTUCE								100
466	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
467	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
468	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
469	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
470	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
471	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
472	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
473	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
474	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
475	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12	1100	2020
476	WEBBER 1972	RED BEET								
477	WEBBER 1972	RED BEET							240	1100
478	WEBBER 1972	RED BEET							200	670
479	WEBBER 1972	RED BEET							200	670
480	WEBBER 1972	RED BEET							240	1100
481	WEBBER 1972	RED BEET							200	670
482	WEBBER 1972	CELERY								
483	WEBBER 1972	CELERY							240	1100
484	WEBBER 1972	CELERY							200	670
485	WEBBER 1972	CELERY							200	670
486	WEBBER 1972	CELERY							240	1100
487	WEBBER 1972	CELERY							200	670
488	WEBBER 1972	CELERY								
489	WEBBER 1972	CELERY								
490	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
491	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307	3505	1471
492	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307	3505	1471
493	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307	3505	1471
494	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307	3505	1471

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
419	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
420	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
421	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
422		WOODTHORNE, U.K.
423	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
424	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
425	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
426		WOODTHORNE, U.K.
427	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
428	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
429	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
430		WOODTHORNE, U.K.
431		WOODTHORNE, U.K.
432		WOODTHORNE, U.K.
433	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
434		WOODTHORNE, U.K.
435		WOODTHORNE, U.K.
436	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
437	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
438		WOODTHORNE, U.K.
439		WOODTHORNE, U.K.
440		WOODTHORNE, U.K.
441	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
442		WOODTHORNE, U.K.
443		WOODTHORNE, U.K.
444		WOODTHORNE, U.K.
445	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
446		WOODTHORNE, U.K.
447		WOODTHORNE, U.K.
448		WOODTHORNE, U.K.
449	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
450		WOODTHORNE, U.K.
451		WOODTHORNE, U.K.
452	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
453	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)	WOODTHORNE, U.K.
454		WOODTHORNE, U.K.
455		WOODTHORNE, U.K.
456		WOODTHORNE, U.K.

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
419	94.5	ROOT			POSSIBLE
420	99.3	ROOT			POSSIBLE
421	100	ROOT			POSSIBLE
422	0	ROOT			NO
423	36	ROOT			POSSIBLE
424	69.4	ROOT			POSSIBLE
425	93.2	ROOT			POSSIBLE
426	0	ROOT TUBER			NO
427	86.1	ROOT TUBER			POSSIBLE
428	92.9	ROOT TUBER			POSSIBLE
429	96.7	ROOT TUBER			POSSIBLE
430	0	ROOT TUBER			NO
431	0	ROOT TUBER			NO
432	0	ROOT TUBER			NO
433	52.8	ROOT TUBER			POSSIBLE
434	0	BULB			NO
435	0	BULB			NO
436	77.6	BULB			POSSIBLE
437	93.9	BULB			POSSIBLE
438	0	BULB			NO
439	0	BULB			NO
440	0	BULB			NO
441	38.1	BULB			POSSIBLE
442	0	BULB			NO
443	0	BULB			NO
444	0	BULB			NO
445	99	BULB			POSSIBLE
446	0	BULB			NO
447	0	BULB			NO
448	0	BULB			NO
449	36.4	BULB			POSSIBLE
450	0	BULB			NO
451	0	BULB			NO
452	70.3	BULB			POSSIBLE
453	100	BULB			POSSIBLE
454	0	BULB			NO
455	0	BULB			NO
456	0	BULB			NO

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
419		1.2	5.8	285	.5 M HOAC	29	N.L.		SLUDGE, FIELD, MATURITY
420		1.2	5.8	570	.5 M HOAC	50	N.L.		SLUDGE, FIELD, MATURITY
421		1.2	5.8	1140	.5 M HOAC	85	N.L.		SLUDGE, FIELD, MATURITY
422		1.2	6.6	0	.5 M HOAC	2	N.L.		SLUDGE, FIELD, MATURITY
423		1.2	6.6	285	.5 M HOAC	29	N.L.		SLUDGE, FIELD, MATURITY
424		1.2	6.6	570	.5 M HOAC	50	N.L.		SLUDGE, FIELD, MATURITY
425		1.2	6.6	1140	.5 M HOAC	85	N.L.		SLUDGE, FIELD, MATURITY
426		1.2	6.2	0	.5 M HOAC	NL	2.5	ROOT TUBER	SLUDGE, FIELD, MATURITY
427		1.2	6.2	285	.5 M HOAC	NL	2.5	ROOT TUBER	SLUDGE, FIELD, MATURITY
428		1.2	6.2	570	.5 M HOAC	NL	3.8	ROOT TUBER	SLUDGE, FIELD, MATURITY
429		1.2	6.2	1140	.5 M HOAC	NL	6.3	ROOT TUBER	SLUDGE, FIELD, MATURITY
430		1.2	7	0	.5 M HOAC	NL	1.3	ROOT TUBER	SLUDGE, FIELD, MATURITY
431		1.2	7	285	.5 M HOAC	NL	2.5	ROOT TUBER	SLUDGE, FIELD, MATURITY
432		1.2	7	570	.5 M HOAC	NL	6.3	ROOT TUBER	SLUDGE, FIELD, MATURITY
433		1.2	7	1140	.5 M HOAC	NL	5	ROOT TUBER	SLUDGE, FIELD, MATURITY
434		1.2	6.2	0		NL	NL		SLUDGE, FIELD, MATURITY
435		1.2	6.2	285		NL	NL		SLUDGE, FIELD, MATURITY
436		1.2	6.2	570		NL	NL		SLUDGE, FIELD, MATURITY
437		1.2	6.2	1140		NL	NL		SLUDGE, FIELD, MATURITY
438		1.2	7	0		NL	NL		SLUDGE, FIELD, MATURITY
439		1.2	7	285		NL	NL		SLUDGE, FIELD, MATURITY
440		1.2	7	570		NL	NL		SLUDGE, FIELD, MATURITY
441		1.2	7	1140		NL	NL		SLUDGE, FIELD, MATURITY
442		1.2	6.3	0		NL	6.3	BULB	SLUDGE, FIELD, MATURITY
443		1.2	6.3	285		NL	16.3	BULB	SLUDGE, FIELD, MATURITY
444		1.2	6.3	570		NL	23.8	BULB	SLUDGE, FIELD, MATURITY
445		1.2	6.3	1140		NL	NL	BULB	SLUDGE, FIELD, MATURITY
446		1.2	6.8	0		NL	2.5	BULB	SLUDGE, FIELD, MATURITY
447		1.2	6.8	285		NL	6.3	BULB	SLUDGE, FIELD, MATURITY
448		1.2	6.8	570		NL	7.5	BULB	SLUDGE, FIELD, MATURITY
449		1.2	6.8	1140		NL	18.8	BULB	SLUDGE, FIELD, MATURITY
450		1.2	6.7	0	.5 M HOAC	4	NL		SLUDGE, FIELD, MATURITY
451		1.2	6.7	285	.5 M HOAC	23	NL		SLUDGE, FIELD, MATURITY
452		1.2	6.7	570	.5 M HOAC	42	NL		SLUDGE, FIELD, MATURITY
453		1.2	6.7	1140	.5 M HOAC	68	NL		SLUDGE, FIELD, MATURITY
454		1.2	7.2	0	.5 M HOAC	4	NL		SLUDGE, FIELD, MATURITY
455		1.2	7.2	285	.5 M HOAC	23	NL		SLUDGE, FIELD, MATURITY
456		1.2	7.2	570	.5 M HOAC	42	NL		SLUDGE, FIELD, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
419	56	56	8			LS			
420	112	112	8			LS			
421	224	224	8			LS			
422	0	0	8			LS			
423	56	56	8			LS			
424	112	112	8			LS			
425	224	224	8			LS			
426	0	0	9			LS			
427	56	56	9			LS			
428	112	112	9			LS			
429	224	224	9			LS			
430	0	0	9			LS			
431	56	56	9			LS			
432	112	112	9			LS			
433	224	224	9			LS			
434	0	0	10			LS			
435	56	56	10			LS			
436	112	112	10			LS			
437	224	224	10			LS			
438	0	0	10			LS			
439	56	56	10			LS			
440	112	112	10			LS			
441	224	224	10			LS			
442	0	0	13			LS			
443	56	56	13			LS			
444	112	112	13			LS			
445	224	224	13			LS			
446	0	0	13			LS			
447	56	56	13			LS			
448	112	112	13			LS			
449	224	224	13			LS			
450	0	0	11			LS			
451	56	56	11			LS			
452	112	112	11			LS			
453	224	224	11			LS			
454	0	0	11			LS			
455	56	56	11			LS			
456	112	112	11			LS			

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
419			5100			11400	AIR DRIED		
420			5100			11400	AIR DRIED		
421			5100			11400	AIR DRIED		
422			5100			11400	AIR DRIED		
423			5100			11400	AIR DRIED		
424			5100			11400	AIR DRIED		
425			5100			11400	AIR DRIED		
426			5100			11400	AIR DRIED		
427			5100			11400	AIR DRIED		
428			5100			11400	AIR DRIED		
429			5100			11400	AIR DRIED		
430			5100			11400	AIR DRIED		
431			5100			11400	AIR DRIED		
432			5100			11400	AIR DRIED		
433			5100			11400	AIR DRIED		
434			5100			11400	AIR DRIED		
435			5100			11400	AIR DRIED		
436			5100			11400	AIR DRIED		
437			5100			11400	AIR DRIED		
438			5100			11400	AIR DRIED		
439			5100			11400	AIR DRIED		
440			5100			11400	AIR DRIED		
441			5100			11400	AIR DRIED		
442			5100			11400	AIR DRIED		
443			5100			11400	AIR DRIED		
444			5100			11400	AIR DRIED		
445			5100			11400	AIR DRIED		
446			5100			11400	AIR DRIED		
447			5100			11400	AIR DRIED		
448			5100			11400	AIR DRIED		
449			5100			11400	AIR DRIED		
450			5100			11400	AIR DRIED		
451			5100			11400	AIR DRIED		
452			5100			11400	AIR DRIED		
453			5100			11400	AIR DRIED		
454			5100			11400	AIR DRIED		
455			5100			11400	AIR DRIED		
456			5100			11400	AIR DRIED		

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
419	WILLIAMS 1977	CARROT								100
420	WILLIAMS 1977	CARROT								100
421	WILLIAMS 1977	CARROT								100
422	WILLIAMS 1977	CARROT								100
423	WILLIAMS 1977	CARROT								100
424	WILLIAMS 1977	CARROT								100
425	WILLIAMS 1977	CARROT								100
426	WILLIAMS 1977	BEET								100
427	WILLIAMS 1977	BEET								100
428	WILLIAMS 1977	BEET								100
429	WILLIAMS 1977	BEET								100
430	WILLIAMS 1977	BEET								100
431	WILLIAMS 1977	BEET								100
432	WILLIAMS 1977	BEET								100
433	WILLIAMS 1977	BEET								100
434	WILLIAMS 1977	ONION								100
435	WILLIAMS 1977	ONION								100
436	WILLIAMS 1977	ONION								100
437	WILLIAMS 1977	ONION								100
438	WILLIAMS 1977	ONION								100
439	WILLIAMS 1977	ONION								100
440	WILLIAMS 1977	ONION								100
441	WILLIAMS 1977	ONION								100
442	WILLIAMS 1977	ONION								100
443	WILLIAMS 1977	ONION								100
444	WILLIAMS 1977	ONION								100
445	WILLIAMS 1977	ONION								100
446	WILLIAMS 1977	ONION								100
447	WILLIAMS 1977	ONION								100
448	WILLIAMS 1977	ONION								100
449	WILLIAMS 1977	ONION								100
450	WILLIAMS 1977	SWEDE								100
451	WILLIAMS 1977	SWEDE								100
452	WILLIAMS 1977	SWEDE								100
453	WILLIAMS 1977	SWEDE								100
454	WILLIAMS 1977	SWEDE								100
455	WILLIAMS 1977	SWEDE								100
456	WILLIAMS 1977	SWEDE								100

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
381	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
382	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
383	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
384	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
385	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
386	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
387	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
388	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
389	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
390	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
391	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
392	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
393	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
394	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
395	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
396	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
397		Virginia
398		Virginia
399		Virginia
400		Virginia
401		Virginia
402		Virginia
403		Virginia
404		Virginia
405		Virginia
406		Virginia
407		Virginia
408		Virginia
409		Virginia
410		Virginia
411		Virginia
412		Virginia
413		Virginia
414		Virginia
415		Atlantic Coastal Plain
416		Atlantic Coastal Plain
417		Atlantic Coastal Plain
418		WOODTHORNE, U.K.

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
381					
382					
383					
384					
385					
386					
387					
388					
389					
390					
391					
392					
393					
394					
395					
396					
397					
398					
399					
400					
401					
402					
403					
404					
405					
406					
407					
408					
409					
410					
411					
412					
413					
414					
415	0	Stover			
416	39	Stover			
417	29	Stover			
418	0	ROOT			NO

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
381		2.8	5.6	33	DTPA	1.8	6.2	Leaf	SLUDGE, FIELD, MATURITY
382		2.8	5.6	0	DTPA	0.9	5.6	Leaf	SLUDGE, FIELD, MATURITY
383		2.8	5.6	11	DTPA	2.1	7.6	Leaf	SLUDGE, FIELD, MATURITY
384		2.8	5.6	33	DTPA	3.2	9.6	Leaf	SLUDGE, FIELD, MATURITY
385		2.8	5.6	0	DTPA	0.6	4	Leaf	SLUDGE, FIELD, MATURITY
386		2.8	5.6	11	DTPA	1	9	Leaf	SLUDGE, FIELD, MATURITY
387		2.8	5.6	33	DTPA	1.8	14	Leaf	SLUDGE, FIELD, MATURITY
388		2.8	5.6	0	DTPA	0.9	20	Leaf	SLUDGE, FIELD, MATURITY
389		2.8	5.6	11	DTPA	2.1	21	Leaf	SLUDGE, FIELD, MATURITY
390		2.8	5.6	33	DTPA	3.2	22	Leaf	SLUDGE, FIELD, MATURITY
391		2.8	5.6	0	DTPA	0.6	5	Leaf	SLUDGE, FIELD, MATURITY
392		2.8	5.6	11	DTPA	1	5	Leaf	SLUDGE, FIELD, MATURITY
393		2.8	5.6	33	DTPA	1.8	7	Leaf	SLUDGE, FIELD, MATURITY
394		2.8	5.6	0	DTPA	0.9	8	Leaf	SLUDGE, FIELD, MATURITY
395		2.8	5.6	11	DTPA	2.1	8	Leaf	SLUDGE, FIELD, MATURITY
396		2.8	5.6	33	DTPA	3.2	11	Leaf	SLUDGE, FIELD, MATURITY
397	5.4	16	6.1	0			0.54	Earleaf	
398	5.4	16	6.2	8.6			1.02	Earleaf	
399	5.4	16	6.1	17.2			0.88	Earleaf	
400	5.4	16	5.8	25.8			0.94	Earleaf	
401	5.4	16	6	34.4			0.8	Earleaf	
402	5.4	16	6	43			0.84	Earleaf	
403	12.5	18	5.7	0			0.38	Earleaf	
404	12.5	18	6	8.6			0.41	Earleaf	
405	12.5	18	5.8	17.2			0.36	Earleaf	
406	12.5	18	5.9	25.8			0.31	Earleaf	
407	12.5	18	5.9	34.4			0.2	Earleaf	
408	12.5	18	5.9	43			0.23	Earleaf	
409	9.3	25	5.7	0			0.28	Earleaf	
410	9.3	25	6	8.6			0.39	Earleaf	
411	9.3	25	5.9	17.2			0.42	Earleaf	
412	9.3	25	5.9	25.8			0.35	Earleaf	
413	9.3	25	5.9	34.4			0.36	Earleaf	
414	9.3	25	5.9	43			0.46	Earleaf	
415	6.9	23	6.6	0			0.54	Earleaf	
416	6.9	23	6.6	8.6			0.66	Earleaf	
417	6.9	23	6.6	17.2			0.66	Earleaf	
418		1.2	5.8	0	.5 M HOAC	2	N.L.		SLUDGE, FIELD, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
381	60	60	0	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
382	0	0	1	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
383	20	20	1	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
384	60	60	1	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
385	0	0	0	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
386	20	20	0	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
387	60	60	0	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
388	0	0	1	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
389	20	20	1	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
390	60	60	1	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
391	0	0	0	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
392	20	20	0	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
393	60	60	0	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
394	0	0	1	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
395	20	20	1	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
396	60	60	1	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
397	0	0		Typic Hapludult	Bojac	loamy sand	64	27.8	8.2
398	42	42		Typic Hapludult	Bojac	loamy sand	64	27.8	8.2
399	84	84		Typic Hapludult	Bojac	loamy sand	64	27.8	8.2
400	126	126		Typic Hapludult	Bojac	loamy sand	64	27.8	8.2
401	168	168		Typic Hapludult	Bojac	loamy sand	64	27.8	8.2
402	210	210		Typic Hapludult	Bojac	loamy sand	64	27.8	8.2
403	0	0		Rhodic Paleudult	Davidson	clay loam	15.3	47.1	37.6
404	42	42		Rhodic Paleudult	Davidson	clay loam	15.3	47.1	37.6
405	84	84		Rhodic Paleudult	Davidson	clay loam	15.3	47.1	37.6
406	126	126		Rhodic Paleudult	Davidson	clay loam	15.3	47.1	37.6
407	168	168		Rhodic Paleudult	Davidson	clay loam	15.3	47.1	37.6
408	210	210		Rhodic Paleudult	Davidson	clay loam	15.3	47.1	37.6
409	0	0		Typic Hapludult	Groseclose	silt loam	20.7	59.3	20
410	42	42		Typic Hapludult	Groseclose	silt loam	20.7	59.3	20
411	84	84		Typic Hapludult	Groseclose	silt loam	20.7	59.3	20
412	126	126		Typic Hapludult	Groseclose	silt loam	20.7	59.3	20
413	168	168		Typic Hapludult	Groseclose	silt loam	20.7	59.3	20
414	210	210		Typic Hapludult	Groseclose	silt loam	20.7	59.3	20
415	0	0		Typic Ochraqualfs	Acredale	silt loam	37.8	52.3	9.9
416	42	42		Typic Ochraqualfs	Acredale	silt loam	37.8	52.3	9.9
417	84	84		Typic Ochraqualfs	Acredale	silt loam	37.8	52.3	9.9
418	0	0	8			LS			

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
381		3	560			1630		ANAEROBICALLY DIGESTED	
382		3	560			1630		ANAEROBICALLY DIGESTED	
383		3	560			1630		ANAEROBICALLY DIGESTED	
384		3	560			1630		ANAEROBICALLY DIGESTED	
385		3	560			1630		ANAEROBICALLY DIGESTED	
386		3	560			1630		ANAEROBICALLY DIGESTED	
387		3	560			1630		ANAEROBICALLY DIGESTED	
388		3	560			1630		ANAEROBICALLY DIGESTED	
389		3	560			1630		ANAEROBICALLY DIGESTED	
390		3	560			1630		ANAEROBICALLY DIGESTED	
391		3	560			1630		ANAEROBICALLY DIGESTED	
392		3	560			1630		ANAEROBICALLY DIGESTED	
393		3	560			1630		ANAEROBICALLY DIGESTED	
394		3	560			1630		ANAEROBICALLY DIGESTED	
395		3	560			1630		ANAEROBICALLY DIGESTED	
396		3	560			1630		ANAEROBICALLY DIGESTED	
397			0			0		All sludge data in kg/ha	
398			8.6			125		as metals applied to soils	
399			17.2			248		from sludge application.	
400			25.8			372			
401			34.4			496			
402			43			620			
403			0			0			
404			8.6			125			
405			17.2			248			
406			25.8			372			
407			34.4			496			
408			43			620			
409			0			0			
410			8.6			125			
411			17.2			248			
412			25.8			372			
413			34.4			496			
414			43			620			
415								No sludge data given	
416									
417									
418			5100			11400	AIR DRIED		

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
381	Schauer, et al. 1980	Carrots	Danvers	4.7	67.5			21		2520
382	Schauer, et al. 1980	Carrots	Danvers	4.7	67.5			21		2520
383	Schauer, et al. 1980	Carrots	Danvers	4.7	67.5			21		2520
384	Schauer, et al. 1980	Carrots	Danvers	4.7	67.5			21		2520
385	Schauer, et al. 1980	Radishes	Cherrybelle	4.7	67.5			21		2520
386	Schauer, et al. 1980	Radishes	Cherrybelle	4.7	67.5			21		2520
387	Schauer, et al. 1980	Radishes	Cherrybelle	4.7	67.5			21		2520
388	Schauer, et al. 1980	Radishes	Cherrybelle	4.7	67.5			21		2520
389	Schauer, et al. 1980	Radishes	Cherrybelle	4.7	67.5			21		2520
390	Schauer, et al. 1980	Radishes	Cherrybelle	4.7	67.5			21		2520
391	Schauer, et al. 1980	Lettuce	Salad Bowl	4.7	67.5			21		2520
392	Schauer, et al. 1980	Lettuce	Salad Bowl	4.7	67.5			21		2520
393	Schauer, et al. 1980	Lettuce	Salad Bowl	4.7	67.5			21		2520
394	Schauer, et al. 1980	Lettuce	Salad Bowl	4.7	67.5			21		2520
395	Schauer, et al. 1980	Lettuce	Salad Bowl	4.7	67.5			21		2520
396	Schauer, et al. 1980	Lettuce	Salad Bowl	4.7	67.5			21		2520
397	RAPPAPORT ET AL 1988	Corn						0		0
398	RAPPAPORT ET AL 1988	Corn						0.9		153
399	RAPPAPORT ET AL 1988	Corn						1.8		304
400	RAPPAPORT ET AL 1988	Corn						2.7		456
401	RAPPAPORT ET AL 1988	Corn						3.6		608
402	RAPPAPORT ET AL 1988	Corn						4.5		760
403	RAPPAPORT ET AL 1988	Corn						0		0
404	RAPPAPORT ET AL 1988	Corn						0.9		153
405	RAPPAPORT ET AL 1988	Corn						1.8		304
406	RAPPAPORT ET AL 1988	Corn						2.7		456
407	RAPPAPORT ET AL 1988	Corn						3.6		608
408	RAPPAPORT ET AL 1988	Corn						4.5		760
409	RAPPAPORT ET AL 1988	Corn						0		0
410	RAPPAPORT ET AL 1988	Corn						0.9		153
411	RAPPAPORT ET AL 1988	Corn						1.8		304
412	RAPPAPORT ET AL 1988	Corn						2.7		456
413	RAPPAPORT ET AL 1988	Corn						3.6		608
414	RAPPAPORT ET AL 1988	Corn						4.5		760
415	RAPPAPORT ET AL 1987	Corn								
416	RAPPAPORT ET AL 1987	Corn								
417	RAPPAPORT ET AL 1987	Corn								
418	WILLIAMS 1977	CARROT								100

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
343		Saskatoon, Can
344		Beltsville, MD
345		Beltsville, MD
346		Beltsville, MD
347		Beltsville, MD
348		Beltsville, MD
349		Beltsville, MD
350		Beltsville, MD
351		Beltsville, MD
352		Beltsville, MD
353		Beltsville, MD
354		Beltsville, MD
355		Beltsville, MD
356		Beltsville, MD
357		Beltsville, MD
358		Beltsville, MD
359		Beltsville, MD
360		Beltsville, MD
361		Beltsville, MD
362		Beltsville, MD
363		Beltsville, MD
364		Beltsville, MD
365		Beltsville, MD
366		Beltsville, MD
367		Beltsville, MD
368		Beltsville, MD
369		Manhattan, Kansas
370		Manhattan, Kansas
371		Dayton, Ohio
372		Dayton, Ohio
373		Oakland, CA
374		Oakland, CA
375		Oakland, CA
376		Oakland, CA
377		Oakland, CA
378		Oakland, CA
379	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND
380	YIELD NOT DETERMINED	KINGSTON, RHODE ISLAND

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
343	0	Whole plant			
344	0	Shoots			
345	0	Shoots			
346	0	Shoots			
347	0	Shoots			
348	0	Shoots			
349	0	Shoots			
350	0	Shoots			
351	0	Shoots			
352	0	Shoots			
353	0	Shoots			
354	0	Shoots			
355	0	Shoots			
356	0	Shoots			
357	0	Shoots			
358	0	Shoots			
359	0	Shoots			
360	0	Shoots			
361	0	Shoots			
362	0	Shoots			
363	0	Shoots			
364	0	Shoots			
365	0	Shoots			
366	0	Shoots			
367	0	Shoots			
368	0	Shoots			
369					
370					
371		Leaves			
372		Leaves			
373	0	Grain			
374	0	Grain			
375	0	Grain			
376	0	Grain			
377	0	Grain			
378	0	Grain			
379					
380					

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
343	35.7					8.6	17	Root	
344			5.9				5.8	Shoots	
345			7.4				8.2	Shoots	
346			7				6.9	Shoots	
347			7.4				5.8	Shoots	
348			7.6				3.7	Shoots	
349			7.7				4.7	Shoots	
350			7.6				3.3	Shoots	
351			6.9				4.4	Shoots	
352			7.4				3.2	Shoots	
353			7.6				3.2	Shoots	
354			5.8				7.8	Shoots	
355			6.1				4.6	Shoots	
356			6.8				4.8	Shoots	
357			7				2.5	Shoots	
358			7.1				3.3	Shoots	
359			5.8				7.7	Shoots	
360			5.7				4.4	Shoots	
361			6				4.4	Shoots	
362			5.2				12.6	Shoots	
363			5.3				7.9	Shoots	
364			5.1				9.8	Shoots	
365			6.4				7.7	Shoots	
366			6.6				7.6	Shoots	
367			5.9				9.6	Shoots	
368			5.7				11.3	Shoots	
369		0.9	5.9			11.9	0.059	Leaves	
370		0.9	5.9			11.9	4.53	Roots	
371			6.2			71.5	2	Leaves	
372			6.2			147	2	Leaves	
373				0		93	<5.0	Straw	
374				0		94	<5.0	Straw	
375				5		106	<5.0	Straw	
376				9.9		99	<5.0	Straw	
377				15.5		104	<5.0	Straw	
378				20.6		105	<5.0	Straw	
379		2.8	5.6	0	DTPA	0.6	5.2	Leaf	SLUDGE, FIELD, MATURITY
380		2.8	5.6	11	DTPA	1	6	Leaf	SLUDGE, FIELD, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
343	150								
344	0	0		Typic Paleudults	Christiana	fine sandy loam			
345	0	0		Typic Paleudults	Christiana	fine sandy loam			
346	56	56		Typic Paleudults	Christiana	fine sandy loam			
347	112	112		Typic Paleudults	Christiana	fine sandy loam			
348	224	224		Typic Paleudults	Christiana	fine sandy loam			
349	336	336		Typic Paleudults	Christiana	fine sandy loam			
350	448	448		Typic Paleudults	Christiana	fine sandy loam			
351	56	56		Typic Paleudults	Christiana	fine sandy loam			
352	112	112		Typic Paleudults	Christiana	fine sandy loam			
353	224	224		Typic Paleudults	Christiana	fine sandy loam			
354	56	56		Typic Paleudults	Christiana	fine sandy loam			
355	112	112		Typic Paleudults	Christiana	fine sandy loam			
356	224	224		Typic Paleudults	Christiana	fine sandy loam			
357	448	448		Typic Paleudults	Christiana	fine sandy loam			
358	672	672		Typic Paleudults	Christiana	fine sandy loam			
359	56	56		Typic Paleudults	Christiana	fine sandy loam			
360	112	112		Typic Paleudults	Christiana	fine sandy loam			
361	224	224		Typic Paleudults	Christiana	fine sandy loam			
362	56	56		Typic Paleudults	Christiana	fine sandy loam			
363	112	112		Typic Paleudults	Christiana	fine sandy loam			
364	224	224		Typic Paleudults	Christiana	fine sandy loam			
365	50	50		Typic Paleudults	Christiana	fine sandy loam			
366	100	100		Typic Paleudults	Christiana	fine sandy loam			
367	50	50		Typic Paleudults	Christiana	fine sandy loam			
368	100	100		Typic Paleudults	Christiana	fine sandy loam			
369	32	128		Typic Udifluvent	Haynie	fine sandy loam			
370	32	128		Typic Udifluvent	Haynie	fine sandy loam			
371	28	980			Warsaw	silt loam			
372	0	0			Warsaw	silt loam			
373	0	0	4	Fluvaquentic Haplaquolls	Omni	silty clay			
374	0+NPK	0+NPK	4	Fluvaquentic Haplaquolls	Omni	silty clay			
375	33	33	4	Fluvaquentic Haplaquolls	Omni	silty clay			
376	66	66	4	Fluvaquentic Haplaquolls	Omni	silty clay			
377	107	107	4	Fluvaquentic Haplaquolls	Omni	silty clay			
378	147	147	4	Fluvaquentic Haplaquolls	Omni	silty clay			
379	0	0	0	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8
380	20	20	0	Typic Dystrochrept	Bridgehampton	silt loam	34	58	8

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
343			26.3	6620	164	420			
344								Control, low pH	
345								Control, high pH	
346			15		217	639		Limed-digested	
347			15		217	639		Limed-digested	
348			15		217	639		Limed-digested	
349			15		217	639		Limed-digested	
350			15		217	639		Limed-digested	
351			17		215	599		Limed-raw	
352			17		215	599		Limed-raw	
353			17		215	599		Limed-raw	
354			201		272	731		Limed-compost	
355			201		272	731		Limed-compost	
356			201		272	731		Limed-compost	
357			201		272	731		Limed-compost	
358			201		272	731		Limed-compost	
359			37		360	1330		Heat-treated, high pH	
360			37		360	1330		Heat-treated, high pH	
361			37		360	1330		Heat-treated, high pH	
362			37		360	1330		Heat-treated, low pH	
363			37		360	1330		Heat-treated, low pH	
364			37		360	1330		Heat-treated, low pH	
365			590		865	4140		Nu-Earth, high pH	
366			590		865	4140		Nu-Earth, high pH	
367			590		865	4140		Nu-Earth, low pH	
368			590		865	4140		Nu-Earth, low pH	
369			35.6	21300	124	1890		aerobically digested	
370			35.6	21300	124	1890		aerobically digested	
371			20370	24000	6940	8390		28t/ha/yr at 35 years	
372			20370	24000	6940	8390		Control	
373								No sludge data given	
374								No sludge data given	
375								No sludge data given	
376								No sludge data given	
377								No sludge data given	
378								No sludge data given	
379		3	560			1630		ANAEROBICALLY DIGESTED	
380		3	560			1630		ANAEROBICALLY DIGESTED	

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
343	GILLIES ET AL 1989	Oat	Harmon					4.6	191	143
344	HECKMAN ET AL 1987	Soybean	Clark							
345	HECKMAN ET AL 1987	Soybean	Clark							
346	HECKMAN ET AL 1987	Soybean	Clark					5.9		259
347	HECKMAN ET AL 1987	Soybean	Clark					5.9		259
348	HECKMAN ET AL 1987	Soybean	Clark					5.9		259
349	HECKMAN ET AL 1987	Soybean	Clark					5.9		259
350	HECKMAN ET AL 1987	Soybean	Clark					5.9		259
351	HECKMAN ET AL 1987	Soybean	Clark					4.9		277
352	HECKMAN ET AL 1987	Soybean	Clark					4.9		277
353	HECKMAN ET AL 1987	Soybean	Clark					4.9		277
354	HECKMAN ET AL 1987	Soybean	Clark					7.2		274
355	HECKMAN ET AL 1987	Soybean	Clark					7.2		274
356	HECKMAN ET AL 1987	Soybean	Clark					7.2		274
357	HECKMAN ET AL 1987	Soybean	Clark					7.2		274
358	HECKMAN ET AL 1987	Soybean	Clark					7.2		274
359	HECKMAN ET AL 1987	Soybean	Clark					13.4		404
360	HECKMAN ET AL 1987	Soybean	Clark					13.4		404
361	HECKMAN ET AL 1987	Soybean	Clark					13.4		404
362	HECKMAN ET AL 1987	Soybean	Clark					13.4		404
363	HECKMAN ET AL 1987	Soybean	Clark					13.4		404
364	HECKMAN ET AL 1987	Soybean	Clark					13.4		404
365	HECKMAN ET AL 1987	Soybean	Clark					210		1160
366	HECKMAN ET AL 1987	Soybean	Clark					210		1160
367	HECKMAN ET AL 1987	Soybean	Clark					210		1160
368	HECKMAN ET AL 1987	Soybean	Clark					210		1160
369	KIRKHAM 1983	Sorghum	Dekalb C-46 Plus	6.7	7770 mg/l			29.2	851	375
370	KIRKHAM 1983	Winter Wheat	Newton	6.7	7770 mg/l			29.2	851	375
371	KIRKHAM 1975	Corn						830	5900	6020
372	KIRKHAM 1975	Corn						830	5900	6020
373	CHANG ET AL 1982	Winter Weat	Anza							
374	CHANG ET AL 1982	Winter Weat	Anza							
375	CHANG ET AL 1982	Winter Weat	Anza							
376	CHANG ET AL 1982	Winter Weat	Anza							
377	CHANG ET AL 1982	Winter Weat	Anza							
378	CHANG ET AL 1982	Winter Weat	Anza							
379	Schauer, et al. 1980	Carrots	Danvers	4.7	67.5			21		2520
380	Schauer, et al. 1980	Carrots	Danvers	4.7	67.5			21		2520

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
305		JOLIET, ILLINOIS
306		JOLIET, ILLINOIS
307		JOLIET, ILLINOIS
308		JOLIET, ILLINOIS
309		JOLIET, ILLINOIS
310		JOLIET, ILLINOIS
311	*DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
312	*DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
313		JOLIET, ILLINOIS
314		JOLIET, ILLINOIS
315		JOLIET, ILLINOIS
316		JOLIET, ILLINOIS
317		JOLIET, ILLINOIS
318		JOLIET, ILLINOIS
319		JOLIET, ILLINOIS
320		JOLIET, ILLINOIS
321		JOLIET, ILLINOIS
322		JOLIET, ILLINOIS
323		JOLIET, ILLINOIS
324		JOLIET, ILLINOIS
325		JOLIET, ILLINOIS
326		JOLIET, ILLINOIS
327		JOLIET, ILLINOIS
328		JOLIET, ILLINOIS
329		JOLIET, ILLINOIS
330		JOLIET, ILLINOIS
331		JOLIET, ILLINOIS
332		JOLIET, ILLINOIS
333		JOLIET, ILLINOIS
334		JOLIET, ILLINOIS
335		JOLIET, ILLINOIS
336		JOLIET, ILLINOIS
337		JOLIET, ILLINOIS
338		JOLIET, ILLINOIS
339		JOLIET, ILLINOIS
340		JOLIET, ILLINOIS
341		Saskatoon, Can
342		Saskatoon, Can

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
305	0	GRAIN	0	STOVER	NO
306	0	GRAIN	0	STOVER	NO
307	0	GRAIN	0	STOVER	NO
308	0	GRAIN	NA	STOVER	NO
309	0	GRAIN	0	STOVER	NO
310	0	GRAIN	0	STOVER	NO
311	60*	GRAIN	0	STOVER	*NO
312	60*	GRAIN	0	STOVER	*NO
313	0	GRAIN	0	STOVER	NO
314	0	GRAIN	0	STOVER	NO
315	0	GRAIN	0	STOVER	NO
316	0	GRAIN	0	STOVER	NO
317	0	GRAIN	0	STOVER	NO
318	0	GRAIN	0	STOVER	NO
319	NA	GRAIN	NA	STOVER	NO
320	0	GRAIN	0	STOVER	NO
321	0	GRAIN	0	STOVER	NO
322	0	GRAIN	0	STOVER	NO
323	0	GRAIN	0	STOVER	NO
324	0	GRAIN	0	STOVER	NO
325	0	GRAIN	0	STOVER	NO
326	0	GRAIN	0	STOVER	NO
327	0	GRAIN	0	STOVER	NO
328	0	GRAIN	0	STOVER	NO
329	0	GRAIN	0	STOVER	NO
330	0	GRAIN	NA	STOVER	NO
331	0	GRAIN	0	STOVER	NO
332	0	GRAIN	0	STOVER	NO
333	0	GRAIN	0	STOVER	NO
334	0	GRAIN	0	STOVER	NO
335	0	GRAIN	0	STOVER	NO
336	0	GRAIN	0	STOVER	NO
337	0	GRAIN	0	STOVER	NO
338	0	GRAIN	0	STOVER	NO
339	0	GRAIN	0	STOVER	NO
340	0	GRAIN	0	STOVER	NO
341	0	Whole plant			
342	0	Whole plant			

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
305		0.76	7	0	HCL-HF	19	<.6	LEAF	SLUDGE, FIELD, MATURITY
306		1.21	6.9	0	HCL-HF	20	<.6	LEAF	SLUDGE, FIELD, MATURITY
307		0.84	7.1	0	HCL-HF	24	<.6	LEAF	SLUDGE, FIELD, MATURITY
308		0.31	NA	12.6	HCL-HF	15	1.3	LEAF	SLUDGE, FIELD, MATURITY
309		0.44	7.2	13.4	HCL-HF	31	1.4	LEAF	SLUDGE, FIELD, MATURITY
310		0.63	7.3	15.3	HCL-HF	12	0.9	LEAF	SLUDGE, FIELD, MATURITY
311		0.67	7.5	21	HCL-HF	12	<.6	LEAF	SLUDGE, FIELD, MATURITY
312		0.78	7	26.3	HCL-HF	20	0.8	LEAF	SLUDGE, FIELD, MATURITY
313		0.8	7	34	HCL-HF	19	NA	LEAF	SLUDGE, FIELD, MATURITY
314		0.99	6.6	34	HCL-HF	25	<.6	LEAF	SLUDGE, FIELD, MATURITY
315		1.42	7.1	34	HCL-HF	35	<.6	LEAF	SLUDGE, FIELD, MATURITY
316		1.71	7.2	34	HCL-HF	30	<.6	LEAF	SLUDGE, FIELD, MATURITY
317		1.82	7.2	34	HCL-HF	34	<.6	LEAF	SLUDGE, FIELD, MATURITY
318		1.96	7.1	34	HCL-HF	31	<.6	LEAF	SLUDGE, FIELD, MATURITY
319		0.43	NA	25.2	HCL-HF	13	1.5	LEAF	SLUDGE, FIELD, MATURITY
320		0.51	7.1	26.8	HCL-HF	20	1.1	LEAF	SLUDGE, FIELD, MATURITY
321		0.94	7	30.6	HCL-HF	16	1.6	LEAF	SLUDGE, FIELD, MATURITY
322		1.16	7.2	41.9	HCL-HF	22	<.6	LEAF	SLUDGE, FIELD, MATURITY
323		1.4	7	52.5	HCL-HF	24	NA	LEAF	SLUDGE, FIELD, MATURITY
324		1.75	6.4	68	HCL-HF	35	1.7	LEAF	SLUDGE, FIELD, MATURITY
325		2	6.3	68	HCL-HF	32	2	LEAF	SLUDGE, FIELD, MATURITY
326		2.16	6.8	68	HCL-HF	38	0.7	LEAF	SLUDGE, FIELD, MATURITY
327		2.02	6.8	68	HCL-HF	51	0.7	LEAF	SLUDGE, FIELD, MATURITY
328		2.33	7.1	68	HCL-HF	53	<.6	LEAF	SLUDGE, FIELD, MATURITY
329		1.66	7	68	HCL-HF	45	<.6	LEAF	SLUDGE, FIELD, MATURITY
330		0.73	NA	50.4	HCL-HF	21	1.3	LEAF	SLUDGE, FIELD, MATURITY
331		0.57	6.8	53.5	HCL-HF	37	1.8	LEAF	SLUDGE, FIELD, MATURITY
332		1.3	6.7	61.1	HCL-HF	16	1.2	LEAF	SLUDGE, FIELD, MATURITY
333		1.42	6.6	83.7	HCL-HF	34	<.6	LEAF	SLUDGE, FIELD, MATURITY
334		2.4	6.4	105	HCL-HF	40	2.8	LEAF	SLUDGE, FIELD, MATURITY
335		2.76	6.1	135.9	HCL-HF	45	3.6	LEAF	SLUDGE, FIELD, MATURITY
336		3.44	5.8	135.9	HCL-HF	49	1.6	LEAF	SLUDGE, FIELD, MATURITY
337		3.16	5.9	135.9	HCL-HF	62	1.7	LEAF	SLUDGE, FIELD, MATURITY
338		3.28	6.2	135.9	HCL-HF	52	0.9	LEAF	SLUDGE, FIELD, MATURITY
339		3.1	6.4	135.9	HCL-HF	64	<.6	LEAF	SLUDGE, FIELD, MATURITY
340		3.15	6.5	135.9	HCL-HF	70	NA	LEAF	SLUDGE, FIELD, MATURITY
341	34.8					10.4	14	Root	
342	36.7					7.5	21	Root	

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
305	0	0	NA		PLAINFIELD	SL			
306	0	0	NA		PLAINFIELD	SL			
307	0	0	NA		PLAINFIELD	SL			
308	26.2	40.1	0		PLAINFIELD	SL			
309	8.1	48.2	0		PLAINFIELD	SL			
310	14.7	62.9	0		PLAINFIELD	SL			
311	17.7	80.6	0		PLAINFIELD	SL			
312	13.1	93.7	0		PLAINFIELD	SL			
313	17.8	111.5	0		PLAINFIELD	SL			
314	0	111.5	1		PLAINFIELD	SL			
315	0	111.5	2		PLAINFIELD	SL			
316	0	111.5	3		PLAINFIELD	SL			
317	0	111.5	4		PLAINFIELD	SL			
318	0	111.5	5		PLAINFIELD	SL			
319	52.4	80.2	0		PLAINFIELD	SL			
320	16.2	96.4	0		PLAINFIELD	SL			
321	29.4	125.8	0		PLAINFIELD	SL			
322	35.4	161.2	0		PLAINFIELD	SL			
323	26.2	187.4	0		PLAINFIELD	SL			
324	35.6	223	0		PLAINFIELD	SL			
325	0	223	1		PLAINFIELD	SL			
326	0	223	2		PLAINFIELD	SL			
327	0	223	3		PLAINFIELD	SL			
328	0	223	4		PLAINFIELD	SL			
329	0	223	5		PLAINFIELD	SL			
330	104.8	160.4	0		PLAINFIELD	SL			
331	32.4	192.8	0		PLAINFIELD	SL			
332	58.8	251.6	0		PLAINFIELD	SL			
333	70.8	322.4	0		PLAINFIELD	SL			
334	52.4	374.8	0		PLAINFIELD	SL			
335	71.2	446	0		PLAINFIELD	SL			
336	0	446	1		PLAINFIELD	SL			
337	0	446	2		PLAINFIELD	SL			
338	0	446	3		PLAINFIELD	SL			
339	0	446	4		PLAINFIELD	SL			
340	0	446	5		PLAINFIELD	SL			
341	0								
342	75								

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
305	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
306	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
307	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
308	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
309	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
310	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
311	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
312	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
313	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
314	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
315	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
316	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
317	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
318	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
319	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
320	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
321	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
322	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
323	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
324	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
325	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
326	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
327	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
328	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
329	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
330	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
331	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
332	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
333	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
334	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
335	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
336	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
337	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
338	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
339	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
340	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
341			26.3	6620	164	420			
342			26.3	6620	164	420			

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
305	HINESLY 1985	CORN					3.2	265	2846	1311
306	HINESLY 1985	CORN					3.2	265	2846	1311
307	HINESLY 1985	CORN					3.2	265	2846	1311
308	HINESLY 1985	CORN					3.2	265	2846	1311
309	HINESLY 1985	CORN					3.2	265	2846	1311
310	HINESLY 1985	CORN					3.2	265	2846	1311
311	HINESLY 1985	CORN					3.2	265	2846	1311
312	HINESLY 1985	CORN					3.2	265	2846	1311
313	HINESLY 1985	CORN					3.2	265	2846	1311
314	HINESLY 1985	CORN					3.2	265	2846	1311
315	HINESLY 1985	CORN					3.2	265	2846	1311
316	HINESLY 1985	CORN					3.2	265	2846	1311
317	HINESLY 1985	CORN					3.2	265	2846	1311
318	HINESLY 1985	CORN					3.2	265	2846	1311
319	HINESLY 1985	CORN					3.2	265	2846	1311
320	HINESLY 1985	CORN					3.2	265	2846	1311
321	HINESLY 1985	CORN					3.2	265	2846	1311
322	HINESLY 1985	CORN					3.2	265	2846	1311
323	HINESLY 1985	CORN					3.2	265	2846	1311
324	HINESLY 1985	CORN					3.2	265	2846	1311
325	HINESLY 1985	CORN					3.2	265	2846	1311
326	HINESLY 1985	CORN					3.2	265	2846	1311
327	HINESLY 1985	CORN					3.2	265	2846	1311
328	HINESLY 1985	CORN					3.2	265	2846	1311
329	HINESLY 1985	CORN					3.2	265	2846	1311
330	HINESLY 1985	CORN					3.2	265	2846	1311
331	HINESLY 1985	CORN					3.2	265	2846	1311
332	HINESLY 1985	CORN					3.2	265	2846	1311
333	HINESLY 1985	CORN					3.2	265	2846	1311
334	HINESLY 1985	CORN					3.2	265	2846	1311
335	HINESLY 1985	CORN					3.2	265	2846	1311
336	HINESLY 1985	CORN					3.2	265	2846	1311
337	HINESLY 1985	CORN					3.2	265	2846	1311
338	HINESLY 1985	CORN					3.2	265	2846	1311
339	HINESLY 1985	CORN					3.2	265	2846	1311
340	HINESLY 1985	CORN					3.2	265	2846	1311
341	GILLIES ET AL 1989	Oat	Harmon					4.6	191	143
342	GILLIES ET AL 1989	Oat	Harmon					4.6	191	143

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
267	*DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
268	*DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
269		JOLIET, ILLINOIS
270		JOLIET, ILLINOIS
271		JOLIET, ILLINOIS
272		JOLIET, ILLINOIS
273		JOLIET, ILLINOIS
274		JOLIET, ILLINOIS
275		JOLIET, ILLINOIS
276		JOLIET, ILLINOIS
277		JOLIET, ILLINOIS
278		JOLIET, ILLINOIS
279		JOLIET, ILLINOIS
280		JOLIET, ILLINOIS
281		JOLIET, ILLINOIS
282		JOLIET, ILLINOIS
283		JOLIET, ILLINOIS
284		JOLIET, ILLINOIS
285		JOLIET, ILLINOIS
286		JOLIET, ILLINOIS
287		JOLIET, ILLINOIS
288		JOLIET, ILLINOIS
289		JOLIET, ILLINOIS
290		JOLIET, ILLINOIS
291		JOLIET, ILLINOIS
292		JOLIET, ILLINOIS
293		JOLIET, ILLINOIS
294		JOLIET, ILLINOIS
295		JOLIET, ILLINOIS
296		JOLIET, ILLINOIS
297		JOLIET, ILLINOIS
298		JOLIET, ILLINOIS
299		JOLIET, ILLINOIS
300		JOLIET, ILLINOIS
301		JOLIET, ILLINOIS
302		JOLIET, ILLINOIS
303		JOLIET, ILLINOIS
304		JOLIET, ILLINOIS

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
267	60*	GRAIN	0	STOVER	*NO
268	28*	GRAIN	0	STOVER	*NO
269	0	GRAIN	0	STOVER	NO
270	0	GRAIN	0	STOVER	NO
271	0	GRAIN	0	STOVER	NO
272	0	GRAIN	0	STOVER	NO
273	0	GRAIN	0	STOVER	NO
274	0	GRAIN	0	STOVER	NO
275	0	GRAIN	NA	STOVER	NO
276	0	GRAIN	0	STOVER	NO
277	0	GRAIN	0	STOVER	NO
278	0	GRAIN	0	STOVER	NO
279	0	GRAIN	0	STOVER	NO
280	0	GRAIN	0	STOVER	NO
281	0	GRAIN	0	STOVER	NO
282	0	GRAIN	0	STOVER	NO
283	0	GRAIN	0	STOVER	NO
284	0	GRAIN	0	STOVER	NO
285	0	GRAIN	0	STOVER	NO
286	0	GRAIN	NA	STOVER	NO
287	0	GRAIN	0	STOVER	NO
288	0	GRAIN	0	STOVER	NO
289	0	GRAIN	0	STOVER	NO
290	0	GRAIN	0	STOVER	NO
291	0	GRAIN	0	STOVER	NO
292	0	GRAIN	0	STOVER	NO
293	0	GRAIN	0	STOVER	NO
294	0	GRAIN	0	STOVER	NO
295	0	GRAIN	0	STOVER	NO
296	0	GRAIN	0	STOVER	NO
297	0	GRAIN	NA	STOVER	NO
298	0	GRAIN	0	STOVER	NO
299	0	GRAIN	0	STOVER	NO
300	0	GRAIN	0	STOVER	NO
301	0	GRAIN	0	STOVER	NO
302	0	GRAIN	0	STOVER	NO
303	0	GRAIN	0	STOVER	NO
304	0	GRAIN	0	STOVER	NO

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
267		1.58	7.4	21	HCL-HF	39	0.6	LEAF	SLUDGE, FIELD, MATURITY
268		1.54	7.1	26.3	HCL-HF	32	0.9	LEAF	SLUDGE, FIELD, MATURITY
269		1.64	6.9	34	HCL-HF	31	<.6	LEAF	SLUDGE, FIELD, MATURITY
270		1.69	6.9	34	HCL-HF	32	0.8	LEAF	SLUDGE, FIELD, MATURITY
271		1.91	7	34	HCL-HF	36	<.6	LEAF	SLUDGE, FIELD, MATURITY
272		1.66	7.3	34	HCL-HF	33	<.6	LEAF	SLUDGE, FIELD, MATURITY
273		2.05	7.1	34	HCL-HF	32	NA	LEAF	SLUDGE, FIELD, MATURITY
274		1.95	7.2	34	HCL-HF	34	<.6	LEAF	SLUDGE, FIELD, MATURITY
275		1.71	NA	25.2	HCL-HF	22	1.5	LEAF	SLUDGE, FIELD, MATURITY
276		1.57	6.9	26.8	HCL-HF	29	1.3	LEAF	SLUDGE, FIELD, MATURITY
277		1.57	7.3	30.6	HCL-HF	24	1.2	LEAF	SLUDGE, FIELD, MATURITY
278		1.79	7.1	41.9	HCL-HF	41	0.6	LEAF	SLUDGE, FIELD, MATURITY
279		1.93	6.9	52.5	HCL-HF	35	<.6	LEAF	SLUDGE, FIELD, MATURITY
280		2.09	6.6	68	HCL-HF	37	1	LEAF	SLUDGE, FIELD, MATURITY
281		2.37	6.4	68	HCL-HF	39	1.1	LEAF	SLUDGE, FIELD, MATURITY
282		2.4	6.4	68	HCL-HF	49	0.7	LEAF	SLUDGE, FIELD, MATURITY
283		2.4	6.8	68	HCL-HF	41	NA	LEAF	SLUDGE, FIELD, MATURITY
284		2.38	6.8	68	HCL-HF	35	<.6	LEAF	SLUDGE, FIELD, MATURITY
285		2.48	7.2	68	HCL-HF	44	<.6	LEAF	SLUDGE, FIELD, MATURITY
286		2.06	NA	50.4	HCL-HF	27	1.3	LEAF	SLUDGE, FIELD, MATURITY
287		2	6.4	53.5	HCL-HF	27	1.4	LEAF	SLUDGE, FIELD, MATURITY
288		1.76	6.4	61.1	HCL-HF	30	1.2	LEAF	SLUDGE, FIELD, MATURITY
289		2.67	6.2	83.7	HCL-HF	41	<.6	LEAF	SLUDGE, FIELD, MATURITY
290		2.72	6.1	105	HCL-HF	44	0.8	LEAF	SLUDGE, FIELD, MATURITY
291		3.53	5.4	135.9	HCL-HF	52	1.5	LEAF	SLUDGE, FIELD, MATURITY
292		3.35	5.5	135.9	HCL-HF	55	1.7	LEAF	SLUDGE, FIELD, MATURITY
293		3.29	5.8	135.9	HCL-HF	51	NA	LEAF	SLUDGE, FIELD, MATURITY
294		2.68	6	135.9	HCL-HF	46	1	LEAF	SLUDGE, FIELD, MATURITY
295		3.02	6	135.9	HCL-HF	47	0.7	LEAF	SLUDGE, FIELD, MATURITY
296		2.2	6.3	135.9	HCL-HF	46	0.8	LEAF	SLUDGE, FIELD, MATURITY
297		0.36	NA	0	HCL-HF	11	1.2	LEAF	SLUDGE, FIELD, MATURITY
298		0.17	7	0	HCL-HF	12	1.6	LEAF	SLUDGE, FIELD, MATURITY
299		0.21	7.2	0	HCL-HF	8	0.6	LEAF	SLUDGE, FIELD, MATURITY
300		0.42	7.1	0	HCL-HF	13	<.6	LEAF	SLUDGE, FIELD, MATURITY
301		0.44	7	0	HCL-HF	16	0.7	LEAF	SLUDGE, FIELD, MATURITY
302		0.56	6.9	0	HCL-HF	33	<.6	LEAF	SLUDGE, FIELD, MATURITY
303		0.48	7	0	HCL-HF	15	NA	LEAF	SLUDGE, FIELD, MATURITY
304		0.75	7	0	HCL-HF	19	0.6	LEAF	SLUDGE, FIELD, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
267	17.7	80.6	0		ELLIOT	SiL			
268	13.1	93.7	0		ELLIOT	SiL			
269	17.8	111.5	0		ELLIOT	SiL			
270	0	111.5	1		ELLIOT	SiL			
271	0	111.5	2		ELLIOT	SiL			
272	0	111.5	3		ELLIOT	SiL			
273	0	111.5	4		ELLIOT	SiL			
274	0	111.5	5		ELLIOT	SiL			
275	52.4	80.2	0		ELLIOT	SiL			
276	16.2	96.4	0		ELLIOT	SiL			
277	29.4	125.8	0		ELLIOT	SiL			
278	35.4	161.2	0		ELLIOT	SiL			
279	26.2	187.4	0		ELLIOT	SiL			
280	35.6	223	0		ELLIOT	SiL			
281	0	223	1		ELLIOT	SiL			
282	0	223	2		ELLIOT	SiL			
283	0	223	3		ELLIOT	SiL			
284	0	223	4		ELLIOT	SiL			
285	0	223	5		ELLIOT	SiL			
286	104.8	160.4	0		ELLIOT	SiL			
287	32.4	192.8	0		ELLIOT	SiL			
288	58.8	251.6	0		ELLIOT	SiL			
289	70.8	322.4	0		ELLIOT	SiL			
290	52.4	374.8	0		ELLIOT	SiL			
291	71.2	446	0		ELLIOT	SiL			
292	0	446	1		ELLIOT	SiL			
293	0	446	2		ELLIOT	SiL			
294	0	446	3		ELLIOT	SiL			
295	0	446	4		ELLIOT	SiL			
296	0	446	5		ELLIOT	SiL			
297	0	0	NA		PLAINFIELD	SL			
298	0	0	NA		PLAINFIELD	SL			
299	0	0	NA		PLAINFIELD	SL			
300	0	0	NA		PLAINFIELD	SL			
301	0	0	NA		PLAINFIELD	SL			
302	0	0	NA		PLAINFIELD	SL			
303	0	0	NA		PLAINFIELD	SL			
304	0	0	NA		PLAINFIELD	SL			

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
267	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
268	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
269	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
270	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
271	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
272	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
273	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
274	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
275	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
276	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
277	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
278	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
279	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
280	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
281	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
282	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
283	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
284	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
285	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
286	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
287	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
288	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
289	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
290	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
291	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
292	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
293	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
294	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
295	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
296	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
297	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
298	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
299	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
300	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
301	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
302	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
303	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
304	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
267	HINESLY 1985	CORN					3.2	265	2846	1311
268	HINESLY 1985	CORN					3.2	265	2846	1311
269	HINESLY 1985	CORN					3.2	265	2846	1311
270	HINESLY 1985	CORN					3.2	265	2846	1311
271	HINESLY 1985	CORN					3.2	265	2846	1311
272	HINESLY 1985	CORN					3.2	265	2846	1311
273	HINESLY 1985	CORN					3.2	265	2846	1311
274	HINESLY 1985	CORN					3.2	265	2846	1311
275	HINESLY 1985	CORN					3.2	265	2846	1311
276	HINESLY 1985	CORN					3.2	265	2846	1311
277	HINESLY 1985	CORN					3.2	265	2846	1311
278	HINESLY 1985	CORN					3.2	265	2846	1311
279	HINESLY 1985	CORN					3.2	265	2846	1311
280	HINESLY 1985	CORN					3.2	265	2846	1311
281	HINESLY 1985	CORN					3.2	265	2846	1311
282	HINESLY 1985	CORN					3.2	265	2846	1311
283	HINESLY 1985	CORN					3.2	265	2846	1311
284	HINESLY 1985	CORN					3.2	265	2846	1311
285	HINESLY 1985	CORN					3.2	265	2846	1311
286	HINESLY 1985	CORN					3.2	265	2846	1311
287	HINESLY 1985	CORN					3.2	265	2846	1311
288	HINESLY 1985	CORN					3.2	265	2846	1311
289	HINESLY 1985	CORN					3.2	265	2846	1311
290	HINESLY 1985	CORN					3.2	265	2846	1311
291	HINESLY 1985	CORN					3.2	265	2846	1311
292	HINESLY 1985	CORN					3.2	265	2846	1311
293	HINESLY 1985	CORN					3.2	265	2846	1311
294	HINESLY 1985	CORN					3.2	265	2846	1311
295	HINESLY 1985	CORN					3.2	265	2846	1311
296	HINESLY 1985	CORN					3.2	265	2846	1311
297	HINESLY 1985	CORN					3.2	265	2846	1311
298	HINESLY 1985	CORN					3.2	265	2846	1311
299	HINESLY 1985	CORN					3.2	265	2846	1311
300	HINESLY 1985	CORN					3.2	265	2846	1311
301	HINESLY 1985	CORN					3.2	265	2846	1311
302	HINESLY 1985	CORN					3.2	265	2846	1311
303	HINESLY 1985	CORN					3.2	265	2846	1311
304	HINESLY 1985	CORN					3.2	265	2846	1311

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
229		JOLIET, ILLINOIS
230		JOLIET, ILLINOIS
231		JOLIET, ILLINOIS
232		JOLIET, ILLINOIS
233		JOLIET, ILLINOIS
234		JOLIET, ILLINOIS
235		JOLIET, ILLINOIS
236		JOLIET, ILLINOIS
237		JOLIET, ILLINOIS
238		JOLIET, ILLINOIS
239		JOLIET, ILLINOIS
240	*DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
241	*DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
242	*DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
243		JOLIET, ILLINOIS
244		JOLIET, ILLINOIS
245	*DOSE RESPONSE AND TISSUE NI CONCENTRATION NOT CONSISTENT	JOLIET, ILLINOIS
246		JOLIET, ILLINOIS
247		JOLIET, ILLINOIS
248		JOLIET, ILLINOIS
249		JOLIET, ILLINOIS
250		JOLIET, ILLINOIS
251		JOLIET, ILLINOIS
252		JOLIET, ILLINOIS
253		JOLIET, ILLINOIS
254		JOLIET, ILLINOIS
255		JOLIET, ILLINOIS
256		JOLIET, ILLINOIS
257		JOLIET, ILLINOIS
258		JOLIET, ILLINOIS
259		JOLIET, ILLINOIS
260		JOLIET, ILLINOIS
261		JOLIET, ILLINOIS
262		JOLIET, ILLINOIS
263		JOLIET, ILLINOIS
264		JOLIET, ILLINOIS
265		JOLIET, ILLINOIS
266		JOLIET, ILLINOIS

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
229	0	GRAIN	0	STOVER	NO
230	0	GRAIN	0	STOVER	NO
231	0	GRAIN	0	STOVER	NO
232	0	GRAIN	0	STOVER	NO
233	0	GRAIN	NA	STOVER	NO
234	0	GRAIN	0	STOVER	NO
235	0	GRAIN	0	STOVER	NO
236	0	GRAIN	0	STOVER	NO
237	0	GRAIN	0	STOVER	NO
238	0	GRAIN	NA	STOVER	NO
239	0	GRAIN	0	STOVER	NO
240	0	GRAIN	37*	STOVER	*NO
241	60*	GRAIN	0	STOVER	*NO
242	28*	GRAIN	0	STOVER	*NO
243	0	GRAIN	NA	STOVER	NO
244	0	GRAIN	0	STOVER	NO
245	0	GRAIN	22*	STOVER	*NO
246	0	GRAIN	0	STOVER	NO
247	0	GRAIN	0	STOVER	NO
248	0	GRAIN	NA	STOVER	NO
249	0	GRAIN	0	STOVER	NO
250	0	GRAIN	0	STOVER	NO
251	0	GRAIN	0	STOVER	NO
252	0	GRAIN	0	STOVER	NO
253	0	GRAIN	NA	STOVER	NO
254	0	GRAIN	0	STOVER	NO
255	0	GRAIN	0	STOVER	NO
256	0	GRAIN	0	STOVER	NO
257	0	GRAIN	0	STOVER	NO
258	0	GRAIN	0	STOVER	NO
259	0	GRAIN	0	STOVER	NO
260	0	GRAIN	0	STOVER	NO
261	0	GRAIN	0	STOVER	NO
262	0	GRAIN	0	STOVER	NO
263	0	GRAIN	0	STOVER	NO
264	0	GRAIN	NA	STOVER	NO
265	0	GRAIN	0	STOVER	NO
266	0	GRAIN	0	STOVER	NO

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
229		2.84	6	135.5	HCL-HF	38	2.5	LEAF	SLUDGE, FIELD, MATURITY
230		3.35	5.9	135.5	HCL-HF	73	1.7	LEAF	SLUDGE, FIELD, MATURITY
231		2.1	6.2	135.5	HCL-HF	39	1.4	LEAF	SLUDGE, FIELD, MATURITY
232		3.03	6.1	135.5	HCL-HF	63	<.6	LEAF	SLUDGE, FIELD, MATURITY
233		1.19	NA	0	HCL-HF	22	1.3	LEAF	SLUDGE, FIELD, MATURITY
234		1.01	7.1	0	HCL-HF	25	1.4	LEAF	SLUDGE, FIELD, MATURITY
235		0.93	7.5	0	HCL-HF	25	1.1	LEAF	SLUDGE, FIELD, MATURITY
236		1.05	7.7	0	HCL-HF	33	<.6	LEAF	SLUDGE, FIELD, MATURITY
237		1.07	7.3	0	HCL-HF	21	0.8	LEAF	SLUDGE, FIELD, MATURITY
238		1.29	NA	12.6	HCL-HF	26	1.3	LEAF	SLUDGE, FIELD, MATURITY
239		1.06	7.2	13.4	HCL-HF	33	1.6	LEAF	SLUDGE, FIELD, MATURITY
240		1.1	7.6	15.3	HCL-HF	29	0.9	LEAF	SLUDGE, FIELD, MATURITY
241		1.29	7.6	21	HCL-HF	36	<.6	LEAF	SLUDGE, FIELD, MATURITY
242		1.17	7.6	26.3	HCL-HF	29	0.7	LEAF	SLUDGE, FIELD, MATURITY
243		1.38	NA	25.2	HCL-HF	29	1.2	LEAF	SLUDGE, FIELD, MATURITY
244		1.15	7.1	26.8	HCL-HF	32	1.1	LEAF	SLUDGE, FIELD, MATURITY
245		1.29	7.6	30.6	HCL-HF	28	0.9	LEAF	SLUDGE, FIELD, MATURITY
246		1.58	7.6	41.9	HCL-HF	36	<.6	LEAF	SLUDGE, FIELD, MATURITY
247		1.75	7.5	52.5	HCL-HF	36	0.6	LEAF	SLUDGE, FIELD, MATURITY
248		1.63	NA	50.4	HCL-HF	31	1.2	LEAF	SLUDGE, FIELD, MATURITY
249		1.28	6.9	53.5	HCL-HF	41	1.6	LEAF	SLUDGE, FIELD, MATURITY
250		1.59	7.5	61.1	HCL-HF	38	0.9	LEAF	SLUDGE, FIELD, MATURITY
251		1.9	7.5	83.7	HCL-HF	45	<.6	LEAF	SLUDGE, FIELD, MATURITY
252		2.56	7.3	105	HCL-HF	48	0.9	LEAF	SLUDGE, FIELD, MATURITY
253		1.51	NA	0	HCL-HF	20	1.3	LEAF	SLUDGE, FIELD, MATURITY
254		1.34	7	0	HCL-HF	24	1.5	LEAF	SLUDGE, FIELD, MATURITY
255		1.29	7.2	0	HCL-HF	25	0.7	LEAF	SLUDGE, FIELD, MATURITY
256		1.45	7.1	0	HCL-HF	31	<.6	LEAF	SLUDGE, FIELD, MATURITY
257		1.3	7.6	0	HCL-HF	20	0.6	LEAF	SLUDGE, FIELD, MATURITY
258		1.3	7	0	HCL-HF	38	<.6	LEAF	SLUDGE, FIELD, MATURITY
259		1.41	7.2	0	HCL-HF	23	0.7	LEAF	SLUDGE, FIELD, MATURITY
260		1.32	6.7	0	HCL-HF	24	0.6	LEAF	SLUDGE, FIELD, MATURITY
261		1.38	7	0	HCL-HF	21	<.6	LEAF	SLUDGE, FIELD, MATURITY
262		1.69	7	0	HCL-HF	23	<.6	LEAF	SLUDGE, FIELD, MATURITY
263		1.48	7.4	0	HCL-HF	29	NA	LEAF	SLUDGE, FIELD, MATURITY
264		1.52	NA	12.6	HCL-HF	22	1.2	LEAF	SLUDGE, FIELD, MATURITY
265		1.4	6.9	13.4	HCL-HF	32	1	LEAF	SLUDGE, FIELD, MATURITY
266		1.35	7.2	15.3	HCL-HF	22	0.9	LEAF	SLUDGE, FIELD, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
229	0	428.3	1		PLAINFIELD	SL			
230	0	428.3	2		PLAINFIELD	SL			
231	0	428.3	3		PLAINFIELD	SL			
232	0	428.3	4		PLAINFIELD	SL			
233	0	0	NA		BLOUNT	SiL			
234	0	0	NA		BLOUNT	SiL			
235	0	0	NA		BLOUNT	SiL			
236	0	0	NA		BLOUNT	SiL			
237	0	0	NA		BLOUNT	SiL			
238	26.2	40.1	0		BLOUNT	SiL			
239	8.1	48.2	0		BLOUNT	SiL			
240	14.7	62.9	0		BLOUNT	SiL			
241	17.7	80.6	0		BLOUNT	SiL			
242	13.1	93.7	0		BLOUNT	SiL			
243	52.4	80.2	0		BLOUNT	SiL			
244	16.2	96.4	0		BLOUNT	SiL			
245	29.4	125.8	0		BLOUNT	SiL			
246	35.4	161.2	0		BLOUNT	SiL			
247	26.2	187.4	0		BLOUNT	SiL			
248	104.8	160.4	0		BLOUNT	SiL			
249	32.4	192.8	0		BLOUNT	SiL			
250	58.8	251.6	0		BLOUNT	SiL			
251	70.8	322.4	0		BLOUNT	SiL			
252	52.4	374.8	0		BLOUNT	SiL			
253	0	0	NA		ELLIOT	SiL			
254	0	0	NA		ELLIOT	SiL			
255	0	0	NA		ELLIOT	SiL			
256	0	0	NA		ELLIOT	SiL			
257	0	0	NA		ELLIOT	SiL			
258	0	0	NA		ELLIOT	SiL			
259	0	0	NA		ELLIOT	SiL			
260	0	0	NA		ELLIOT	SiL			
261	0	0	NA		ELLIOT	SiL			
262	0	0	NA		ELLIOT	SiL			
263	0	0	NA		ELLIOT	SiL			
264	26.2	40.1	0		ELLIOT	SiL			
265	8.1	48.2	0		ELLIOT	SiL			
266	14.7	62.9	0		ELLIOT	SiL			

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
229	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
230	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
231	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
232	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
233	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
234	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
235	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
236	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
237	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
238	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
239	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
240	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
241	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
242	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
243	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
244	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
245	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
246	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
247	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
248	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
249	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
250	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
251	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
252	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
253	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
254	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
255	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
256	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
257	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
258	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
259	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
260	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
261	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
262	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
263	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
264	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
265	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
266	4.2	5.5	305	3.3	1169	4769	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
229	HINESLY 1985	CORN					3.4	263	2963	1422
230	HINESLY 1985	CORN					3.4	263	2963	1422
231	HINESLY 1985	CORN					3.4	263	2963	1422
232	HINESLY 1985	CORN					3.4	263	2963	1422
233	HINESLY 1985	CORN					3.2	265	2846	1311
234	HINESLY 1985	CORN					3.2	265	2846	1311
235	HINESLY 1985	CORN					3.2	265	2846	1311
236	HINESLY 1985	CORN					3.2	265	2846	1311
237	HINESLY 1985	CORN					3.2	265	2846	1311
238	HINESLY 1985	CORN					3.2	265	2846	1311
239	HINESLY 1985	CORN					3.2	265	2846	1311
240	HINESLY 1985	CORN					3.2	265	2846	1311
241	HINESLY 1985	CORN					3.2	265	2846	1311
242	HINESLY 1985	CORN					3.2	265	2846	1311
243	HINESLY 1985	CORN					3.2	265	2846	1311
244	HINESLY 1985	CORN					3.2	265	2846	1311
245	HINESLY 1985	CORN					3.2	265	2846	1311
246	HINESLY 1985	CORN					3.2	265	2846	1311
247	HINESLY 1985	CORN					3.2	265	2846	1311
248	HINESLY 1985	CORN					3.2	265	2846	1311
249	HINESLY 1985	CORN					3.2	265	2846	1311
250	HINESLY 1985	CORN					3.2	265	2846	1311
251	HINESLY 1985	CORN					3.2	265	2846	1311
252	HINESLY 1985	CORN					3.2	265	2846	1311
253	HINESLY 1985	CORN					3.2	265	2846	1311
254	HINESLY 1985	CORN					3.2	265	2846	1311
255	HINESLY 1985	CORN					3.2	265	2846	1311
256	HINESLY 1985	CORN					3.2	265	2846	1311
257	HINESLY 1985	CORN					3.2	265	2846	1311
258	HINESLY 1985	CORN					3.2	265	2846	1311
259	HINESLY 1985	CORN					3.2	265	2846	1311
260	HINESLY 1985	CORN					3.2	265	2846	1311
261	HINESLY 1985	CORN					3.2	265	2846	1311
262	HINESLY 1985	CORN					3.2	265	2846	1311
263	HINESLY 1985	CORN					3.2	265	2846	1311
264	HINESLY 1985	CORN					3.2	265	2846	1311
265	HINESLY 1985	CORN					3.2	265	2846	1311
266	HINESLY 1985	CORN					3.2	265	2846	1311

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
191		JOLIET, ILLINOIS
192		JOLIET, ILLINOIS
193		JOLIET, ILLINOIS
194		JOLIET, ILLINOIS
195		JOLIET, ILLINOIS
196		JOLIET, ILLINOIS
197		JOLIET, ILLINOIS
198		JOLIET, ILLINOIS
199		JOLIET, ILLINOIS
200		JOLIET, ILLINOIS
201		JOLIET, ILLINOIS
202		JOLIET, ILLINOIS
203		JOLIET, ILLINOIS
204		JOLIET, ILLINOIS
205		JOLIET, ILLINOIS
206		JOLIET, ILLINOIS
207		JOLIET, ILLINOIS
208		JOLIET, ILLINOIS
209		JOLIET, ILLINOIS
210		JOLIET, ILLINOIS
211		JOLIET, ILLINOIS
212		JOLIET, ILLINOIS
213		JOLIET, ILLINOIS
214		JOLIET, ILLINOIS
215		JOLIET, ILLINOIS
216		JOLIET, ILLINOIS
217		JOLIET, ILLINOIS
218		JOLIET, ILLINOIS
219		JOLIET, ILLINOIS
220		JOLIET, ILLINOIS
221		JOLIET, ILLINOIS
222		JOLIET, ILLINOIS
223		JOLIET, ILLINOIS
224		JOLIET, ILLINOIS
225		JOLIET, ILLINOIS
226		JOLIET, ILLINOIS
227		JOLIET, ILLINOIS
228		JOLIET, ILLINOIS

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
229	HINESLY 1985	CORN					3.4	263	2963	1422
230	HINESLY 1985	CORN					3.4	263	2963	1422
231	HINESLY 1985	CORN					3.4	263	2963	1422
232	HINESLY 1985	CORN					3.4	263	2963	1422
233	HINESLY 1985	CORN					3.2	265	2846	1311
234	HINESLY 1985	CORN					3.2	265	2846	1311
235	HINESLY 1985	CORN					3.2	265	2846	1311
236	HINESLY 1985	CORN					3.2	265	2846	1311
237	HINESLY 1985	CORN					3.2	265	2846	1311
238	HINESLY 1985	CORN					3.2	265	2846	1311
239	HINESLY 1985	CORN					3.2	265	2846	1311
240	HINESLY 1985	CORN					3.2	265	2846	1311
241	HINESLY 1985	CORN					3.2	265	2846	1311
242	HINESLY 1985	CORN					3.2	265	2846	1311
243	HINESLY 1985	CORN					3.2	265	2846	1311
244	HINESLY 1985	CORN					3.2	265	2846	1311
245	HINESLY 1985	CORN					3.2	265	2846	1311
246	HINESLY 1985	CORN					3.2	265	2846	1311
247	HINESLY 1985	CORN					3.2	265	2846	1311
248	HINESLY 1985	CORN					3.2	265	2846	1311
249	HINESLY 1985	CORN					3.2	265	2846	1311
250	HINESLY 1985	CORN					3.2	265	2846	1311
251	HINESLY 1985	CORN					3.2	265	2846	1311
252	HINESLY 1985	CORN					3.2	265	2846	1311
253	HINESLY 1985	CORN					3.2	265	2846	1311
254	HINESLY 1985	CORN					3.2	265	2846	1311
255	HINESLY 1985	CORN					3.2	265	2846	1311
256	HINESLY 1985	CORN					3.2	265	2846	1311
257	HINESLY 1985	CORN					3.2	265	2846	1311
258	HINESLY 1985	CORN					3.2	265	2846	1311
259	HINESLY 1985	CORN					3.2	265	2846	1311
260	HINESLY 1985	CORN					3.2	265	2846	1311
261	HINESLY 1985	CORN					3.2	265	2846	1311
262	HINESLY 1985	CORN					3.2	265	2846	1311
263	HINESLY 1985	CORN					3.2	265	2846	1311
264	HINESLY 1985	CORN					3.2	265	2846	1311
265	HINESLY 1985	CORN					3.2	265	2846	1311
266	HINESLY 1985	CORN					3.2	265	2846	1311

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
191		JOLIET, ILLINOIS
192		JOLIET, ILLINOIS
193		JOLIET, ILLINOIS
194		JOLIET, ILLINOIS
195		JOLIET, ILLINOIS
196		JOLIET, ILLINOIS
197		JOLIET, ILLINOIS
198		JOLIET, ILLINOIS
199		JOLIET, ILLINOIS
200		JOLIET, ILLINOIS
201		JOLIET, ILLINOIS
202		JOLIET, ILLINOIS
203		JOLIET, ILLINOIS
204		JOLIET, ILLINOIS
205		JOLIET, ILLINOIS
206		JOLIET, ILLINOIS
207		JOLIET, ILLINOIS
208		JOLIET, ILLINOIS
209		JOLIET, ILLINOIS
210		JOLIET, ILLINOIS
211		JOLIET, ILLINOIS
212		JOLIET, ILLINOIS
213		JOLIET, ILLINOIS
214		JOLIET, ILLINOIS
215		JOLIET, ILLINOIS
216		JOLIET, ILLINOIS
217		JOLIET, ILLINOIS
218		JOLIET, ILLINOIS
219		JOLIET, ILLINOIS
220		JOLIET, ILLINOIS
221		JOLIET, ILLINOIS
222		JOLIET, ILLINOIS
223		JOLIET, ILLINOIS
224		JOLIET, ILLINOIS
225		JOLIET, ILLINOIS
226		JOLIET, ILLINOIS
227		JOLIET, ILLINOIS
228		JOLIET, ILLINOIS

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
191	0	GRAIN	0	STOVER	NO
192	0	GRAIN	0	STOVER	NO
193	NA	GRAIN	0	STOVER	NO
194	0	GRAIN	0	STOVER	NO
195	0	GRAIN	0	STOVER	NO
196	0	GRAIN	0	STOVER	NO
197	0	GRAIN	0	STOVER	NO
198	0	GRAIN	0	STOVER	NO
199	0	GRAIN	0	STOVER	NO
200	0	GRAIN	0	STOVER	NO
201	0	GRAIN	0	STOVER	NO
202	0	GRAIN	0	STOVER	NO
203	0	GRAIN	NA	STOVER	NO
204	0	GRAIN	0	STOVER	NO
205	0	GRAIN	0	STOVER	NO
206	0	GRAIN	0	STOVER	NO
207	0	GRAIN	0	STOVER	NO
208	0	GRAIN	0	STOVER	NO
209	0	GRAIN	0	STOVER	NO
210	0	GRAIN	0	STOVER	NO
211	0	GRAIN	0	STOVER	NO
212	0	GRAIN	0	STOVER	NO
213	NA	GRAIN	NA	STOVER	NO
214	0	GRAIN	0	STOVER	NO
215	0	GRAIN	0	STOVER	NO
216	0	GRAIN	0	STOVER	NO
217	0	GRAIN	0	STOVER	NO
218	0	GRAIN	0	STOVER	NO
219	0	GRAIN	0	STOVER	NO
220	0	GRAIN	0	STOVER	NO
221	0	GRAIN	0	STOVER	NO
222	0	GRAIN	0	STOVER	NO
223	NA	GRAIN	NA	STOVER	NO
224	0	GRAIN	0	STOVER	NO
225	0	GRAIN	0	STOVER	NO
226	0	GRAIN	0	STOVER	NO
227	0	GRAIN	0	STOVER	NO
228	0	GRAIN	0	STOVER	NO

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
191		2.6	6.1	135.5	HCL-HF	51	0.6	LEAF	SLUDGE, FIELD, MATURITY
192		3.2	6.1	135.5	HCL-HF	68	<.6	LEAF	SLUDGE, FIELD, MATURITY
193		0.39	7.8	0	HCL-HF	17	1.3	LEAF	SLUDGE, FIELD, MATURITY
194		0.17	7.1	0	HCL-HF	14	1.2	LEAF	SLUDGE, FIELD, MATURITY
195		0.26	7.3	0	HCL-HF	14	<.6	LEAF	SLUDGE, FIELD, MATURITY
196		0.27	6.8	0	HCL-HF	10	<.6	LEAF	SLUDGE, FIELD, MATURITY
197		0.33	7.6	0	HCL-HF	15	<.6	LEAF	SLUDGE, FIELD, MATURITY
198		0.27	7.5	0	HCL-HF	14	0.8	LEAF	SLUDGE, FIELD, MATURITY
199		0.29	7.5	0	HCL-HF	8	1.4	LEAF	SLUDGE, FIELD, MATURITY
200		0.42	7.4	0	HCL-HF	14	<.6	LEAF	SLUDGE, FIELD, MATURITY
201		0.49	7.4	0	HCL-HF	16	<.6	LEAF	SLUDGE, FIELD, MATURITY
202		0.64	7.3	0	HCL-HF	20	<.6	LEAF	SLUDGE, FIELD, MATURITY
203		0.36	7.6	12.1	HCL-HF	16	1.2	LEAF	SLUDGE, FIELD, MATURITY
204		0.28	7.1	13.2	HCL-HF	22	1.4	LEAF	SLUDGE, FIELD, MATURITY
205		0.61	7.4	14.5	HCL-HF	15	<.6	LEAF	SLUDGE, FIELD, MATURITY
206		0.91	7.3	14.5	HCL-HF	16	<.6	LEAF	SLUDGE, FIELD, MATURITY
207		0.56	7.4	14.5	HCL-HF	17	<.6	LEAF	SLUDGE, FIELD, MATURITY
208		0.58	7.1	14.5	HCL-HF	16	2	LEAF	SLUDGE, FIELD, MATURITY
209		0.45	7.5	14.5	HCL-HF	9	0.8	LEAF	SLUDGE, FIELD, MATURITY
210		0.34	7.7	14.5	HCL-HF	18	<.6	LEAF	SLUDGE, FIELD, MATURITY
211		0.47	7.4	14.5	HCL-HF	19	1.6	LEAF	SLUDGE, FIELD, MATURITY
212		0.83	7.4	14.5	HCL-HF	24	<.6	LEAF	SLUDGE, FIELD, MATURITY
213		0.58	7.5	24.2	HCL-HF	16	1.6	LEAF	SLUDGE, FIELD, MATURITY
214		0.44	6.9	26.4	HCL-HF	24	5.3	LEAF	SLUDGE, FIELD, MATURITY
215		0.81	7.1	29	HCL-HF	18	3.4	LEAF	SLUDGE, FIELD, MATURITY
216		0.95	6.8	29	HCL-HF	15	1.1	LEAF	SLUDGE, FIELD, MATURITY
217		0.75	7.1	29	HCL-HF	22	<.6	LEAF	SLUDGE, FIELD, MATURITY
218		0.96	7.1	29	HCL-HF	15	1.2	LEAF	SLUDGE, FIELD, MATURITY
219		0.59	6.9	29	HCL-HF	15	1.6	LEAF	SLUDGE, FIELD, MATURITY
220		0.89	7	29	HCL-HF	17	<.6	LEAF	SLUDGE, FIELD, MATURITY
221		0.81	7.1	29	HCL-HF	17	<.6	LEAF	SLUDGE, FIELD, MATURITY
222		0.52	7.1	29	HCL-HF	17	<.6	LEAF	SLUDGE, FIELD, MATURITY
223		0.9	7.6	48.4	HCL-HF	43	1.4	LEAF	SLUDGE, FIELD, MATURITY
224		0.6	6.6	52.7	HCL-HF	34	2	LEAF	SLUDGE, FIELD, MATURITY
225		2.4	6.8	57.9	HCL-HF	32	2.4	LEAF	SLUDGE, FIELD, MATURITY
226		1.85	6.5	82.1	HCL-HF	14	0.9	LEAF	SLUDGE, FIELD, MATURITY
227		1.78	6.1	103.4	HCL-HF	32	<.6	LEAF	SLUDGE, FIELD, MATURITY
228		1.96	6.2	135.5	HCL-HF	32	6.2	LEAF	SLUDGE, FIELD, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
191	0	428.3	3		ELLIOT	SiL			
192	0	428.3	4		ELLIOT	SiL			
193	0	0	NA		PLAINFIELD	SL			
194	0	0	NA		PLAINFIELD	SL			
195	0	0	NA		PLAINFIELD	SL			
196	0	0	NA		PLAINFIELD	SL			
197	0	0	NA		PLAINFIELD	SL			
198	0	0	NA		PLAINFIELD	SL			
199	0	0	NA		PLAINFIELD	SL			
200	0	0	NA		PLAINFIELD	SL			
201	0	0	NA		PLAINFIELD	SL			
202	0	0	NA		PLAINFIELD	SL			
203	14.5	31.8	0		PLAINFIELD	SL			
204	11.1	42.9	0		PLAINFIELD	SL			
205	15.3	58.2	0		PLAINFIELD	SL			
206	0	58.2	1		PLAINFIELD	SL			
207	0	58.2	2		PLAINFIELD	SL			
208	0	58.2	3		PLAINFIELD	SL			
209	0	58.2	4		PLAINFIELD	SL			
210	0	58.2	5		PLAINFIELD	SL			
211	0	58.2	6		PLAINFIELD	SL			
212	0	58.2	7		PLAINFIELD	SL			
213	29	63.6	0		PLAINFIELD	SL			
214	22.2	85.8	0		PLAINFIELD	SL			
215	30.6	116.4	0		PLAINFIELD	SL			
216	0	116.4	1		PLAINFIELD	SL			
217	0	116.4	2		PLAINFIELD	SL			
218	0	116.4	3		PLAINFIELD	SL			
219	0	116.4	4		PLAINFIELD	SL			
220	0	116.4	5		PLAINFIELD	SL			
221	0	116.4	6		PLAINFIELD	SL			
222	0	116.4	7		PLAINFIELD	SL			
223	57.8	127	0		PLAINFIELD	SL			
224	44.4	171.4	0		PLAINFIELD	SL			
225	61.1	232.5	0		PLAINFIELD	SL			
226	69.8	302.3	0		PLAINFIELD	SL			
227	54	356.3	0		PLAINFIELD	SL			
228	72	428.3	0		PLAINFIELD	SL			

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
191	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
192	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
193	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
194	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
195	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
196	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
197	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
198	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
199	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
200	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
201	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
202	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
203	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
204	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
205	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
206	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
207	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
208	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
209	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
210	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
211	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
212	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
213	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
214	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
215	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
216	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
217	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
218	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
219	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
220	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
221	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
222	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
223	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
224	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
225	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
226	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
227	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
228	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
191	HINESLY 1985	CORN					3.4	263	2963	1422
192	HINESLY 1985	CORN					3.4	263	2963	1422
193	HINESLY 1985	CORN					3.4	263	2963	1422
194	HINESLY 1985	CORN					3.4	263	2963	1422
195	HINESLY 1985	CORN					3.4	263	2963	1422
196	HINESLY 1985	CORN					3.4	263	2963	1422
197	HINESLY 1985	CORN					3.4	263	2963	1422
198	HINESLY 1985	CORN					3.4	263	2963	1422
199	HINESLY 1985	CORN					3.4	263	2963	1422
200	HINESLY 1985	CORN					3.4	263	2963	1422
201	HINESLY 1985	CORN					3.4	263	2963	1422
202	HINESLY 1985	CORN					3.4	263	2963	1422
203	HINESLY 1985	CORN					3.4	263	2963	1422
204	HINESLY 1985	CORN					3.4	263	2963	1422
205	HINESLY 1985	CORN					3.4	263	2963	1422
206	HINESLY 1985	CORN					3.4	263	2963	1422
207	HINESLY 1985	CORN					3.4	263	2963	1422
208	HINESLY 1985	CORN					3.4	263	2963	1422
209	HINESLY 1985	CORN					3.4	263	2963	1422
210	HINESLY 1985	CORN					3.4	263	2963	1422
211	HINESLY 1985	CORN					3.4	263	2963	1422
212	HINESLY 1985	CORN					3.4	263	2963	1422
213	HINESLY 1985	CORN					3.4	263	2963	1422
214	HINESLY 1985	CORN					3.4	263	2963	1422
215	HINESLY 1985	CORN					3.4	263	2963	1422
216	HINESLY 1985	CORN					3.4	263	2963	1422
217	HINESLY 1985	CORN					3.4	263	2963	1422
218	HINESLY 1985	CORN					3.4	263	2963	1422
219	HINESLY 1985	CORN					3.4	263	2963	1422
220	HINESLY 1985	CORN					3.4	263	2963	1422
221	HINESLY 1985	CORN					3.4	263	2963	1422
222	HINESLY 1985	CORN					3.4	263	2963	1422
223	HINESLY 1985	CORN					3.4	263	2963	1422
224	HINESLY 1985	CORN					3.4	263	2963	1422
225	HINESLY 1985	CORN					3.4	263	2963	1422
226	HINESLY 1985	CORN					3.4	263	2963	1422
227	HINESLY 1985	CORN					3.4	263	2963	1422
228	HINESLY 1985	CORN					3.4	263	2963	1422

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
153		JOLIET, ILLINOIS
154		JOLIET, ILLINOIS
155		JOLIET, ILLINOIS
156		JOLIET, ILLINOIS
157		JOLIET, ILLINOIS
158		JOLIET, ILLINOIS
159		JOLIET, ILLINOIS
160		JOLIET, ILLINOIS
161		JOLIET, ILLINOIS
162		JOLIET, ILLINOIS
163		JOLIET, ILLINOIS
164		JOLIET, ILLINOIS
165		JOLIET, ILLINOIS
166		JOLIET, ILLINOIS
167		JOLIET, ILLINOIS
168		JOLIET, ILLINOIS
169		JOLIET, ILLINOIS
170		JOLIET, ILLINOIS
171		JOLIET, ILLINOIS
172		JOLIET, ILLINOIS
173		JOLIET, ILLINOIS
174		JOLIET, ILLINOIS
175		JOLIET, ILLINOIS
176		JOLIET, ILLINOIS
177		JOLIET, ILLINOIS
178		JOLIET, ILLINOIS
179		JOLIET, ILLINOIS
180		JOLIET, ILLINOIS
181		JOLIET, ILLINOIS
182		JOLIET, ILLINOIS
183		JOLIET, ILLINOIS
184		JOLIET, ILLINOIS
185		JOLIET, ILLINOIS
186		JOLIET, ILLINOIS
187		JOLIET, ILLINOIS
188		JOLIET, ILLINOIS
189		JOLIET, ILLINOIS
190		JOLIET, ILLINOIS

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
153	0	GRAIN	0	STOVER	NO
154	0	GRAIN	0	STOVER	NO
155	0	GRAIN	0	STOVER	NO
156	0	GRAIN	0	STOVER	NO
157	0	GRAIN	0	STOVER	NO
158	0	GRAIN	0	STOVER	NO
159	0	GRAIN	0	STOVER	NO
160	0	GRAIN	0	STOVER	NO
161	0	GRAIN	0	STOVER	NO
162	0	GRAIN	0	STOVER	NO
163	0	GRAIN	NA	STOVER	NO
164	0	GRAIN	0	STOVER	NO
165	0	GRAIN	0	STOVER	NO
166	0	GRAIN	0	STOVER	NO
167	0	GRAIN	0	STOVER	NO
168	0	GRAIN	0	STOVER	NO
169	0	GRAIN	0	STOVER	NO
170	0	GRAIN	0	STOVER	NO
171	0	GRAIN	0	STOVER	NO
172	0	GRAIN	0	STOVER	NO
173	0	GRAIN	NA	STOVER	NO
174	0	GRAIN	0	STOVER	NO
175	0	GRAIN	0	STOVER	NO
176	0	GRAIN	0	STOVER	NO
177	0	GRAIN	0	STOVER	NO
178	0	GRAIN	0	STOVER	NO
179	0	GRAIN	0	STOVER	NO
180	0	GRAIN	0	STOVER	NO
181	0	GRAIN	0	STOVER	NO
182	0	GRAIN	0	STOVER	NO
183	0	GRAIN	NA	STOVER	NO
184	0	GRAIN	0	STOVER	NO
185	0	GRAIN	0	STOVER	NO
186	0	GRAIN	0	STOVER	NO
187	0	GRAIN	0	STOVER	NO
188	0	GRAIN	0	STOVER	NO
189	0	GRAIN	0	STOVER	NO
190	0	GRAIN	0	STOVER	NO

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
153		1.64	7.6	0	HCL-HF	18	1.2	LEAF	SLUDGE, FIELD, MATURITY
154		1.61	6.8	0	HCL-HF	23	0.8	LEAF	SLUDGE, FIELD, MATURITY
155		1.54	7.2	0	HCL-HF	30	<.6	LEAF	SLUDGE, FIELD, MATURITY
156		1.53	7.2	0	HCL-HF	28	0.6	LEAF	SLUDGE, FIELD, MATURITY
157		1.54	7	0	HCL-HF	23	<.6	LEAF	SLUDGE, FIELD, MATURITY
158		1.51	7	0	HCL-HF	25	0.7	LEAF	SLUDGE, FIELD, MATURITY
159		1.58	7.4	0	HCL-HF	18	<.6	LEAF	SLUDGE, FIELD, MATURITY
160		1.54	7.2	0	HCL-HF	29	<.6	LEAF	SLUDGE, FIELD, MATURITY
161		1.51	7	0	HCL-HF	28	<.6	LEAF	SLUDGE, FIELD, MATURITY
162		1.62	7	0	HCL-HF	31	<.6	LEAF	SLUDGE, FIELD, MATURITY
163		1.64	7.3	12.1	HCL-HF	24	1.2	LEAF	SLUDGE, FIELD, MATURITY
164		1.84	6.8	13.2	HCL-HF	24	0.6	LEAF	SLUDGE, FIELD, MATURITY
165		1.74	7.1	14.5	HCL-HF	36	1.7	LEAF	SLUDGE, FIELD, MATURITY
166		2.18	7.1	14.5	HCL-HF	28	<.6	LEAF	SLUDGE, FIELD, MATURITY
167		1.86	7.2	14.5	HCL-HF	26	<.6	LEAF	SLUDGE, FIELD, MATURITY
168		1.67	7.2	14.5	HCL-HF	30	0.8	LEAF	SLUDGE, FIELD, MATURITY
169		1.83	7.5	14.5	HCL-HF	22	0.6	LEAF	SLUDGE, FIELD, MATURITY
170		1.55	7.2	14.5	HCL-HF	30	<.6	LEAF	SLUDGE, FIELD, MATURITY
171		1.68	7	14.5	HCL-HF	23	<.6	LEAF	SLUDGE, FIELD, MATURITY
172		1.89	7.1	14.5	HCL-HF	36	<.6	LEAF	SLUDGE, FIELD, MATURITY
173		1.97	7.8	24.2	HCL-HF	29	1.6	LEAF	SLUDGE, FIELD, MATURITY
174		1.81	7	26.4	HCL-HF	40	1.3	LEAF	SLUDGE, FIELD, MATURITY
175		1.88	7.3	29	HCL-HF	27	1.5	LEAF	SLUDGE, FIELD, MATURITY
176		2.21	7.3	29	HCL-HF	36	<.6	LEAF	SLUDGE, FIELD, MATURITY
177		1.99	7.4	29	HCL-HF	26	<.6	LEAF	SLUDGE, FIELD, MATURITY
178		1.89	7.3	29	HCL-HF	34	0.8	LEAF	SLUDGE, FIELD, MATURITY
179		1.94	7.4	29	HCL-HF	26	2.4	LEAF	SLUDGE, FIELD, MATURITY
180		1.72	7.4	29	HCL-HF	36	<.6	LEAF	SLUDGE, FIELD, MATURITY
181		1.79	7.2	29	HCL-HF	27	<.6	LEAF	SLUDGE, FIELD, MATURITY
182		1.87	7.2	29	HCL-HF	41	<.6	LEAF	SLUDGE, FIELD, MATURITY
183		2.23	7.5	48.4	HCL-HF	37	1.2	LEAF	SLUDGE, FIELD, MATURITY
184		2.22	6.4	52.7	HCL-HF	40	1.4	LEAF	SLUDGE, FIELD, MATURITY
185		2.28	6.5	57.9	HCL-HF	36	1.2	LEAF	SLUDGE, FIELD, MATURITY
186		2.61	6.5	82.1	HCL-HF	44	<.6	LEAF	SLUDGE, FIELD, MATURITY
187		2.74	6.5	103.4	HCL-HF	41	<.6	LEAF	SLUDGE, FIELD, MATURITY
188		2.94	5.9	135.5	HCL-HF	49	2.7	LEAF	SLUDGE, FIELD, MATURITY
189		3.92	5.9	135.5	HCL-HF	60	1.4	LEAF	SLUDGE, FIELD, MATURITY
190		3.77	5.8	135.5	HCL-HF	75	<.6	LEAF	SLUDGE, FIELD, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
153	0	0	NA		ELLIOT	SiL			
154	0	0	NA		ELLIOT	SiL			
155	0	0	NA		ELLIOT	SiL			
156	0	0	NA		ELLIOT	SiL			
157	0	0	NA		ELLIOT	SiL			
158	0	0	NA		ELLIOT	SiL			
159	0	0	NA		ELLIOT	SiL			
160	0	0	NA		ELLIOT	SiL			
161	0	0	NA		ELLIOT	SiL			
162	0	0	NA		ELLIOT	SiL			
163	14.5	31.8	0		ELLIOT	SiL			
164	11.1	42.9	0		ELLIOT	SiL			
165	15.3	58.2	0		ELLIOT	SiL			
166	0	58.2	1		ELLIOT	SiL			
167	0	58.2	2		ELLIOT	SiL			
168	0	58.2	3		ELLIOT	SiL			
169	0	58.2	4		ELLIOT	SiL			
170	0	58.2	5		ELLIOT	SiL			
171	0	58.2	6		ELLIOT	SiL			
172	0	58.2	7		ELLIOT	SiL			
173	29	63.6	0		ELLIOT	SiL			
174	22.2	85.8	0		ELLIOT	SiL			
175	30.6	116.4	0		ELLIOT	SiL			
176	0	116.4	1		ELLIOT	SiL			
177	0	116.4	2		ELLIOT	SiL			
178	0	116.4	3		ELLIOT	SiL			
179	0	116.4	4		ELLIOT	SiL			
180	0	116.4	5		ELLIOT	SiL			
181	0	116.4	6		ELLIOT	SiL			
182	0	116.4	7		ELLIOT	SiL			
183	57.8	127	0		ELLIOT	SiL			
184	44.4	171.4	0		ELLIOT	SiL			
185	61.1	232.5	0		ELLIOT	SiL			
186	69.8	302.3	0		ELLIOT	SiL			
187	54	356.3	0		ELLIOT	SiL			
188	72	428.3	0		ELLIOT	SiL			
189	0	428.3	1		ELLIOT	SiL			
190	0	428.3	2		ELLIOT	SiL			

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
153	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
154	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
155	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
156	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
157	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
158	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
159	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
160	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
161	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
162	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
163	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
164	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
165	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
166	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
167	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
168	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
169	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
170	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
171	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
172	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
173	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
174	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
175	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
176	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
177	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
178	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
179	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
180	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
181	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
182	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
183	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
184	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
185	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
186	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
187	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
188	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
189	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
190	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
153	HINESLY 1985	CORN					3.4	263	2963	1422
154	HINESLY 1985	CORN					3.4	263	2963	1422
155	HINESLY 1985	CORN					3.4	263	2963	1422
156	HINESLY 1985	CORN					3.4	263	2963	1422
157	HINESLY 1985	CORN					3.4	263	2963	1422
158	HINESLY 1985	CORN					3.4	263	2963	1422
159	HINESLY 1985	CORN					3.4	263	2963	1422
160	HINESLY 1985	CORN					3.4	263	2963	1422
161	HINESLY 1985	CORN					3.4	263	2963	1422
162	HINESLY 1985	CORN					3.4	263	2963	1422
163	HINESLY 1985	CORN					3.4	263	2963	1422
164	HINESLY 1985	CORN					3.4	263	2963	1422
165	HINESLY 1985	CORN					3.4	263	2963	1422
166	HINESLY 1985	CORN					3.4	263	2963	1422
167	HINESLY 1985	CORN					3.4	263	2963	1422
168	HINESLY 1985	CORN					3.4	263	2963	1422
169	HINESLY 1985	CORN					3.4	263	2963	1422
170	HINESLY 1985	CORN					3.4	263	2963	1422
171	HINESLY 1985	CORN					3.4	263	2963	1422
172	HINESLY 1985	CORN					3.4	263	2963	1422
173	HINESLY 1985	CORN					3.4	263	2963	1422
174	HINESLY 1985	CORN					3.4	263	2963	1422
175	HINESLY 1985	CORN					3.4	263	2963	1422
176	HINESLY 1985	CORN					3.4	263	2963	1422
177	HINESLY 1985	CORN					3.4	263	2963	1422
178	HINESLY 1985	CORN					3.4	263	2963	1422
179	HINESLY 1985	CORN					3.4	263	2963	1422
180	HINESLY 1985	CORN					3.4	263	2963	1422
181	HINESLY 1985	CORN					3.4	263	2963	1422
182	HINESLY 1985	CORN					3.4	263	2963	1422
183	HINESLY 1985	CORN					3.4	263	2963	1422
184	HINESLY 1985	CORN					3.4	263	2963	1422
185	HINESLY 1985	CORN					3.4	263	2963	1422
186	HINESLY 1985	CORN					3.4	263	2963	1422
187	HINESLY 1985	CORN					3.4	263	2963	1422
188	HINESLY 1985	CORN					3.4	263	2963	1422
189	HINESLY 1985	CORN					3.4	263	2963	1422
190	HINESLY 1985	CORN					3.4	263	2963	1422

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
115		JOLIET, ILLINOIS
116		JOLIET, ILLINOIS
117		JOLIET, ILLINOIS
118		JOLIET, ILLINOIS
119		JOLIET, ILLINOIS
120		JOLIET, ILLINOIS
121		JOLIET, ILLINOIS
122		JOLIET, ILLINOIS
123		JOLIET, ILLINOIS
124		JOLIET, ILLINOIS
125		JOLIET, ILLINOIS
126		JOLIET, ILLINOIS
127		JOLIET, ILLINOIS
128		JOLIET, ILLINOIS
129		JOLIET, ILLINOIS
130		JOLIET, ILLINOIS
131		JOLIET, ILLINOIS
132		JOLIET, ILLINOIS
133		JOLIET, ILLINOIS
134		JOLIET, ILLINOIS
135		JOLIET, ILLINOIS
136		JOLIET, ILLINOIS
137		JOLIET, ILLINOIS
138		JOLIET, ILLINOIS
139		JOLIET, ILLINOIS
140		JOLIET, ILLINOIS
141		JOLIET, ILLINOIS
142		JOLIET, ILLINOIS
143		JOLIET, ILLINOIS
144		JOLIET, ILLINOIS
145		JOLIET, ILLINOIS
146		JOLIET, ILLINOIS
147		JOLIET, ILLINOIS
148		JOLIET, ILLINOIS
149		JOLIET, ILLINOIS
150		JOLIET, ILLINOIS
151		JOLIET, ILLINOIS
152		JOLIET, ILLINOIS

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
115	0	GRAIN	0	STOVER	NO
116	0	GRAIN	0	STOVER	NO
117	0	GRAIN	0	STOVER	NO
118	0	GRAIN	0	STOVER	NO
119	0	GRAIN	0	STOVER	NO
120	0	GRAIN	0	STOVER	NO
121	0	GRAIN	0	STOVER	NO
122	0	GRAIN	0	STOVER	NO
123	0	GRAIN	NA	STOVER	NO
124	0	GRAIN	0	STOVER	NO
125	0	GRAIN	0	STOVER	NO
126	0	GRAIN	0	STOVER	NO
127	0	GRAIN	0	STOVER	NO
128	0	GRAIN	0	STOVER	NO
129	0	GRAIN	0	STOVER	NO
130	0	GRAIN	0	STOVER	NO
131	0	GRAIN	0	STOVER	NO
132	0	GRAIN	0	STOVER	NO
133	0	GRAIN	NA	STOVER	NO
134	0	GRAIN	0	STOVER	NO
135	0	GRAIN	0	STOVER	NO
136	0	GRAIN	0	STOVER	NO
137	0	GRAIN	0	STOVER	NO
138	0	GRAIN	0	STOVER	NO
139	0	GRAIN	0	STOVER	NO
140	0	GRAIN	0	STOVER	NO
141	0	GRAIN	0	STOVER	NO
142	0	GRAIN	0	STOVER	NO
143	0	GRAIN	NA	STOVER	NO
144	0	GRAIN	0	STOVER	NO
145	0	GRAIN	0	STOVER	NO
146	0	GRAIN	0	STOVER	NO
147	0	GRAIN	0	STOVER	NO
148	0	GRAIN	0	STOVER	NO
149	0	GRAIN	0	STOVER	NO
150	0	GRAIN	0	STOVER	NO
151	0	GRAIN	0	STOVER	NO
152	0	GRAIN	0	STOVER	NO

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
115		0.94	7.6	0	HCL-HF	30	<.6	LEAF	SLUDGE, FIELD, MATURITY
116		0.93	7.6	0	HCL-HF	31	<.6	LEAF	SLUDGE, FIELD, MATURITY
117		0.92	7.8	0	HCL-HF	25	<.6	LEAF	SLUDGE, FIELD, MATURITY
118		0.87	7.5	0	HCL-HF	27	0.7	LEAF	SLUDGE, FIELD, MATURITY
119		0.9	7.6	0	HCL-HF	22	1.1	LEAF	SLUDGE, FIELD, MATURITY
120		0.88	7.5	0	HCL-HF	30	<.6	LEAF	SLUDGE, FIELD, MATURITY
121		0.73	7.6	0	HCL-HF	26	<.6	LEAF	SLUDGE, FIELD, MATURITY
122		1	7.4	0	HCL-HF	36	<.6	LEAF	SLUDGE, FIELD, MATURITY
123		1.06	7.7	12.1	HCL-HF	28	1.3	LEAF	SLUDGE, FIELD, MATURITY
124		1.11	6.9	13.2	HCL-HF	20	1	LEAF	SLUDGE, FIELD, MATURITY
125		1.18	7.5	14.5	HCL-HF	35	2.4	LEAF	SLUDGE, FIELD, MATURITY
126		1.4	7.5	14.5	HCL-HF	42	<.6	LEAF	SLUDGE, FIELD, MATURITY
127		1.16	7.6	14.5	HCL-HF	25	<.6	LEAF	SLUDGE, FIELD, MATURITY
128		1.08	7.5	14.5	HCL-HF	33	0.9	LEAF	SLUDGE, FIELD, MATURITY
129		1.18	7.7	14.5	HCL-HF	26	1.2	LEAF	SLUDGE, FIELD, MATURITY
130		1.23	7.6	14.5	HCL-HF	32	<.6	LEAF	SLUDGE, FIELD, MATURITY
131		1.09	7.5	14.5	HCL-HF	27	<.6	LEAF	SLUDGE, FIELD, MATURITY
132		1.32	7.3	14.5	HCL-HF	38	<.6	LEAF	SLUDGE, FIELD, MATURITY
133		1.38	7.6	24.2	HCL-HF	28	1.4	LEAF	SLUDGE, FIELD, MATURITY
134		1.12	7	26.4	HCL-HF	19	0.9	LEAF	SLUDGE, FIELD, MATURITY
135		1.29	7.4	29	HCL-HF	44	2	LEAF	SLUDGE, FIELD, MATURITY
136		1.83	7.3	29	HCL-HF	35	<.6	LEAF	SLUDGE, FIELD, MATURITY
137		1.36	7.5	29	HCL-HF	21	<.6	LEAF	SLUDGE, FIELD, MATURITY
138		1.34	7.2	29	HCL-HF	28	<.6	LEAF	SLUDGE, FIELD, MATURITY
139		1.6	7.4	29	HCL-HF	26	0.8	LEAF	SLUDGE, FIELD, MATURITY
140		1.31	7.3	29	HCL-HF	35	<.6	LEAF	SLUDGE, FIELD, MATURITY
141		1.54	7.1	29	HCL-HF	27	<.6	LEAF	SLUDGE, FIELD, MATURITY
142		1.62	7.1	29	HCL-HF	39	<.6	LEAF	SLUDGE, FIELD, MATURITY
143		1.62	7.6	48.4	HCL-HF	37	1.2	LEAF	SLUDGE, FIELD, MATURITY
144		1.63	6.8	52.7	HCL-HF	30	1.1	LEAF	SLUDGE, FIELD, MATURITY
145		1.94	7.3	57.9	HCL-HF	42	2.3	LEAF	SLUDGE, FIELD, MATURITY
146		2.5	7.2	57.9	HCL-HF	44	0.7	LEAF	SLUDGE, FIELD, MATURITY
147		1.83	7.3	57.9	HCL-HF	36	<.6	LEAF	SLUDGE, FIELD, MATURITY
148		1.88	7.2	57.9	HCL-HF	37	0.8	LEAF	SLUDGE, FIELD, MATURITY
149		2.03	7.3	57.9	HCL-HF	33	0.8	LEAF	SLUDGE, FIELD, MATURITY
150		1.6	7.1	57.9	HCL-HF	40	<.6	LEAF	SLUDGE, FIELD, MATURITY
151		1.54	7.1	57.9	HCL-HF	28	<.6	LEAF	SLUDGE, FIELD, MATURITY
152		1.84	7	57.9	HCL-HF	43	<.6	LEAF	SLUDGE, FIELD, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
115	0	0	NA		BLOUNT	SiL			
116	0	0	NA		BLOUNT	SiL			
117	0	0	NA		BLOUNT	SiL			
118	0	0	NA		BLOUNT	SiL			
119	0	0	NA		BLOUNT	SiL			
120	0	0	NA		BLOUNT	SiL			
121	0	0	NA		BLOUNT	SiL			
122	0	0	NA		BLOUNT	SiL			
123	14.5	31.8	0		BLOUNT	SiL			
124	11.1	42.9	0		BLOUNT	SiL			
125	15.3	58.2	0		BLOUNT	SiL			
126	0	58.2	1		BLOUNT	SiL			
127	0	58.2	2		BLOUNT	SiL			
128	0	58.2	3		BLOUNT	SiL			
129	0	58.2	4		BLOUNT	SiL			
130	0	58.2	5		BLOUNT	SiL			
131	0	58.2	6		BLOUNT	SiL			
132	0	58.2	7		BLOUNT	SiL			
133	29	63.6	0		BLOUNT	SiL			
134	22.2	85.8	0		BLOUNT	SiL			
135	30.6	116.4	0		BLOUNT	SiL			
136	0	116.4	1		BLOUNT	SiL			
137	0	116.4	2		BLOUNT	SiL			
138	0	116.4	3		BLOUNT	SiL			
139	0	116.4	4		BLOUNT	SiL			
140	0	116.4	5		BLOUNT	SiL			
141	0	116.4	6		BLOUNT	SiL			
142	0	116.4	7		BLOUNT	SiL			
143	57.8	127	0		BLOUNT	SiL			
144	44.4	171.4	0		BLOUNT	SiL			
145	61.1	232.5	0		BLOUNT	SiL			
146	0	232.5	1		BLOUNT	SiL			
147	0	232.5	1		BLOUNT	SiL			
148	0	232.5	1		BLOUNT	SiL			
149	0	232.5	1		BLOUNT	SiL			
150	0	232.5	1		BLOUNT	SiL			
151	0	232.5	1		BLOUNT	SiL			
152	0	232.5	1		BLOUNT	SiL			

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
115	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
116	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
117	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
118	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
119	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
120	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
121	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
122	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
123	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
124	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
125	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
126	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
127	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
128	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
129	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
130	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
131	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
132	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
133	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
134	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
135	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
136	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
137	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
138	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
139	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
140	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
141	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
142	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
143	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
144	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
145	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
146	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
147	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
148	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
149	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
150	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
151	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
152	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
115	HINESLY 1985	CORN					3.4	263	2963	1422
116	HINESLY 1985	CORN					3.4	263	2963	1422
117	HINESLY 1985	CORN					3.4	263	2963	1422
118	HINESLY 1985	CORN					3.4	263	2963	1422
119	HINESLY 1985	CORN					3.4	263	2963	1422
120	HINESLY 1985	CORN					3.4	263	2963	1422
121	HINESLY 1985	CORN					3.4	263	2963	1422
122	HINESLY 1985	CORN					3.4	263	2963	1422
123	HINESLY 1985	CORN					3.4	263	2963	1422
124	HINESLY 1985	CORN					3.4	263	2963	1422
125	HINESLY 1985	CORN					3.4	263	2963	1422
126	HINESLY 1985	CORN					3.4	263	2963	1422
127	HINESLY 1985	CORN					3.4	263	2963	1422
128	HINESLY 1985	CORN					3.4	263	2963	1422
129	HINESLY 1985	CORN					3.4	263	2963	1422
130	HINESLY 1985	CORN					3.4	263	2963	1422
131	HINESLY 1985	CORN					3.4	263	2963	1422
132	HINESLY 1985	CORN					3.4	263	2963	1422
133	HINESLY 1985	CORN					3.4	263	2963	1422
134	HINESLY 1985	CORN					3.4	263	2963	1422
135	HINESLY 1985	CORN					3.4	263	2963	1422
136	HINESLY 1985	CORN					3.4	263	2963	1422
137	HINESLY 1985	CORN					3.4	263	2963	1422
138	HINESLY 1985	CORN					3.4	263	2963	1422
139	HINESLY 1985	CORN					3.4	263	2963	1422
140	HINESLY 1985	CORN					3.4	263	2963	1422
141	HINESLY 1985	CORN					3.4	263	2963	1422
142	HINESLY 1985	CORN					3.4	263	2963	1422
143	HINESLY 1985	CORN					3.4	263	2963	1422
144	HINESLY 1985	CORN					3.4	263	2963	1422
145	HINESLY 1985	CORN					3.4	263	2963	1422
146	HINESLY 1985	CORN					3.4	263	2963	1422
147	HINESLY 1985	CORN					3.4	263	2963	1422
148	HINESLY 1985	CORN					3.4	263	2963	1422
149	HINESLY 1985	CORN					3.4	263	2963	1422
150	HINESLY 1985	CORN					3.4	263	2963	1422
151	HINESLY 1985	CORN					3.4	263	2963	1422
152	HINESLY 1985	CORN					3.4	263	2963	1422

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
77		MUSCLE SCHOALES, AL
78		MUSCLE SCHOALES, AL
79		MUSCLE SCHOALES, AL
80		MUSCLE SCHOALES, AL
81		MUSCLE SCHOALES, AL
82		MUSCLE SCHOALES, AL
83	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	MUSCLE SCHOALES, AL
84		MUSCLE SCHOALES, AL
85		MUSCLE SCHOALES, AL
86		MUSCLE SCHOALES, AL
87		MUSCLE SCHOALES, AL
88		MUSCLE SCHOALES, AL
89	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	MUSCLE SCHOALES, AL
90		MUSCLE SCHOALES, AL
91		MUSCLE SCHOALES, AL
92		MUSCLE SCHOALES, AL
93		MUSCLE SCHOALES, AL
94		MUSCLE SCHOALES, AL
95	*AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS	MUSCLE SCHOALES, AL
96		MUSCLE SCHOALES, AL
97		MUSCLE SCHOALES, AL
98		MUSCLE SCHOALES, AL
99	*AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS	MUSCLE SCHOALES, AL
100		MUSCLE SCHOALES, AL
101		MUSCLE SCHOALES, AL
102		MUSCLE SCHOALES, AL
103	*AUTHORS STATE YIELD REDUCTIONS NOT ATTRIBUTABLE TO METALS	MUSCLE SCHOALES, AL
104		MUSCLE SCHOALES, AL
105		MUSCLE SCHOALES, AL
106		MUSCLE SCHOALES, AL
107		MUSCLE SCHOALES, AL
108		MUSCLE SCHOALES, AL
109		MUSCLE SCHOALES, AL
110		MUSCLE SCHOALES, AL
111		MUSCLE SCHOALES, AL
112		MUSCLE SCHOALES, AL
113		JOLIET, ILLINOIS
114		JOLIET, ILLINOIS

TABLE F-3 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY
77	0	EDIBLE PART			NO
78	0	EDIBLE PART			NO
79	0	EDIBLE PART			NO
80	0	EDIBLE PART			NO
81	0	EDIBLE PART			NO
82	0	EDIBLE PART			NO
83	25*	EDIBLE PART			*NO
84	0	EDIBLE PART			NO
85	0	EDIBLE PART			NO
86	0	EDIBLE PART			NO
87	0	EDIBLE PART			NO
88	0	EDIBLE PART			NO
89	21.1*	EDIBLE PART			*NO
90	0	EDIBLE PART			NO
91	0	EDIBLE PART			NO
92	0	EDIBLE PART			NO
93	0	TOTAL PLANT			NO
94	0	TOTAL PLANT			NO
95	15.4*	TOTAL PLANT			*NO
96	0	TOTAL PLANT			NO
97	0	TOTAL PLANT			NO
98	0	TOTAL PLANT			NO
99	10*	TOTAL PLANT			*NO
100	0	TOTAL PLANT			NO
101	0	TOTAL PLANT			NO
102	0	TOTAL PLANT			NO
103	12.5*	TOTAL PLANT			*NO
104	0	TOTAL PLANT			NO
105	0	TOTAL PLANT			NO
106	0	TOTAL PLANT			NO
107	0	TOTAL PLANT			NO
108	0	TOTAL PLANT			NO
109	0	TOTAL PLANT			NO
110	0	TOTAL PLANT			NO
111	0	TOTAL PLANT			NO
112	0	TOTAL PLANT			NO
113	0	GRAIN	0	STOVER	NO
114	0	GRAIN	0	STOVER	NO

TABLE F-3 (cont.)

	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Ni LOADING RATE (kg/ha)	SOIL EXTRACTANT	SOIL Ni CONCENTRTN mg/kg	PLANT Ni CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESIGN SUMMARY
77			6.4	4.4	0.5 M HCL	1.8	2.4	LEAF	FIELD, SLUDGE, MATURITY
78			5.8	0	0.5 M HCL	1	1.8	LEAF	FIELD, SLUDGE, MATURITY
79			5.8	2.2	0.5 M HCL	2.7	1.7	LEAF	FIELD, SLUDGE, MATURITY
80			5.8	4.4	0.5 M HCL	1.8	1.8	LEAF	FIELD, SLUDGE, MATURITY
81			5.8	0	0.5 M HCL	1	2.3	LEAF	FIELD, SLUDGE, MATURITY
82			5.8	2.2	0.5 M HCL	2.7	3	LEAF	FIELD, SLUDGE, MATURITY
83			5.8	4.4	0.5 M HCL	1.8	2.4	LEAF	FIELD, SLUDGE, MATURITY
84			5.8	0	0.5 M HCL	1	2.5	LEAF	FIELD, SLUDGE, MATURITY
85			5.8	2.2	0.5 M HCL	2.7	2.8	LEAF	FIELD, SLUDGE, MATURITY
86			5.8	4.4	0.5 M HCL	1.8	2.2	LEAF	FIELD, SLUDGE, MATURITY
87			5.8	0	0.5 M HCL	1	2.6	LEAF	FIELD, SLUDGE, MATURITY
88			5.8	2.2	0.5 M HCL	2.7	4.4	LEAF	FIELD, SLUDGE, MATURITY
89			5.8	4.4	0.5 M HCL	1.8	2.9	LEAF	FIELD, SLUDGE, MATURITY
90			5.8	0	0.5 M HCL	1	3.9	LEAF	FIELD, SLUDGE, MATURITY
91			5.8	2.2	0.5 M HCL	2.7	4.4	LEAF	FIELD, SLUDGE, MATURITY
92			5.8	4.4	0.5 M HCL	1.8	4.9	LEAF	FIELD, SLUDGE, MATURITY
93			5.1	0	.5 M HCL	0.6	3.5	LEAF	FIELD, SLUDGE, MATURITY
94			5.1	0	.5 M HCL	0.6	3	LEAF	FIELD, SLUDGE, MATURITY
95			5.1	4.5	.5 M HCL	1.6	6.3	LEAF	FIELD, SLUDGE, MATURITY
96			5.1	4.5	.5 M HCL	1.2	7.4	LEAF	FIELD, SLUDGE, MATURITY
97			5.1	0	.5 M HCL	0.6	4.6	LEAF	FIELD, SLUDGE, MATURITY
98			5.1	0	.5 M HCL	0.6	3.1	LEAF	FIELD, SLUDGE, MATURITY
99			5.1	4.5	.5 M HCL	1.6	3.3	LEAF	FIELD, SLUDGE, MATURITY
100			5.1	4.5	.5 M HCL	1.2	2.9	LEAF	FIELD, SLUDGE, MATURITY
101			5.1	0	.5 M HCL	0.6	3.7	LEAF	FIELD, SLUDGE, MATURITY
102			5.1	0	.5 M HCL	0.6	4.6	LEAF	FIELD, SLUDGE, MATURITY
103			5.1	4.5	.5 M HCL	1.6	3.7	LEAF	FIELD, SLUDGE, MATURITY
104			5.1	4.5	.5 M HCL	1.2	4.1	LEAF	FIELD, SLUDGE, MATURITY
105			5.1	0	.5 M HCL	0.6	2.2	LEAF	FIELD, SLUDGE, MATURITY
106			5.1	0	.5 M HCL	0.6	2.4	LEAF	FIELD, SLUDGE, MATURITY
107			5.1	4.5	.5 M HCL	1.6	2.2	LEAF	FIELD, SLUDGE, MATURITY
108			5.1	4.5	.5 M HCL	1.2	2.2	LEAF	FIELD, SLUDGE, MATURITY
109			5.1	0	.5 M HCL	0.6	3	LEAF	FIELD, SLUDGE, MATURITY
110			5.1	0	.5 M HCL	0.6	3.3	LEAF	FIELD, SLUDGE, MATURITY
111			5.1	4.5	.5 M HCL	1.6	3.5	LEAF	FIELD, SLUDGE, MATURITY
112			5.1	4.5	.5 M HCL	1.2	3.3	LEAF	FIELD, SLUDGE, MATURITY
113		0.85	7.8	0	HCL-HF	24	1.2	LEAF	SLUDGE, FIELD, MATURITY
114		0.9	6.9	0	HCL-HF	27	0.9	LEAF	SLUDGE, FIELD, MATURITY

TABLE F-3 (cont.)

	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE	CONTENT %	CONTENT %	CONTENT %
77	112	112	0		SANGO	SiL			
78	0	0			SANGO	SiL			
79	112	112	1		SANGO	SiL			
80	112	112	1		SANGO	SiL			
81	0	0			SANGO	SiL			
82	112	112	1		SANGO	SiL			
83	112	112	1		SANGO	SiL			
84	0	0			SANGO	SiL			
85	112	112	1		SANGO	SiL			
86	112	112	1		SANGO	SiL			
87	0	0			SANGO	SiL			
88	112	112	1		SANGO	SiL			
89	112	112	1		SANGO	SiL			
90	0	0			SANGO	SiL			
91	112	112	1		SANGO	SiL			
92	112	112	1		SANGO	SiL			
93	0	0			SANGO	SiL			
94	0	0			SANGO	SiL			
95	224	224	0		SANGO	SiL			
96	224	224	0		SANGO	SiL			
97	0	0			SANGO	SiL			
98	0	0			SANGO	SiL			
99	224	224	0		SANGO	SiL			
100	224	224	0		SANGO	SiL			
101	0	0			SANGO	SiL			
102	0	0			SANGO	SiL			
103	224	224	0		SANGO	SiL			
104	224	224	0		SANGO	SiL			
105	0	0			SANGO	SiL			
106	0	0			SANGO	SiL			
107	224	224	0		SANGO	SiL			
108	224	224	0		SANGO	SiL			
109	0	0			SANGO	SiL			
110	0	0			SANGO	SiL			
111	224	224	0		SANGO	SiL			
112	224	224	0		SANGO	SiL			
113	0	0	NA		BLOUNT	SiL			
114	0	0	NA		BLOUNT	SiL			

TABLE F-3 (cont.)

	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING	SLUDGE CHEMICAL STABILIZATN
77	1.5	2.1	40	1.3	1600	1800			
78									
79	1.7	2.3	20	1.6	530	1800			
80	1.5	2.1	40	1.3	1600	1800			
81									
82	1.7	2.3	20	1.6	530	1800			
83	1.5	2.1	40	1.3	1600	1800			
84									
85	1.7	2.3	20	1.6	530	1800			
86	1.5	2.1	40	1.3	1600	1800			
87									
88	1.7	2.3	20	1.6	530	1800			
89	1.5	2.1	40	1.3	1600	1800			
90									
91	1.7	2.3	20	1.6	530	1800			
92	1.5	2.1	40	1.3	1600	1800			
93	1.7	2.3	20	1.6	530	1800			
94	1.7	2.3	20	1.6	530	1800			
95	1.7	2.3	20	1.6	530	1800			
96	1.7	2.3	20	1.6	530	1800			
97	1.7	2.3	20	1.6	530	1800			
98	1.7	2.3	20	1.6	530	1800			
99	1.7	2.3	20	1.6	530	1800			
100	1.7	2.3	20	1.6	530	1800			
101	1.7	2.3	20	1.6	530	1800			
102	1.7	2.3	20	1.6	530	1800			
103	1.7	2.3	20	1.6	530	1800			
104	1.7	2.3	20	1.6	530	1800			
105	1.7	2.3	20	1.6	530	1800			
106	1.7	2.3	20	1.6	530	1800			
107	1.7	2.3	20	1.6	530	1800			
108	1.7	2.3	20	1.6	530	1800			
109	1.7	2.3	20	1.6	530	1800			
110	1.7	2.3	20	1.6	530	1800			
111	1.7	2.3	20	1.6	530	1800			
112	1.7	2.3	20	1.6	530	1800			
113	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3
114	4.5	5.9	316	3.5	1135	5059	0.03	2ND TRTMNT, ANAEROBIC DIGESTION	CENT POLY, FECL3

TABLE F-3 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg
77	GIORDANO & MAYS 1977	KALE		6.1			1.7	40	400	520
78	GIORDANO & MAYS 1977	OKRA								
79	GIORDANO & MAYS 1977	OKRA		6.6			2.5	50	350	730
80	GIORDANO & MAYS 1977	OKRA		6.1			1.7	40	400	520
81	GIORDANO & MAYS 1977	PEPPER								
82	GIORDANO & MAYS 1977	PEPPER		6.6			2.5	50	350	730
83	GIORDANO & MAYS 1977	PEPPER		6.1			1.7	40	400	520
84	GIORDANO & MAYS 1977	TOMATO								
85	GIORDANO & MAYS 1977	TOMATO		6.6			2.5	50	350	730
86	GIORDANO & MAYS 1977	TOMATO		6.1			1.7	40	400	520
87	GIORDANO & MAYS 1977	SQUASH								
88	GIORDANO & MAYS 1977	SQUASH		6.6			2.5	50	350	730
89	GIORDANO & MAYS 1977	SQUASH		6.1			1.7	40	400	520
90	GIORDANO & MAYS 1977	LETTUCE								
91	GIORDANO & MAYS 1977	LETTUCE		6.6			2.5	50	350	730
92	GIORDANO & MAYS 1977	LETTUCE		6.1			1.7	40	400	520
93	GIORDANO&MAYS 1977	LETTUCE		6.6			2.5	50	350	730
94	GIORDANO&MAYS 1977	LETTUCE		6.6			2.5	50	350	730
95	GIORDANO&MAYS 1977	LETTUCE		6.6			2.5	50	350	730
96	GIORDANO&MAYS 1977	LETTUCE		6.6			2.5	50	350	730
97	GIORDANO&MAYS 1977	PEPPER		6.6			2.5	50	350	730
98	GIORDANO&MAYS 1977	PEPPER		6.6			2.5	50	350	730
99	GIORDANO&MAYS 1977	PEPPER		6.6			2.5	50	350	730
100	GIORDANO&MAYS 1977	PEPPER		6.6			2.5	50	350	730
101	GIORDANO&MAYS 1977	BEAN		6.6			2.5	50	350	730
102	GIORDANO&MAYS 1977	BEAN		6.6			2.5	50	350	730
103	GIORDANO&MAYS 1977	BEAN		6.6			2.5	50	350	730
104	GIORDANO&MAYS 1977	BEAN		6.6			2.5	50	350	730
105	GIORDANO&MAYS 1977	CORN		6.6			2.5	50	350	730
106	GIORDANO&MAYS 1977	CORN		6.6			2.5	50	350	730
107	GIORDANO&MAYS 1977	CORN		6.6			2.5	50	350	730
108	GIORDANO&MAYS 1977	CORN		6.6			2.5	50	350	730
109	GIORDANO&MAYS 1977	SQUASH		6.6			2.5	50	350	730
110	GIORDANO&MAYS 1977	SQUASH		6.6			2.5	50	350	730
111	GIORDANO&MAYS 1977	SQUASH		6.6			2.5	50	350	730
112	GIORDANO&MAYS 1977	SQUASH		6.6			2.5	50	350	730
113	HINESLY 1985	CORN					3.4	263	2963	1422
114	HINESLY 1985	CORN					3.4	263	2963	1422

TABLE F-3 (cont.)

	COMMENTS	LOCATION OF STUDY
39		MUSCLE SCHOALES, AL
40	*DOSE RESPONSE & TISSUE NI CONCENTRATION INCONSISTANT	MUSCLE SCHOALES, AL
41		MUSCLE SCHOALES, AL
42		MUSCLE SCHOALES, AL
43	*DOSE RESPONSE NOT CONSISTANT, PH<5.5	MUSCLE SCHOALES, AL
44		MUSCLE SCHOALES, AL
45		MUSCLE SCHOALES, AL
46		MUSCLE SCHOALES, AL
47		MUSCLE SCHOALES, AL
48		MUSCLE SCHOALES, AL
49		MUSCLE SCHOALES, AL
50		MUSCLE SCHOALES, AL
51	*DOSE RESPONSE & TISSUE NI CONCENTRATION NOT CONSISTANT	MUSCLE SCHOALES, AL
52	*DOSE RESPONSE & TISSUE NI CONCENTRATION NOT CONSISTANT	MUSCLE SCHOALES, AL
53		MUSCLE SCHOALES, AL
54	*TISSUE NI NOT CONSISTANT, SOIL PH<5.5, SLUDGE LOADING EXCEEDS AGRONOMIC RATES	MUSCLE SCHOALES, AL
55	*TISSUE NI NOT CONSISTANT, SOIL PH<5.5, SLUDGE LOADING EXCEEDS AGRONOMIC RATES	MUSCLE SCHOALES, AL
56	*TISSUE NI NOT CONSISTANT, SLUDGE LOADING EXCEEDS AGRONOMIC RATES	MUSCLE SCHOALES, AL
57		MUSCLE SCHOALES, AL
58		MUSCLE SCHOALES, AL
59	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	MUSCLE SCHOALES, AL
60		MUSCLE SCHOALES, AL
61	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	MUSCLE SCHOALES, AL
62	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	MUSCLE SCHOALES, AL
63		MUSCLE SCHOALES, AL
64		MUSCLE SCHOALES, AL
65	*NOT TESTED STATISTICALLY, MAY BE ATTRIBUTED TO WET SEASON/INSECTS	MUSCLE SCHOALES, AL
66		MUSCLE SCHOALES, AL
67		MUSCLE SCHOALES, AL
68		MUSCLE SCHOALES, AL
69		MUSCLE SCHOALES, AL
70		MUSCLE SCHOALES, AL
71		MUSCLE SCHOALES, AL
72		MUSCLE SCHOALES, AL
73		MUSCLE SCHOALES, AL
74		MUSCLE SCHOALES, AL
75		MUSCLE SCHOALES, AL
76		MUSCLE SCHOALES, AL

TABLE F-4 (cont.)

	LOCATION OF STUDY
381	Joliet, Ill.
382	Joliet, Ill.
383	Joliet, Ill.
384	Joliet, Ill.
385	Joliet, Ill.
386	Joliet, Ill.
387	Joliet, Ill.
388	Joliet, Ill.
389	Joliet, Ill.
390	Joliet, Ill.
391	Joliet, Ill.
392	Joliet, Ill.
393	Joliet, Ill.
394	Joliet, Ill.
395	Joliet, Ill.
396	Joliet, Ill.
397	Joliet, Ill.
398	Joliet, Ill.
399	Joliet, Ill.
400	Joliet, Ill.
401	Joliet, Ill.
402	Joliet, Ill.
403	Joliet, Ill.
404	Joliet, Ill.
405	Joliet, Ill.
406	Joliet, Ill.
407	Joliet, Ill.
408	Joliet, Ill.
409	Joliet, Ill.
410	Joliet, Ill.
411	Joliet, Ill.
412	Joliet, Ill.
413	Joliet, Ill.
414	Joliet, Ill.
415	Joliet, Ill.
416	Joliet, Ill.
417	Joliet, Ill.
418	Joliet, Ill.

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
419	Hinesly, T.D. et al., 1978. #95	Corn	H96					
420	Hinesly, T.D. et al., 1978. #95	Corn	R177					
421	Hinesly, T.D. et al., 1978. #95	Corn	B77					
422	Hinesly, T.D. et al., 1978. #95	Corn	Oh43					
423	Hinesly, T.D. et al., 1978. #95	Corn	R806					
424	Hinesly, T.D. et al., 1978. #95	Corn	H98					
425	Hinesly, T.D. et al., 1978. #95	Corn	A619					
426	Hinesly, T.D. et al., 1978. #95	Corn	Mo17					
427	Hinesly, T.D. et al., 1978. #95	Corn	Oh545					
428	Hinesly, T.D. et al., 1978. #95	Corn	B37					
429	Hinesly, T.D. et al., 1978. #95	Corn	R805					
430	Hinesly, T.D. et al., 1978. #95	Corn	Va26					
431	Hinesly, T.D. et al., 1978. #95	Corn	H100					
432	Hinesly, T.D. et al., 1978. #95	Corn	B73					
433	Hinesly, T.D. et al., 1978. #95	Corn	B14					
434	Hinesly, T.D. et al., 1978. #95	Corn	A632					
435	Hinesly, T.D. et al., 1978. #95	Corn	N28					
436	Hinesly, T.D. et al., 1978. #95	Corn	W64A					
437	Hinesly, T.D. et al., 1978. #95	Corn	R802A					
438	Hinesly, T.D. et al., 1978. #95	Corn	H99					
439	Hinesly, T.D. et al., 1978. #95	Corn	H96					
440	Hinesly, T.D. et al., 1978. #95	Corn	R177					
441	Hinesly, T.D. et al., 1978. #95	Corn	B77					
442	Hinesly, T.D. et al., 1978. #95	Corn	Oh43					
443	Hinesly, T.D. et al., 1978. #95	Corn	R806					
444	Hinesly, T.D. et al., 1978. #95	Corn	H98					
445	Hinesly, T.D. et al., 1978. #95	Corn	A619					
446	Hinesly, T.D. et al., 1978. #95	Corn	Mo17					
447	Hinesly, T.D. et al., 1978. #95	Corn	Oh545					
448	Hinesly, T.D. et al., 1978. #95	Corn	B37					
449	Hinesly, T.D. et al., 1978. #95	Corn	R805					
450	Hinesly, T.D. et al., 1978. #95	Corn	Va26					
451	Hinesly, T.D. et al., 1978. #95	Corn	H100					
452	Hinesly, T.D. et al., 1978. #95	Corn	B73					
453	Hinesly, T.D. et al., 1978. #95	Corn	B14					
454	Hinesly, T.D. et al., 1978. #95	Corn	A632					
455	Hinesly, T.D. et al., 1978. #95	Corn	N28					
456	Hinesly, T.D. et al., 1978. #95	Corn	W64A					

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
419										One-quarter maximum
420										One-quarter maximum
421										One-quarter maximum
422										One-half maximum
423										One-half maximum
424										One-half maximum
425										One-half maximum
426										One-half maximum
427										One-half maximum
428										One-half maximum
429										One-half maximum
430										One-half maximum
431										One-half maximum
432										One-half maximum
433										One-half maximum
434										One-half maximum
435										One-half maximum
436										One-half maximum
437										One-half maximum
438										One-half maximum
439										One-half maximum
440										One-half maximum
441										One-half maximum
442										Maximum
443										Maximum
444										Maximum
445										Maximum
446										Maximum
447										Maximum
448										Maximum
449										Maximum
450										Maximum
451										Maximum
452										Maximum
453										Maximum
454										Maximum
455										Maximum
456										Maximum

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
419		17.75		7	Aeric Ochraqualf	Blount	silt loam
420		17.75		7	Aeric Ochraqualf	Blount	silt loam
421		17.75		7	Aeric Ochraqualf	Blount	silt loam
422		35.5		7	Aeric Ochraqualf	Blount	silt loam
423		35.5		7	Aeric Ochraqualf	Blount	silt loam
424		35.5		7	Aeric Ochraqualf	Blount	silt loam
425		35.5		7	Aeric Ochraqualf	Blount	silt loam
426		35.5		7	Aeric Ochraqualf	Blount	silt loam
427		35.5		7	Aeric Ochraqualf	Blount	silt loam
428		35.5		7	Aeric Ochraqualf	Blount	silt loam
429		35.5		7	Aeric Ochraqualf	Blount	silt loam
430		35.5		7	Aeric Ochraqualf	Blount	silt loam
431		35.5		7	Aeric Ochraqualf	Blount	silt loam
432		35.5		7	Aeric Ochraqualf	Blount	silt loam
433		35.5		7	Aeric Ochraqualf	Blount	silt loam
434		35.5		7	Aeric Ochraqualf	Blount	silt loam
435		35.5		7	Aeric Ochraqualf	Blount	silt loam
436		35.5		7	Aeric Ochraqualf	Blount	silt loam
437		35.5		7	Aeric Ochraqualf	Blount	silt loam
438		35.5		7	Aeric Ochraqualf	Blount	silt loam
439		35.5		7	Aeric Ochraqualf	Blount	silt loam
440		35.5		7	Aeric Ochraqualf	Blount	silt loam
441		35.5		7	Aeric Ochraqualf	Blount	silt loam
442		71		7	Aeric Ochraqualf	Blount	silt loam
443		71		7	Aeric Ochraqualf	Blount	silt loam
444		71		7	Aeric Ochraqualf	Blount	silt loam
445		71		7	Aeric Ochraqualf	Blount	silt loam
446		71		7	Aeric Ochraqualf	Blount	silt loam
447		71		7	Aeric Ochraqualf	Blount	silt loam
448		71		7	Aeric Ochraqualf	Blount	silt loam
449		71		7	Aeric Ochraqualf	Blount	silt loam
450		71		7	Aeric Ochraqualf	Blount	silt loam
451		71		7	Aeric Ochraqualf	Blount	silt loam
452		71		7	Aeric Ochraqualf	Blount	silt loam
453		71		7	Aeric Ochraqualf	Blount	silt loam
454		71		7	Aeric Ochraqualf	Blount	silt loam
455		71		7	Aeric Ochraqualf	Blount	silt loam
456		71		7	Aeric Ochraqualf	Blount	silt loam

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
419							
420							
421							
422							
423							
424							
425							
426							
427							
428							
429							
430							
431							
432							
433							
434							
435							
436							
437							
438							
439							
440							
441							
442							
443							
444							
445							
446							
447							
448							
449							
450							
451							
452							
453							
454							
455							
456							

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
419		188	43.3		SLUDGE, FIELD, MATURITY	NOT REPORTED	
420		188	34.3		SLUDGE, FIELD, MATURITY	NOT REPORTED	
421		188	32		SLUDGE, FIELD, MATURITY	NOT REPORTED	
422		326	142.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
423		326	156.1		SLUDGE, FIELD, MATURITY	NOT REPORTED	
424		326	112.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
425		326	62		SLUDGE, FIELD, MATURITY	NOT REPORTED	
426		326	107.1		SLUDGE, FIELD, MATURITY	NOT REPORTED	
427		326	89.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
428		326	99		SLUDGE, FIELD, MATURITY	NOT REPORTED	
429		326	91		SLUDGE, FIELD, MATURITY	NOT REPORTED	
430		326	77.1		SLUDGE, FIELD, MATURITY	NOT REPORTED	
431		326	65.9		SLUDGE, FIELD, MATURITY	NOT REPORTED	
432		326	77.7		SLUDGE, FIELD, MATURITY	NOT REPORTED	
433		326	71		SLUDGE, FIELD, MATURITY	NOT REPORTED	
434		326	52.8		SLUDGE, FIELD, MATURITY	NOT REPORTED	
435		326	56.7		SLUDGE, FIELD, MATURITY	NOT REPORTED	
436		326	55.4		SLUDGE, FIELD, MATURITY	NOT REPORTED	
437		326	65.3		SLUDGE, FIELD, MATURITY	NOT REPORTED	
438		326	47.9		SLUDGE, FIELD, MATURITY	NOT REPORTED	
439		326	63.5		SLUDGE, FIELD, MATURITY	NOT REPORTED	
440		326	64.8		SLUDGE, FIELD, MATURITY	NOT REPORTED	
441		326	43.7		SLUDGE, FIELD, MATURITY	NOT REPORTED	
442		454	281.8		SLUDGE, FIELD, MATURITY	NOT REPORTED	
443		454	268.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
444		454	217.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
445		454	193.3		SLUDGE, FIELD, MATURITY	NOT REPORTED	
446		454	188.8		SLUDGE, FIELD, MATURITY	NOT REPORTED	
447		454	170.6		SLUDGE, FIELD, MATURITY	NOT REPORTED	
448		454	164.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
449		454	148.1		SLUDGE, FIELD, MATURITY	NOT REPORTED	
450		454	144.4		SLUDGE, FIELD, MATURITY	NOT REPORTED	
451		454	140.1		SLUDGE, FIELD, MATURITY	NOT REPORTED	
452		454	133.7		SLUDGE, FIELD, MATURITY	NOT REPORTED	
453		454	130.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	
454		454	113		SLUDGE, FIELD, MATURITY	NOT REPORTED	
455		454	109.4		SLUDGE, FIELD, MATURITY	NOT REPORTED	
456		454	107.2		SLUDGE, FIELD, MATURITY	NOT REPORTED	

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
419			NO	
420			NO	
421			NO	
422			NO	
423			NO	
424			NO	
425			NO	
426			NO	
427			NO	
428			NO	
429			NO	
430			NO	
431			NO	
432			NO	
433			NO	
434			NO	
435			NO	
436			NO	
437			NO	
438			NO	
439			NO	
440			NO	
441			NO	
442			NO	
443			NO	
444			NO	
445			NO	
446			NO	
447			NO	
448			NO	
449			NO	
450			NO	
451			NO	
452			NO	
453			NO	
454			NO	
455			NO	
456			NO	

TABLE F-4 (cont.)

	LOCATION OF STUDY
419	Joliet, Ill.
420	Joliet, Ill.
421	Joliet, Ill.
422	Joliet, Ill.
423	Joliet, Ill.
424	Joliet, Ill.
425	Joliet, Ill.
426	Joliet, Ill.
427	Joliet, Ill.
428	Joliet, Ill.
429	Joliet, Ill.
430	Joliet, Ill.
431	Joliet, Ill.
432	Joliet, Ill.
433	Joliet, Ill.
434	Joliet, Ill.
435	Joliet, Ill.
436	Joliet, Ill.
437	Joliet, Ill.
438	Joliet, Ill.
439	Joliet, Ill.
440	Joliet, Ill.
441	Joliet, Ill.
442	Joliet, Ill.
443	Joliet, Ill.
444	Joliet, Ill.
445	Joliet, Ill.
446	Joliet, Ill.
447	Joliet, Ill.
448	Joliet, Ill.
449	Joliet, Ill.
450	Joliet, Ill.
451	Joliet, Ill.
452	Joliet, Ill.
453	Joliet, Ill.
454	Joliet, Ill.
455	Joliet, Ill.
456	Joliet, Ill.

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
457	Hinesly, T.D. et al., 1978. #95	Corn	R802A					
458	Hinesly, T.D. et al., 1978. #95	Corn	H99					
459	Hinesly, T.D. et al., 1978. #95	Corn	H96					
460	Hinesly, T.D. et al., 1978. #95	Corn	R177					
461	Hinesly, T.D. et al., 1978. #95	Corn	B77					
462	Hue, N.V., 1988. #104	Sudangrass	Piper				0.97	5
463	Hue, N.V., 1988. #104	Sudangrass	Piper				0.97	5
464	Hue, N.V., 1988. #104	Sudangrass	Piper				0.97	5
465	Hue, N.V., 1988. #104	Sudangrass	Piper				0.97	5
466	Kirkham, M.B., 1975 #125	Corn						
467	Kirkham, M.B., 1975 #125	Corn						
468	Kirkham, M.B., 1975 #125	Corn						830
469	Kirkham, M.B., 1983 #127	Sorghum	Dekalb C-46 Plus	6.7	7770			29.2
470	Kirkham, M.B., 1983 #127	Sorghum	Dekalb C-46 Plus	6.7	7770			29.2
471	MacLean, K.S. et al., 1987. #147	Legume						8-17.6
472	MacLean, K.S. et al., 1987. #147	Legume						8-17.6
473	MacLean, K.S. et al., 1987. #147	GRASS						8-17.6
474	MacLean, K.S. et al., 1987. #147	GRASS						8-17.6
475	Sikora, Lawrence J. et al., 1980. #214	Oats	Clintford	11.2	19			2
476	Sikora, Lawrence J. et al., 1980. #214	Oats	Clintford	6.9	22			18
477	Sikora, Lawrence J. et al., 1980. #214	Wheat	Potomac	11.2	19			2
478	Sikora, Lawrence J. et al., 1980. #214	Wheat	Potomac	6.9	22			18
479	Sikora, Lawrence J. et al., 1980. #214	Chard	Fordhook Giant Swiss	11.2	19			2
480	Sikora, Lawrence J. et al., 1980. #214	Chard	Fordhook Giant Swiss	6.9	22			18
481	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
482	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
483	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
484	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
485	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
486	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
487	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
488	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
489	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
490	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
491	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
492	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
493	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
494	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					

TABLE F-4 (cont.)

	SLUDGE	SLUDGE	SLUDGE	SLUDGE	SLUDGE	SLUDGE	SLUDGE	SLUDGE	SLUDGE	SLUDGE
	Cr	Cu	Fe	N	Ni	P	Pb	Zn	SOLIDS	BIOLOGICAL
	mg/kg	mg/kg	%	%	mg/kg	mg/kg	mg/kg	mg/kg	CONTNT	PROCESSING
457										Maximum
458										Maximum
459										Maximum
460										Maximum
461										Maximum
462		440		5	29			640		
463		440		5	29			640		
464		440		5	29			640		
465		440		5	29			640		
466										control
467										supernatant
468	5900	6020			ND	24000		8390		sludge
469	851	375			35.6	21300	124	1890		Sludge-treated soil
470	851	375			35.6	21300	124	1890		Control
471	31-130	398-678			28-56		288-684	610-1398		Treated with sludge
472	31-130	398-678			28-56		288-684	610-1398		Untreated
473	31-130	398-678			28-56		288-684	610-1398		Treated with sludge
474	31-130	398-678			28-56		288-684	610-1398		Untreated
475		200						400		Limed raw sludge
476		627						2050		Digested sludge
477		200						400		Limed raw sludge
478		627						2050		Digested sludge
479		200						400		Limed raw sludge
480		627						2050		Digested sludge
481										
482										
483										
484										
485										
486										
487										
488										
489										
490										
491										
492										
493										
494										

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
457		71		7	Aeric Ochraqualf	Blount	silt loam
458		71		7	Aeric Ochraqualf	Blount	silt loam
459		71		7	Aeric Ochraqualf	Blount	silt loam
460		71		7	Aeric Ochraqualf	Blount	silt loam
461		71		7	Aeric Ochraqualf	Blount	silt loam
462		0	0	3	Tropeptic Eutrustox	Wahiawa	silty clay
463		45	45	3	Tropeptic Eutrustox	Wahiawa	silty clay
464		90	90	3	Tropeptic Eutrustox	Wahiawa	silty clay
465		180	180	0	Tropeptic Eutrustox	Wahiawa	silty clay
466		0		8		Warsaw	silt loam
467				8		Warsaw	silt loam
468			1010	8		Warsaw	silt loam
469		32	128		Typic Udifluvent	Haynie	vf sandy loam
470		32	128		Typic Udifluvent	Haynie	vf sandy loam
471		44.9(WET WT.)	44.9(WET WT.)	1-2 years			CL, SL
472		0	0	1-2 years			CL, SL
473							CL, SL
474							CL, SL
475						Galestown-Evesboro	loamy sand
476							
477							
478							
479							
480							
481		0	0			DUBLIN	L
482		0	0			DUBLIN	L
483		0	0			DUBLIN	L
484		0	0			DUBLIN	L
485		0	0			DUBLIN	L
486		0	0			DUBLIN	L
487		0	0			DUBLIN	L
488		0	0			DUBLIN	L
489		0	0			DUBLIN	L
490		0	0			DUBLIN	L
491		0	0			DUBLIN	L
492		0	0			DUBLIN	L
493		0	0			DUBLIN	L
494		0	0			DUBLIN	L

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
457							
458							
459							
460							
461							
462					1.14	5.32	0
463					1.22	5.77	29
464					1.34	6.03	58
465					1.6	6.38	116
466				21.1	3.9	6.2	
467						5.9	
468						5.9	10650
469						5.9	
470						7	
471					6.98	6.2	
472					7.48	6.05	
473					6.98	6.2	
474					7.48	6.05	
475						6.7	
476						6.7	
477						6.7	
478						6.7	
479						6.7	
480						6.7	
481				20		5.5	0
482				20		5.5	0
483				20		5.5	0
484				20		5.5	0
485				20		5.5	0
486				20		5.5	0
487				20		5.5	0
488				20		5.5	0
489				20		5.5	0
490				20		5.5	0
491				20		5.5	0
492				20		5.5	0
493				20		5.5	0
494				20		5.5	0

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
457		454	104.9		SLUDGE, FIELD, MATURITY	NOT REPORTED	
458		454	102.9		SLUDGE, FIELD, MATURITY	NOT REPORTED	
459		454	94.3		SLUDGE, FIELD, MATURITY	NOT REPORTED	
460		454	88		SLUDGE, FIELD, MATURITY	NOT REPORTED	
461		454	61.8		SLUDGE, FIELD, MATURITY	NOT REPORTED	
462	DTPA	3.7	176	ABOVE GROUND	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
463	DTPA	8.1	150	ABOVE GROUND	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
464	DTPA	10.3	115	ABOVE GROUND	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
465	DTPA	13.6	172	ABOVE GROUND	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
466	TOTAL	158	67	LEAF	SLUDGE, FIELD, MATURITY	NOT REPORTED	
467	TOTAL	988	202	LEAF	SLUDGE, FIELD, MATURITY	NOT REPORTED	
468	TOTAL	2065	196	LEAF	SLUDGE, FIELD, MATURITY	NOT REPORTED	
469		10.2	37	Leaf	SLUDGE, FIELD, MATURITY	NOT REPORTED	
470		0.8	37	Leaf	SLUDGE, FIELD, MATURITY	NOT REPORTED	
471	.1 N HCL	2.57	28.4	Above Ground	SLUDGE, FIELD, MATURITY	NOT REPORTED	
472	.1 N HCL	2.2	25.9	Above Ground	SLUDGE, FIELD, MATURITY	NOT REPORTED	
473	.1 N HCL	2.57	20.8	Above Ground	SLUDGE, FIELD, MATURITY	NOT REPORTED	
474	.1 N HCL	2.2	23	Above Ground	SLUDGE, FIELD, MATURITY	NOT REPORTED	
475		4.2	5.3	Stover	SLUDGE, FIELD, MATURITY		
476		14.5	71.4	Stover	SLUDGE, FIELD, MATURITY		
477		4.2	5.3	Stover	SLUDGE, FIELD, MATURITY		
478		14.5	69.7	Stover	SLUDGE, FIELD, MATURITY		
479		4.2	53	Whole	SLUDGE, FIELD, MATURITY		
480		14.5	254	Whole	SLUDGE, FIELD, MATURITY		
481			72	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
482			58	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
483			71	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
484			51	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
485			37	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
486			116	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
487			68	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
488			90	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
489			45	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
490			47	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
491			47	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
492			32	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
493			73	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
494			61	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
457			NO	
458			NO	
459			NO	
460			NO	
461			NO	
462			NO	YIELD SIGNIFICANTLY INCREASED BY SLUDGE APPLICATION
463			NO	YIELD SIGNIFICANTLY INCREASED BY SLUDGE APPLICATION
464			NO	YIELD SIGNIFICANTLY INCREASED BY SLUDGE APPLICATION
465			NO	YIELD SIGNIFICANTLY INCREASED BY SLUDGE APPLICATION
466			NO	
467			NO	
468			NO	
469			NO	
470			NO	
471			NO	
472			NO	
473			NO	
474			NO	
475			NO	
476			NO	
477			NO	
478			NO	
479			NO	
480			NO	
481			NO	
482			NO	
483			NO	
484			NO	
485			NO	
486			NO	
487			NO	
488			NO	
489			NO	
490			NO	
491			NO	
492			NO	
493			NO	
494			NO	

TABLE F-4 (cont.)

	LOCATION OF STUDY
457	Joliet, Ill.
458	Joliet, Ill.
459	Joliet, Ill.
460	Joliet, Ill.
461	Joliet, Ill.
462	OAHU, HAWAII
463	OAHU, HAWAII
464	OAHU, HAWAII
465	OAHU, HAWAII
466	Dayton, Ohio
467	Dayton, Ohio
468	Dayton, Ohio
469	Manhattan, Kansas
470	Manhattan, Kansas
471	Pictou county, Nova Scotia
472	Pictou county, Nova Scotia
473	Pictou county, Nova Scotia
474	Pictou county, Nova Scotia
475	Beltsville, Maryland
476	Beltsville, Maryland
477	Beltsville, Maryland
478	Beltsville, Maryland
479	Beltsville, Maryland
480	Beltsville, Maryland
481	BERKELEY, CALIFORNIA
482	BERKELEY, CALIFORNIA
483	BERKELEY, CALIFORNIA
484	BERKELEY, CALIFORNIA
485	BERKELEY, CALIFORNIA
486	BERKELEY, CALIFORNIA
487	BERKELEY, CALIFORNIA
488	BERKELEY, CALIFORNIA
489	BERKELEY, CALIFORNIA
490	BERKELEY, CALIFORNIA
491	BERKELEY, CALIFORNIA
492	BERKELEY, CALIFORNIA
493	BERKELEY, CALIFORNIA
494	BERKELEY, CALIFORNIA

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
495	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
496	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
497	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
498	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
499	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
500	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
501	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
502	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
503	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
504	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
505	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
506	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
507	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
508	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
509	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
510	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
511	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
512	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
513	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
514	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
515	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
516	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
517	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
518	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
519	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
520	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
521	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
522	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
523	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
524	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
525	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
526	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
527	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
528	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
529	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					37
530	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
531	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
532	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
495	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
496	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
497	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
498	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
499	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
500	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	SECONDARY
501	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	SECONDARY
502	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
503	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
504	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
505	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
506	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
507	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	SECONDARY
508	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	SECONDARY
509	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
510	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
511	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
512	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
513	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
514	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	SECONDARY
515	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	SECONDARY
516	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
517	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
518	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
519	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
520	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
521	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	SECONDARY
522	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	SECONDARY
523	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
524	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
525	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
526	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
527	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	PRIMARY
528	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	SECONDARY
529	1470	600	2.2	3.3	180	1.6	1090	3910	0.2	SECONDARY
530										
531										
532										

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
495		45	45	0		DUBLIN	L
496		45	90	0		DUBLIN	L
497		45	135	0		DUBLIN	L
498		45	180	0		DUBLIN	L
499		45	225	0		DUBLIN	L
500		45	270	0		DUBLIN	L
501		45	315	0		DUBLIN	L
502		90	90	0		DUBLIN	L
503		90	180	0		DUBLIN	L
504		90	270	0		DUBLIN	L
505		90	360	0		DUBLIN	L
506		90	450	0		DUBLIN	L
507		90	540	0		DUBLIN	L
508		90	630	0		DUBLIN	L
509		135	135	0		DUBLIN	L
510		135	270	0		DUBLIN	L
511		135	405	0		DUBLIN	L
512		135	540	0		DUBLIN	L
513		135	675	0		DUBLIN	L
514		135	810	0		DUBLIN	L
515		135	945	0		DUBLIN	L
516		180	180	0		DUBLIN	L
517		180	360	0		DUBLIN	L
518		180	540	0		DUBLIN	L
519		180	720	0		DUBLIN	L
520		180	900	0		DUBLIN	L
521		180	1080	0		DUBLIN	L
522		180	1260	0		DUBLIN	L
523		225	225	0		DUBLIN	L
524		225	450	0		DUBLIN	L
525		225	675	0		DUBLIN	L
526		225	900	0		DUBLIN	L
527		225	1125	0		DUBLIN	L
528		225	1350	0		DUBLIN	L
529		225	1575	0		DUBLIN	L
530		0	0			DUBLIN	L
531		0	0			DUBLIN	L
532		0	0			DUBLIN	L

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
495				20		5	176
496				20		5	352
497				20		5	528
498				20		5	686
499				20		5	815
500				20		5	995
501				20		5	1210
502				20		5.2	352
503				20		5.2	704
504				20		5.2	1056
505				20		5.2	1373
506				20		5.2	1630
507				20		5.2	1989
508				20		5.2	2419
509				20		4.5	528
510				20		4.5	1056
511				20		4.5	1584
512				20		4.5	2058
513				20		4.5	2445
514				20		4.5	2984
515				20		4.5	3029
516				20		4.5	704
517				20		4.5	1408
518				20		4.5	2112
519				20		4.5	2746
520				20		4.5	3261
521				20		4.5	3979
522				20		4.5	4839
523				20		NR	880
524				20		NR	1760
525				20		NR	2640
526				20		NR	3432
527				20		NR	4076
528				20		NR	4974
529				20		NR	6050
530				20		5.5	0
531				20		5.5	0
532				20		5.5	0

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
495			76	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
496			81	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
497			90	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
498			100	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
499			127	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
500			147	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
501			149	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
502			92	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
503			85	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
504			115	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
505			131	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
506			127	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
507			333	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
508			236	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
509			81	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
510			159	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
511			215	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
512			259	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
513			351	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
514			435	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
515			462	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
516			113	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
517			150	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
518			248	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
519			341	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
520			402	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
521			455	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
522			820	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
523			NR	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
524			NR	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
525			NR	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
526			NR	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
527			NR	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
528			NR	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
529			NR	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
530			45	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
531			41	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
532			52	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
495			NO	
496			NO	
497			NO	
498			NO	
499			NO	
500			NO	
501			NO	
502			NO	
503			NO	
504			NO	
505			NO	
506			NO	
507			NO	
508			NO	
509			NO	
510			NO	
511			NO	
512			NO	
513			NO	
514			NO	
515			NO	
516			NO	
517			NO	
518			NO	
519			NO	
520			NO	
521			NO	
522			NO	
523			NO	
524			NO	
525			NO	
526			NO	
527			NO	
528			NO	
529			NO	
530			NO	
531			NO	
532			NO	

TABLE F-4 (cont.)

	LOCATION OF STUDY
495	BERKELEY, CALIFORNIA
496	BERKELEY, CALIFORNIA
497	BERKELEY, CALIFORNIA
498	BERKELEY, CALIFORNIA
499	BERKELEY, CALIFORNIA
500	BERKELEY, CALIFORNIA
501	BERKELEY, CALIFORNIA
502	BERKELEY, CALIFORNIA
503	BERKELEY, CALIFORNIA
504	BERKELEY, CALIFORNIA
505	BERKELEY, CALIFORNIA
506	BERKELEY, CALIFORNIA
507	BERKELEY, CALIFORNIA
508	BERKELEY, CALIFORNIA
509	BERKELEY, CALIFORNIA
510	BERKELEY, CALIFORNIA
511	BERKELEY, CALIFORNIA
512	BERKELEY, CALIFORNIA
513	BERKELEY, CALIFORNIA
514	BERKELEY, CALIFORNIA
515	BERKELEY, CALIFORNIA
516	BERKELEY, CALIFORNIA
517	BERKELEY, CALIFORNIA
518	BERKELEY, CALIFORNIA
519	BERKELEY, CALIFORNIA
520	BERKELEY, CALIFORNIA
521	BERKELEY, CALIFORNIA
522	BERKELEY, CALIFORNIA
523	BERKELEY, CALIFORNIA
524	BERKELEY, CALIFORNIA
525	BERKELEY, CALIFORNIA
526	BERKELEY, CALIFORNIA
527	BERKELEY, CALIFORNIA
528	BERKELEY, CALIFORNIA
529	BERKELEY, CALIFORNIA
530	BERKELEY, CALIFORNIA
531	BERKELEY, CALIFORNIA
532	BERKELEY, CALIFORNIA

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
533	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
534	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
535	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
536	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
537	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
538	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
539	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
540	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
541	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
542	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
543	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					
544	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
545	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
546	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
547	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
548	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
549	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
550	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
551	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
552	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
553	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
554	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
555	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
556	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
557	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
558	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
559	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
560	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
561	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
562	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
563	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
564	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
565	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
566	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
567	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
568	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
569	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
570	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
533										
534										
535										
536										
537										
538										
539										
540										
541										
542										
543										
544	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
545	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
546	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
547	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
548	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
549	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
550	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
551	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
552	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
553	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
554	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
555	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
556	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
557	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
558	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
559	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
560	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
561	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
562	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
563	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
564	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
565	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
566	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
567	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
568	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
569	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
570	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
533		0	0			DUBLIN	L
534		0	0			DUBLIN	L
535		0	0			DUBLIN	L
536		0	0			DUBLIN	L
537		0	0			DUBLIN	L
538		0	0			DUBLIN	L
539		0	0			DUBLIN	L
540		0	0			DUBLIN	L
541		0	0			DUBLIN	L
542		0	0			DUBLIN	L
543		0	0			DUBLIN	L
544		45	45	0		DUBLIN	L
545		45	90	0		DUBLIN	L
546		45	135	0		DUBLIN	L
547		45	180	0		DUBLIN	L
548		45	225	0		DUBLIN	L
549		45	270	0		DUBLIN	L
550		45	315	0		DUBLIN	L
551		90	90	0		DUBLIN	L
552		90	180	0		DUBLIN	L
553		90	270	0		DUBLIN	L
554		90	360	0		DUBLIN	L
555		90	450	0		DUBLIN	L
556		90	540	0		DUBLIN	L
557		90	630	0		DUBLIN	L
558		135	135	0		DUBLIN	L
559		135	270	0		DUBLIN	L
560		135	405	0		DUBLIN	L
561		135	540	0		DUBLIN	L
562		135	675	0		DUBLIN	L
563		135	810	0		DUBLIN	L
564		135	945	0		DUBLIN	L
565		180	180	0		DUBLIN	L
566		180	360	0		DUBLIN	L
567		180	540	0		DUBLIN	L
568		180	720	0		DUBLIN	L
569		180	900	0		DUBLIN	L
570		180	1080	0		DUBLIN	L

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
533				20		5.5	0
534				20		5.5	0
535				20		5.5	0
536				20		5.5	0
537				20		5.5	0
538				20		5.5	0
539				20		5.5	0
540				20		5.5	0
541				20		5.5	0
542				20		5.5	0
543				20		5.5	0
544				20		7	20
545				20		7	40
546				20		7	60
547				20		7	92
548				20		7	109
549				20		7	130
550				20		7	152
551				20		7	40
552				20		7	79
553				20		7	119
554				20		7	183
555				20		7	218
556				20		7	259
557				20		7	302
558				20		7	59
559				20		7	119
560				20		7	178
561				20		7	275
562				20		7	325
563				20		7	388
564				20		7	454
565				20		7	99
566				20		7	198
567				20		7	297
568				20		7	426
539				20		7	494
570				20		7	577

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
533			37	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
534			31	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
535			98	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
536			57	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
537			69	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
538			39	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
539			43	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
540			44	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
541			28	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
542			96	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
543			45	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
544			66	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
545			46	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
546			52	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
547			46	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
548			44	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
549			93	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
550			54	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
551			69	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
552			49	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
553			44	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
554			37	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
555			39	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
556			83	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
557			51	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
558			73	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
559			59	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
560			61	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
561			39	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
562			37	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
563			81	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
564			61	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
565			79	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
566			55	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
567			63	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
568			49	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
569			42	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
570			89	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
533			NO	
534			NO	
535			NO	
536			NO	
537			NO	
538			NO	
539			NO	
540			NO	
541			NO	
542			NO	
543			NO	
544			NO	
545			NO	
546			NO	
547			NO	
548			NO	
549			NO	
550			NO	
551			NO	
552			NO	
553			NO	
554			NO	
555			NO	
556			NO	
557			NO	
558			NO	
559			NO	
560			NO	
561			NO	
562			NO	
563			NO	
564			NO	
565			NO	
566			NO	
567			NO	
568			NO	
569			NO	
570			NO	

TABLE F-4 (cont.)

	LOCATION OF STUDY
533	BERKELEY, CALIFORNIA
534	BERKELEY, CALIFORNIA
535	BERKELEY, CALIFORNIA
536	BERKELEY, CALIFORNIA
537	BERKELEY, CALIFORNIA
538	BERKELEY, CALIFORNIA
539	BERKELEY, CALIFORNIA
540	BERKELEY, CALIFORNIA
541	BERKELEY, CALIFORNIA
542	BERKELEY, CALIFORNIA
543	BERKELEY, CALIFORNIA
544	BERKELEY, CALIFORNIA
545	BERKELEY, CALIFORNIA
546	BERKELEY, CALIFORNIA
547	BERKELEY, CALIFORNIA
548	BERKELEY, CALIFORNIA
549	BERKELEY, CALIFORNIA
550	BERKELEY, CALIFORNIA
551	BERKELEY, CALIFORNIA
552	BERKELEY, CALIFORNIA
553	BERKELEY, CALIFORNIA
554	BERKELEY, CALIFORNIA
555	BERKELEY, CALIFORNIA
556	BERKELEY, CALIFORNIA
557	BERKELEY, CALIFORNIA
558	BERKELEY, CALIFORNIA
559	BERKELEY, CALIFORNIA
560	BERKELEY, CALIFORNIA
561	BERKELEY, CALIFORNIA
562	BERKELEY, CALIFORNIA
563	BERKELEY, CALIFORNIA
564	BERKELEY, CALIFORNIA
565	BERKELEY, CALIFORNIA
566	BERKELEY, CALIFORNIA
567	BERKELEY, CALIFORNIA
568	BERKELEY, CALIFORNIA
569	BERKELEY, CALIFORNIA
570	BERKELEY, CALIFORNIA

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
571	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
572	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
573	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
574	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
575	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
576	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
577	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
578	Vlamis, J. et al., 1985. #245	Barley	MARIOUT					8
579	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
580	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
581	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
582	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
583	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
584	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
585	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
586	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
587	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
588	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
589	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
590	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
591	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
592	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
593	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
594	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
595	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
596	Rappaport, B.D. et al., 1987. #197	Corn	Pioneer 3192					
597	BIDWELL AND DOWDY, 1987	CORN						139
598	BIDWELL AND DOWDY, 1987	CORN						139
599	BIDWELL AND DOWDY, 1987	CORN						139
600	BIDWELL AND DOWDY, 1987	CORN						139
601	BIDWELL AND DOWDY, 1987	CORN						139
602	BIDWELL AND DOWDY, 1987	CORN						139
603	BIDWELL AND DOWDY, 1987	CORN						139
604	BIDWELL AND DOWDY, 1987	CORN						139
605	BIDWELL AND DOWDY, 1987	CORN						139
606	BIDWELL AND DOWDY, 1987	CORN						139
607	BIDWELL AND DOWDY, 1987	CORN						139
608	BIDWELL AND DOWDY, 1987	CORN						139

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
571	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
572	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
573	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
574	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
575	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
576	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
577	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
578	40	180	1.2	1.1	40	0.4	250	440	1	COMPOSTED
579										
580										
581										
582										
583										
584										
585										
586										
587										
588										
589										
590										
591										
592										
593										
594										
595										
596										
597								1987		
598								1987		
599								1987		
600								1987		
601								1987		
602								1987		
603								1987		
604								1987		
605								1987		
606								1987		
607								1987		
608								1987		

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
571		180	1260	0		DUBLIN	L
572		225	225	0		DUBLIN	L
573		225	450	0		DUBLIN	L
574		225	675	0		DUBLIN	L
575		225	900	0		DUBLIN	L
576		225	1125	0		DUBLIN	L
577		225	1350	0		DUBLIN	L
578		225	1575	0		DUBLIN	L
579					Typic Hapludult	Bojac	loamy sand
580					Typic Hapludult	Bojac	loamy sand
581					Typic Hapludult	Bojac	loamy sand
582					Typic Hapludult	Bojac	loamy sand
583					Typic Hapludult	Bojac	loamy sand
584					Typic Hapludult	Bojac	loamy sand
585					Rhodic Paleudult	Davidson	clay loam
586					Rhodic Paleudult	Davidson	clay loam
587					Rhodic Paleudult	Davidson	clay loam
588					Rhodic Paleudult	Davidson	clay loam
589					Rhodic Paleudult	Davidson	clay loam
590					Rhodic Paleudult	Davidson	clay loam
591					Typic Hapludult	Groseclose	silt loam
592					Typic Hapludult	Groseclose	silt loam
593					Typic Hapludult	Groseclose	silt loam
594					Typic Hapludult	Groseclose	silt loam
595					Typic Hapludult	Groseclose	silt loam
596					Typic Hapludult	Groseclose	silt loam
597			0	1	Typic Hapludoll	Waukegan	silt loam
598			60	1	Typic Hapludoll	Waukegan	silt loam
599			120	1	Typic Hapludoll	Waukegan	silt loam
600			180	1	Typic Hapludoll	Waukegan	silt loam
601			0	2	Typic Hapludoll	Waukegan	silt loam
602			60	2	Typic Hapludoll	Waukegan	silt loam
603			120	2	Typic Hapludoll	Waukegan	silt loam
604			180	2	Typic Hapludoll	Waukegan	silt loam
605			0	3	Typic Hapludoll	Waukegan	silt loam
606			60	3	Typic Hapludoll	Waukegan	silt loam
607			120	3	Typic Hapludoll	Waukegan	silt loam
608			180	3	Typic Hapludoll	Waukegan	silt loam

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
571				20		7	664
572				20		7	119
573				20		7	238
574				20		7	356
575				20		7	518
576				20		7	602
577				20		7	706
578				20		7	815
579	64	27.8	8.2	5.4		6.1	0
580	64	27.8	8.2	5.4		6.2	125
581	64	27.8	8.2	5.4		6.1	248
582	64	27.8	8.2	5.4		5.8	372
583	64	27.8	8.2	5.4		6	496
584	64	27.8	8.2	5.4		6	620
585	15.3	47.1	37.6	12.5		5.7	0
586	15.3	47.1	37.6	12.5		6	125
587	15.3	47.1	37.6	12.5		5.8	248
588	15.3	47.1	37.6	12.5		5.9	372
589	15.3	47.1	37.6	12.5		5.9	496
590	15.3	47.1	37.6	12.5		5.9	620
591	20.7	59.3	20	9.3		5.7	0
592	20.7	59.3	20	9.3		6	125
593	20.7	59.3	20	9.3		5.9	248
594	20.7	59.3	20	9.3		5.9	372
595	20.7	59.3	20	9.3		5.9	496
596	20.7	59.3	20	9.3		5.9	620
597						6.2	0
598						6.2	106
599						6.2	219
600						6.2	348
601						6.2	0
602						6.2	106
603						6.2	219
604						6.2	348
605						6.2	0
606						6.2	106
607						6.2	219
608						6.2	348

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
571			68	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
572			84	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
573			58	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
574			66	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
575			51	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
576			46	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
577			88	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
578			77	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
579			66	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
580			69	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
581			68	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
582			56	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
583			60	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
584			71	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
585			21	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
586			21	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
587			25	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
588			26	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
589			28	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
590			27	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
591			22	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
592			28	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
593			39	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
594			40	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
595			48	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
596			45	Ear Leaf	SLUDGE, FIELD, MATURITY	0	GRAIN
597			20	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
598			89	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
599			101	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
600			140	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
601			32	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
602			73	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
603			119	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
604			153	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
605			19	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
606			67	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
607			87	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
608			121	Stover	SLUDGE, FIELD, MATURITY	0	STOVER

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
571			NO	
572			NO	
573			NO	
574			NO	
575			NO	
576			NO	
577			NO	
578			NO	
579	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
580	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
581	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
582	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
583	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
584	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
585	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
586	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
587	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
588	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
589	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
590	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
591	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
592	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
593	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
594	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
595	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
596	0	STOVER	NO	YIELD REDUCTION RESULTS INFERRED FROM AUTHOR'S WRITTEN STATEMENT
597	0	GRAIN	NO	GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS
598	0	GRAIN	NO	GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS
599	0	GRAIN	NO	GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS
600	0	GRAIN	NO	GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS
601	0	GRAIN	NO	GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS
602	43*	GRAIN	*NO	*GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS
603	26*	GRAIN	*NO	*GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS
604	24*	GRAIN	*NO	*GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS
605	0	GRAIN	NO	
606	22*	GRAIN	*NO	*GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS
607	5*	GRAIN	*NO	*GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS
608	8*	GRAIN	*NO	*GRAIN YIELD REDUCTION FOUND NOT TO BE ASSOCIATED WITH METALS BY AUTHORS

TABLE F-4 (cont.)

	LOCATION OF STUDY
571	BERKELEY, CALIFORNIA
572	BERKELEY, CALIFORNIA
573	BERKELEY, CALIFORNIA
574	BERKELEY, CALIFORNIA
575	BERKELEY, CALIFORNIA
576	BERKELEY, CALIFORNIA
577	BERKELEY, CALIFORNIA
578	BERKELEY, CALIFORNIA
579	COASTAL PLAIN VIRGINIA
580	COASTAL PLAIN VIRGINIA
581	COASTAL PLAIN VIRGINIA
582	COASTAL PLAIN VIRGINIA
583	COASTAL PLAIN VIRGINIA
584	COASTAL PLAIN VIRGINIA
585	PIEDMONT VIRGINIA
586	PIEDMONT VIRGINIA
587	PIEDMONT VIRGINIA
588	PIEDMONT VIRGINIA
589	PIEDMONT VIRGINIA
590	PIEDMONT VIRGINIA
591	FOOTHILLS VIRGINIA
592	FOOTHILLS VIRGINIA
593	FOOTHILLS VIRGINIA
594	FOOTHILLS VIRGINIA
595	FOOTHILLS VIRGINIA
596	FOOTHILLS VIRGINIA
597	MINNESOTA
598	MINNESOTA
599	MINNESOTA
600	MINNESOTA
601	MINNESOTA
602	MINNESOTA
603	MINNESOTA
604	MINNESOTA
605	MINNESOTA
606	MINNESOTA
607	MINNESOTA
608	MINNESOTA

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
609	BIDWELL AND DOWDY, 1987	CORN						139
610	BIDWELL AND DOWDY, 1987	CORN						139
611	BIDWELL AND DOWDY, 1987	CORN						139
612	BIDWELL AND DOWDY, 1987	CORN						139
613	BIDWELL AND DOWDY, 1987	CORN						139
614	BIDWELL AND DOWDY, 1987	CORN						139
615	BIDWELL AND DOWDY, 1987	CORN						139
616	BIDWELL AND DOWDY, 1987	CORN						139
617	BIDWELL AND DOWDY, 1987	Corn						
618	BIDWELL AND DOWDY, 1987	Corn						
619	BIDWELL AND DOWDY, 1987	Corn						
620	BIDWELL AND DOWDY, 1987	Corn						
621	RAPPAPORT ET AL 1987	Corn						
622	RAPPAPORT ET AL 1987	Corn						
623	RAPPAPORT ET AL 1987	Corn						
624	CHANG ET AL 1983	BARLEY			72			53
625	CHANG ET AL 1983	BARLEY			72			53
626	CHANG ET AL 1983	BARLEY			72			53
627	CHANG ET AL 1983	BARLEY			72			53
628	CHANG ET AL 1983	BARLEY			72			53
629	CHANG ET AL 1983	BARLEY			72			53
630	CHANG ET AL 1983	BARLEY			72			53
631	CHANG ET AL 1983	BARLEY			72			53
632	CHANG ET AL 1983	BARLEY			72			53
633	CHANG ET AL 1983	BARLEY			72			53
634	CHANG ET AL 1983	BARLEY			72			53
635	CHANG ET AL 1983	BARLEY			72			53
636	CHANG ET AL 1983	BARLEY			72			53
637	CHANG ET AL 1983	BARLEY			72			53
638	CHANG ET AL 1983	BARLEY			72			53
639	CHANG ET AL 1983	BARLEY			72			53
640	CHANG ET AL 1983	BARLEY			72			53
641	CHANG ET AL 1983	BARLEY			72			53
642	CHANG ET AL 1983	BARLEY			72			53
643	CHANG ET AL 1983	BARLEY			72			53
644	CHANG ET AL 1983	BARLEY			72			53
645	CHANG ET AL 1983	BARLEY			72			53
646	CHANG ET AL 1983	BARLEY			72			53

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
609								1987		
610								1987		
611								1987		
612								1987		
613								1987		
614								1987		
615								1987		
616								1987		
617										Control
618										Year 1, Years 2 and 3
619										Year 1, Years 2 and 3
620										Year 1, Years 2 and 3
621										
622										
623										
624	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
625	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
626	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
627	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
628	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
629	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
630	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
631	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
632	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
633	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
634	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
635	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
636	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
637	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
638	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
639	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
640	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
641	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
642	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
643	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
644	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
645	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
646	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
609			0	4	Typic Hapludoll	Waukegan	silt loam
610			60	4	Typic Hapludoll	Waukegan	silt loam
611			120	4	Typic Hapludoll	Waukegan	silt loam
612			180	4	Typic Hapludoll	Waukegan	silt loam
613			0	5	Typic Hapludoll	Waukegan	silt loam
614			60	5	Typic Hapludoll	Waukegan	silt loam
615			120	5	Typic Hapludoll	Waukegan	silt loam
616			180	5	Typic Hapludoll	Waukegan	silt loam
617		0	0	6	Typic Hapludoll	Waukegan	silt loam
618		30,15	60	6	Typic Hapludoll	Waukegan	silt loam
619		60,30	120	6	Typic Hapludoll	Waukegan	silt loam
620		90,45	180	6	Typic Hapludoll	Waukegan	silt loam
621		0			Typic Ochraqualfs	Acredale	silt loam
622		42			Typic Ochraqualfs	Acredale	silt loam
623		84			Typic Ochraqualfs	Acredale	silt loam
624		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
625		22.5	22.5	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
626		45	45	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
627		90	90	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
628		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
629		22.5	45	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
630		45	90	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
631		90	180	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
632		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
633		22.5	68	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
634		45	135	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
635		90	271	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
636		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
637		22.5	90	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
638		45	180	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
639		90	361	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
640		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
641		22.5	113	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
642		45	226	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
643		90	451	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
644		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
645		22.5	135	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
646		45	271	0	XEROLLIC CALCIOTHID	DOMINO	LOAM

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
609						6.2	0
610						6.2	106
611						6.2	219
612						6.2	348
613						6.2	0
614						6.2	106
615						6.2	219
616						6.2	348
617						6.2	0
618						6.2	106
619						6.2	219
620						6.2	348
621	37.8	52.3	9.9	6.9		6.6	0
622	37.8	52.3	9.9	6.9		6.6	124
623	37.8	52.3	9.9	6.9		6.6	248
624				40		7.5	0
625				40		7.4	80
626				40		7.4	160
627				40		7.2	320
628				40		7.1	0
629				40		7	160
630				40		7.1	320
631				40		7.1	640
632				40		7.3	0
633				40		7.2	240
634				40		7.1	480
635				40		7.1	960
636				40		7.1	0
637				40		7	320
638				40		6.9	640
639				40		6.8	1280
640				40		7.2	0
641				40		6.9	400
642				40		6.8	800
643				40		6.6	1600
644				40		7	0
645				40		16.9	480
646				40		6.6	960

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
609			31	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
610			88	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
611			105	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
612			107	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
613			26	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
614			112	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
615			114	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
616			154	Stover	SLUDGE, FIELD, MATURITY	0	STOVER
617			18.5	Stover	SLUDGE, FIELD, MATURITY	0	Stover
618			66.6	Stover	SLUDGE, FIELD, MATURITY	0	Stover
619			75.8	Stover	SLUDGE, FIELD, MATURITY	0	Stover
620			105	Stover	SLUDGE, FIELD, MATURITY	0	Stover
621		0.2	14	Earleaf	SLUDGE, FIELD, MATURITY	0	Stover
622			27	Earleaf	SLUDGE, FIELD, MATURITY	0	Stover
623		25	31	Earleaf	SLUDGE, FIELD, MATURITY	0	Stover
624	4 N HNO3		20	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
625	4 N HNO3		24	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
626	4 N HNO3		29	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
627	4 N HNO3		30	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
628	4 N HNO3		14	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
629	4 N HNO3		20	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
630	4 N HNO3		23	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
631	4 N HNO3		30	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
632	4 N HNO3		18	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
633	4 N HNO3		17	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
634	4 N HNO3		20	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
635	4 N HNO3		43	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
636	4 N HNO3		23	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
637	4 N HNO3		29	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
638	4 N HNO3		28	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
639	4 N HNO3		51	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
640	4 N HNO3		21	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
641	4 N HNO3		26	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
642	4 N HNO3		32	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
643	4 N HNO3		34	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
644	4 N HNO3		21	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
645	4 N HNO3		26	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
646	4 N HNO3		30	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
609	0	GRAIN	NO	
610	0	GRAIN	NO	
611	0	GRAIN	NO	
612	0	GRAIN	NO	
613	0	GRAIN	NO	
614	0	GRAIN	NO	
615	0	GRAIN	NO	
616	0	GRAIN	NO	
617	0	GRAIN	NO	
618	0	GRAIN	NO	
619	0	GRAIN	NO	
620	0	GRAIN	NO	
621			NO	
622			NO	
623			NO	
624			NO	
625			NO	
626			NO	
627			NO	
628			NO	
629			NO	
630			NO	
631			NO	
632			NO	
633			NO	
634			NO	
635			NO	
636			NO	
637			NO	
638			NO	
639			NO	
640			NO	
641			NO	
642			NO	
643			NO	
644			NO	
645			NO	
646			NO	

TABLE F-4 (cont.)

	LOCATION OF STUDY
609	MINNESOTA
610	MINNESOTA
611	MINNESOTA
612	MINNESOTA
613	MINNESOTA
614	MINNESOTA
615	MINNESOTA
616	MINNESOTA
617	MINNESOTA
618	MINNESOTA
619	MINNESOTA
620	MINNESOTA
621	Atlantic Coastal Plain
622	Atlantic Coastal Plain
623	Atlantic Coastal Plain
624	Riverside, California
625	Riverside, California
626	Riverside, California
627	Riverside, California
628	Riverside, California
629	Riverside, California
630	Riverside, California
631	Riverside, California
632	Riverside, California
633	Riverside, California
634	Riverside, California
635	Riverside, California
636	Riverside, California
637	Riverside, California
638	Riverside, California
639	Riverside, California
640	Riverside, California
641	Riverside, California
642	Riverside, California
643	Riverside, California
644	Riverside, California
645	Riverside, California
646	Riverside, California

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
647	CHANG ET AL 1983	BARLEY			72			53
648	CHANG ET AL 1983	BARLEY			72			53
649	CHANG ET AL 1983	BARLEY			72			53
650	CHANG ET AL 1983	BARLEY			72			53
651	CHANG ET AL 1983	BARLEY			72			53
652	CHANG ET AL 1983	BARLEY			72			53
653	CHANG ET AL 1983	BARLEY			72			53
654	CHANG ET AL 1983	BARLEY			72			53
655	CHANG ET AL 1983	BARLEY			72			53
656	CHANG ET AL 1983	BARLEY			72			53
657	CHANG ET AL 1983	BARLEY			72			53
658	CHANG ET AL 1983	BARLEY			72			53
659	CHANG ET AL 1983	BARLEY			72			53
660	CHANG ET AL 1983	BARLEY			72			53
661	CHANG ET AL 1983	BARLEY			72			53
662	CHANG ET AL 1983	BARLEY			72			53
663	CHANG ET AL 1983	BARLEY			72			53
664	CHANG ET AL 1983	BARLEY			72			53
665	CHANG ET AL 1983	BARLEY			72			53
666	CHANG ET AL 1983	BARLEY			72			53
667	CHANG ET AL 1983	BARLEY			72			53
668	CHANG ET AL 1983	BARLEY			72			53
669	CHANG ET AL 1983	BARLEY			72			53
670	CHANG ET AL 1983	BARLEY			72			53
671	CHANG ET AL 1983	BARLEY			72			53
672	CHANG ET AL 1983	BARLEY			75			126
673	CHANG ET AL 1983	BARLEY			75			126
674	CHANG ET AL 1983	BARLEY			75			126
675	CHANG ET AL 1983	BARLEY			75			126
676	CHANG ET AL 1983	BARLEY			75			126
677	CHANG ET AL 1983	BARLEY			75			126
678	CHANG ET AL 1983	BARLEY			75			126
679	CHANG ET AL 1983	BARLEY			75			126
680	CHANG ET AL 1983	BARLEY			75			126
681	CHANG ET AL 1983	BARLEY			75			126
682	CHANG ET AL 1983	BARLEY			75			126
683	CHANG ET AL 1983	BARLEY			75			126
684	CHANG ET AL 1983	BARLEY			75			126

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
647	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
648	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
649	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
650	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
651	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
652	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
653	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
654	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
655	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
656	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
657	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
658	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
659	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
660	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
661	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
662	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
663	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
664	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
665	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
666	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
667	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
668	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
669	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
670	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
671	1437	896		0.5	373	0.8	1153	3548	60	AEROBICALLY DIG. COMPOSTED
672	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
673	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
674	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
675	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
676	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
677	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
678	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
679	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
680	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
681	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
682	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
683	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
684	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
647		90	541	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
648		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
649		22.5	22.5	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
650		45	45	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
651		90	90	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
652		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
653		22.5	45	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
654		45	90	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
655		90	180	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
656		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
657		22.5	68	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
658		45	135	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
659		90	271	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
660		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
661		22.5	90	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
662		45	180	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
663		90	361	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
664		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
665		22.5	113	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
666		45	226	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
667		90	451	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
668		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
669		22.5	135	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
670		45	271	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
671		90	541	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
672		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
673		16	16	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
674		30	30	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
675		60	60	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
676		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
677		16	32	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
678		30	61	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
679		60	120	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
680		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
681		16	47	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
682		30	92	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
683		60	180	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
684		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
647				40		6.4	1920
648				16		6.3	0
649				16		6.5	80
650				16		6.6	160
651				16		6.7	320
652				16		6.3	0
653				16		6.5	160
654				16		6.5	320
655				16		6.5	640
656				16		6.6	0
657				16		7	240
658				16		6.9	480
659				16		6.9	960
660				16		6.7	0
661				16		6.8	320
662				16		6.7	640
663				16		6.7	1280
664				16		6.9	0
665				16		6.7	400
666				16		6.8	800
667				16		6.7	1600
668				16		7	0
669				16		6.7	480
670				16		6.6	960
671				16		6.3	1920
672				40		7.2	0
673				40		6.7	68
674				40		6	130
675				40		5.7	252
676				40		7.5	0
677				40		6.6	135
678				40		5.9	261
679				40		5.7	504
680				40		7.2	0
681				40		6.4	203
682				40		6	391
683				40		6.1	756
684				40		7.1	0

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
647	4 N HNO3		41	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
648	4 N HNO3		16	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
649	4 N HNO3		19	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
650	4 N HNO3		20	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
651	4 N HNO3		28	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
652	4 N HNO3		13	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
653	4 N HNO3		22	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
654	4 N HNO3		23	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
655	4 N HNO3		25	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
656	4 N HNO3		25	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
657	4 N HNO3		23	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
658	4 N HNO3		33	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
659	4 N HNO3		37	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
660	4 N HNO3		21	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
661	4 N HNO3		32	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
662	4 N HNO3		33	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
663	4 N HNO3		39	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
664	4 N HNO3		18	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
665	4 N HNO3		32	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
666	4 N HNO3		33	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
667	4 N HNO3		39	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
668	4 N HNO3		22	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
669	4 N HNO3		47	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
670	4 N HNO3		56	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
671	4 N HNO3		57	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
672	4 N HNO3		17	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
673	4 N HNO3		29	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
674	4 N HNO3		32	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
675	4 N HNO3		49	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
676	4 N HNO3		18	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
677	4 N HNO3		42	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
678	4 N HNO3		29	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
679	4 N HNO3		35	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
680	4 N HNO3		16	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
681	4 N HNO3		25	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
682	4 N HNO3		34	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
683	4 N HNO3		41	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
684	4 N HNO3		20	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
647			NO	
648			NO	
649			NO	
650			NO	
651			NO	
652			NO	
653			NO	
654			NO	
655			NO	
656			NO	
657			NO	
658			NO	
659			NO	
660			NO	
661			NO	
662			NO	
663			NO	
664			NO	
665			NO	
666			NO	
667			NO	
668			NO	
669			NO	
670			NO	
671			NO	
672			NO	
673			NO	
674			NO	
675			NO	
676			NO	
677			NO	
678			NO	
679			NO	
680			NO	
681			NO	
682			NO	
683			NO	
684			NO	

TABLE F-4 (cont.)

	LOCATION OF STUDY
647	Riverside, California
648	Riverside, California
649	Riverside, California
650	Riverside, California
651	Riverside, California
652	Riverside, California
653	Riverside, California
654	Riverside, California
655	Riverside, California
656	Riverside, California
657	Riverside, California
658	Riverside, California
659	Riverside, California
660	Riverside, California
661	Riverside, California
662	Riverside, California
663	Riverside, California
664	Riverside, California
665	Riverside, California
666	Riverside, California
667	Riverside, California
668	Riverside, California
669	Riverside, California
670	Riverside, California
671	Riverside, California
672	Riverside, California
673	Riverside, California
674	Riverside, California
675	Riverside, California
676	Riverside, California
677	Riverside, California
678	Riverside, California
679	Riverside, California
680	Riverside, California
681	Riverside, California
682	Riverside, California
683	Riverside, California
684	Riverside, California

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
685	CHANG ET AL 1983	BARLEY			75			126
686	CHANG ET AL 1983	BARLEY			75			126
687	CHANG ET AL 1983	BARLEY			75			126
688	CHANG ET AL 1983	BARLEY			75			126
689	CHANG ET AL 1983	BARLEY			75			126
690	CHANG ET AL 1983	BARLEY			75			126
691	CHANG ET AL 1983	BARLEY			75			126
692	CHANG ET AL 1983	BARLEY			75			150
693	CHANG ET AL 1983	BARLEY			75			150
694	CHANG ET AL 1983	BARLEY			75			150
695	CHANG ET AL 1983	BARLEY			75			150
696	CHANG ET AL 1983	BARLEY			75			150
697	CHANG ET AL 1983	BARLEY			75			150
698	CHANG ET AL 1983	BARLEY			75			150
699	CHANG ET AL 1983	BARLEY			75			150
700	CHANG ET AL 1983	BARLEY			75			150
701	CHANG ET AL 1983	BARLEY			75			150
702	CHANG ET AL 1983	BARLEY			75			150
703	CHANG ET AL 1983	BARLEY			75			150
704	CHANG ET AL 1983	BARLEY			75			150
705	CHANG ET AL 1983	BARLEY			75			150
706	CHANG ET AL 1983	BARLEY			75			150
707	CHANG ET AL 1983	BARLEY			75			150
708	CHANG ET AL 1983	BARLEY			75			150
709	CHANG ET AL 1983	BARLEY			75			150
710	CHANG ET AL 1983	BARLEY			75			150
711	CHANG ET AL 1983	BARLEY			75			150
712	CHANG ET AL 1983	BARLEY			70			83
713	CHANG ET AL 1983	BARLEY			70			83
714	CHANG ET AL 1983	BARLEY			70			83
715	CHANG ET AL 1983	BARLEY			70			83
716	CHANG ET AL 1983	BARLEY			70			83
717	CHANG ET AL 1983	BARLEY			70			83
718	CHANG ET AL 1983	BARLEY			70			83
719	CHANG ET AL 1983	BARLEY			70			83
720	CHANG ET AL 1983	BARLEY			70			83
721	CHANG ET AL 1983	BARLEY			70			83
722	CHANG ET AL 1983	BARLEY			70			83

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
685	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
686	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
687	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
688	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
689	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
690	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
691	2092	1600		8.5	592	1.5	781	4265	2.1	ANAEROBICALLY DIGESTED
692	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
693	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
694	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
695	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
696	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
697	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
698	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
699	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
700	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
701	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
702	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
703	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
704	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
705	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
706	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
707	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
708	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
709	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
710	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
711	2053	1745		8.5	608	1.5	693	4368	2.1	ANAEROBICALLY DIGESTED
712	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
713	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
714	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
715	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
716	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
717	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
718	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
719	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
720	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
721	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
722	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
685		16	34	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
686		30	122	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
687		60	240	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
688		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
689		16	50	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
690		30	152	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
691		60	300	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
692		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
693		16	16	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
694		32	32	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
695		59	59	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
696		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
697		16	32	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
698		32	64	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
699		59	119	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
700		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
701		16	48	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
702		32	96	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
703		59	177	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
704		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
705		16	64	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
706		32	128	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
707		59	236	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
708		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
709		16	80	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
710		32	160	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
711		59	295	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
712		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
713		16	16	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
714		33	33	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
715		63	63	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
716		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
717		16	31	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
718		33	66	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
719		63	126	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
720		0	0	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
721		16	47	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
722		33	96	0	XEROLLIC CALCIOTHID	DOMINO	LOAM

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
685				40		6.3	271
686				40		6	522
687				40		5.9	1008
688				40		7.3	0
689				40		6.1	339
690				40		5.9	652
691				40		5.5	1262
692				16		6.1	0
693				16		5.6	67
694				16		5.4	133
695				16		5.3	249
696				16		6.2	0
697				16		5.8	134
698				16		5.6	265
699				16		5.3	497
700				16		6.6	0
701				16		5.7	200
702				16		5.7	398
703				16		5.6	746
704				16		6.8	0
705				16		6	267
706				16		5.9	530
707				16		5.8	995
708				16		6.9	0
709				16		5.9	334
710				16		5.8	663
711				16		5.5	1244
712				40		7.4	0
713				40		6.9	65
714				40		6.4	140
715				40		6.1	252
716				40		5.7	0
717				40		6.8	130
718				40		6.6	279
719				40		6.3	503
720				40		7.1	0
721				40		6.9	196
722				40		6.6	419

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
685	4 N HNO3		30	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
686	4 N HNO3		47	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
687	4 N HNO3		38	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
688	4 N HNO3		25	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
689	4 N HNO3		38	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
690	4 N HNO3		41	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
691	4 N HNO3		51	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
692	4 N HNO3		26	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
693	4 N HNO3		31	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
694	4 N HNO3		50	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
695	4 N HNO3		53	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
696	4 N HNO3		20	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
697	4 N HNO3		35	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
698	4 N HNO3		51	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
699	4 N HNO3		50	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
700	4 N HNO3		18	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
701	4 N HNO3		32	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
702	4 N HNO3		35	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
703	4 N HNO3		44	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
704	4 N HNO3		18	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
705	4 N HNO3		32	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
706	4 N HNO3		35	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
707	4 N HNO3		44	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
708	4 N HNO3		21	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
709	4 N HNO3		43	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
710	4 N HNO3		51	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
711	4 N HNO3		82	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
712	4 N HNO3		29	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
713	4 N HNO3		31	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
714	4 N HNO3		32	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
715	4 N HNO3		38	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
716	4 N HNO3		20	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
717	4 N HNO3		35	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
718	4 N HNO3		37	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
719	4 N HNO3		33	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
720	4 N HNO3		23	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
721	4 N HNO3		27	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
722	4 N HNO3		27	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
685			NO	
686			NO	
687			NO	
688			NO	
689			NO	
690			NO	
691			NO	
692			NO	
693			NO	
694			NO	
695			NO	
696			NO	
697			NO	
698			NO	
699			NO	
700			NO	
701			NO	
702			NO	
703			NO	
704			NO	
705			NO	
706			NO	
707			NO	
708			NO	
709			NO	
710			NO	
711			NO	
712			NO	
713			NO	
714			NO	
715			NO	
716			NO	
717			NO	
718			NO	
719			NO	
720			NO	
721			NO	
722			NO	

TABLE F-4 (cont.)

	LOCATION OF STUDY
685	Riverside, California
686	Riverside, California
687	Riverside, California
688	Riverside, California
689	Riverside, California
690	Riverside, California
691	Riverside, California
692	Riverside, California
693	Riverside, California
694	Riverside, California
695	Riverside, California
696	Riverside, California
697	Riverside, California
698	Riverside, California
699	Riverside, California
700	Riverside, California
701	Riverside, California
702	Riverside, California
703	Riverside, California
704	Riverside, California
705	Riverside, California
706	Riverside, California
707	Riverside, California
708	Riverside, California
709	Riverside, California
710	Riverside, California
711	Riverside, California
712	Riverside, California
713	Riverside, California
714	Riverside, California
715	Riverside, California
716	Riverside, California
717	Riverside, California
718	Riverside, California
719	Riverside, California
720	Riverside, California
721	Riverside, California
722	Riverside, California

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
723	CHANG ET AL 1983	BARLEY			70			83
724	CHANG ET AL 1983	BARLEY			70			83
725	CHANG ET AL 1983	BARLEY			70			83
726	CHANG ET AL 1983	BARLEY			70			83
727	CHANG ET AL 1983	BARLEY			70			83
728	CHANG ET AL 1983	BARLEY			70			83
729	Chang, A.C. et al., 1983 #33	BARLEY			70			83
730	Chang, A.C. et al., 1983 #33	BARLEY			70			83
731	Chang, A.C. et al., 1983 #33	BARLEY			70			83
732	Chang, A.C. et al., 1983 #33	BARLEY			70			86
733	Chang, A.C. et al., 1983 #33	BARLEY			70			86
734	Chang, A.C. et al., 1983 #33	BARLEY			70			86
735	Chang, A.C. et al., 1983 #33	BARLEY			70			86
736	Chang, A.C. et al., 1983 #33	BARLEY			70			86
737	Chang, A.C. et al., 1983 #33	BARLEY			70			86
738	Chang, A.C. et al., 1983 #33	BARLEY			70			86
739	Chang, A.C. et al., 1983 #33	BARLEY			70			86
740	Chang, A.C. et al., 1983 #33	BARLEY			70			86
741	Chang, A.C. et al., 1983 #33	BARLEY			70			86
742	Chang, A.C. et al., 1983 #33	BARLEY			70			86
743	Chang, A.C. et al., 1983 #33	BARLEY			70			86
744	Chang, A.C. et al., 1983 #33	BARLEY			70			86
745	Chang, A.C. et al., 1983 #33	BARLEY			70			86
746	Chang, A.C. et al., 1983 #33	BARLEY			70			86
747	Chang, A.C. et al., 1983 #33	BARLEY			70			86
748	Chang, A.C. et al., 1983 #33	BARLEY			70			86
749	Chang, A.C. et al., 1983 #33	BARLEY			70			86
750	Chang, A.C. et al., 1983 #33	BARLEY			70			86
751	Chang, A.C. et al., 1983 #33	BARLEY			70			86
752	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
753	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
754	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
755	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
756	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
757	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
758	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
759	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
760	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
723	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
724	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
725	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
726	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
727	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
728	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
729	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
730	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
731	2561	1293		4.5	542	1.1	930	4154	2.8	ANAEROBICALLY DIGESTED
732	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
733	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
734	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
735	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
736	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
737	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
738	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
739	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
740	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
741	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
742	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
743	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
744	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
745	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
746	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
747	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
748	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
749	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
750	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
751	2639	1363		4.5	534	1.1	902	4002	2.8	ANAEROBICALLY DIGESTED
752										Unlimed sludge, 1976
753										Unlimed sludge, 1976
754										Unlimed sludge, 1976
755										Unlimed sludge, 1976
756										Unlimed sludge, 1976
757										Unlimed sludge, 1976
758										Unlimed sludge, 1976
759										Unlimed sludge, 1976
760										Unlimed sludge, 1977

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
723		63	189	0	XEROLLIC CALCIOTHID	DOMINO	LOAM
724		0	0	1	XEROLLIC CALCIOTHID	DOMINO	LOAM
725		0	47	1	XEROLLIC CALCIOTHID	DOMINO	LOAM
726		0	96	1	XEROLLIC CALCIOTHID	DOMINO	LOAM
727		0	189	1	XEROLLIC CALCIOTHID	DOMINO	LOAM
728		0	0	2	XEROLLIC CALCIOTHID	DOMINO	LOAM
729		0	47	2	XEROLLIC CALCIOTHID	DOMINO	LOAM
730		0	96	2	XEROLLIC CALCIOTHID	DOMINO	LOAM
731		0	189	2	XEROLLIC CALCIOTHID	DOMINO	LOAM
732		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
733		16	16	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
734		32	32	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
735		66	66	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
736		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
737		16	33	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
738		32	64	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
739		66	131	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
740		0	0	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
741		16	49	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
742		32	98	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
743		66	197	0	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
744		0	0	1	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
745		0	49	1	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
746		0	98	1	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
747		0	197	1	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
748		0	0	2	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
749		0	49	2	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
750		0	98	2	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
751		0	197	2	TYPIC HALOXERALF	GREENFIELD	SANDY LOAM
752		0			Fluventic Halpoxerolls	Sultan	silt loam
753		22.4	0		Fluventic Halpoxerolls	Sultan	silt loam
754		44.8	22.4		Fluventic Halpoxerolls	Sultan	silt loam
755		89.6	44.8		Fluventic Halpoxerolls	Sultan	silt loam
756		0	89.6		Aquic Xerofluvents	Puyallup	fine sandy loam
757		22.4	0		Aquic Xerofluvents	Puyallup	fine sandy loam
758		44.8	22.4		Aquic Xerofluvents	Puyallup	fine sandy loam
759		89.6	44.8		Aquic Xerofluvents	Puyallup	fine sandy loam
760		0	89.6		Fluventic Halpoxerolls	Sultan	silt loam

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
723				40		6.4	755
724				40		7.2	0
725				40		6.6	196
726				40		6.5	419
727				40		6.4	755
728				40		7.5	0
729				40		6.9	196
730				40		6.7	419
731				40		6.5	755
732				16		6	0
733				16		5.8	65
734				16		5.7	132
735				16		5.7	269
736				16		6.5	0
737				16		6.4	130
738				16		6.2	264
739				16		6.1	538
740				16		6.5	0
741				16		6.3	196
742				16		6.1	397
743				16		6	807
744				16		6.5	0
745				16		6.3	196
746				16		6.1	397
747				16		6	807
748				16		6.8	0
749				16		6.4	196
750				16		6.2	397
751				16		6.2	807
752				13.7		4.6	0
753				13.7		4.6	55
754				13.7		4.6	110
755				13.7		4.6	220
756				9.1		4.7	0
757				9.1		4.7	55
758				9.1		4.7	110
759				9.1		4.7	220
760				13.7		4.6	0

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
723	4 N HNO3		39	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
724	4 N HNO3		21	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
725	4 N HNO3		28	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
726	4 N HNO3		32	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
727	4 N HNO3		35	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
728	4 N HNO3		25	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
729	4 N HNO3		31	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
730	4 N HNO3		39	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
731	4 N HNO3		41	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
732	4 N HNO3		30	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
733	4 N HNO3		26	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
734	4 N HNO3		40	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
735	4 N HNO3		52	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
736	4 N HNO3		33	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
737	4 N HNO3		33	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
738	4 N HNO3		38	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
739	4 N HNO3		39	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
740	4 N HNO3		31	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
741	4 N HNO3		31	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
742	4 N HNO3		33	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
743	4 N HNO3		38	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
744	4 N HNO3		19	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
745	4 N HNO3		28	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
746	4 N HNO3		32	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
747	4 N HNO3		34	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
748	4 N HNO3		24	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
749	4 N HNO3		37	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
750	4 N HNO3		39	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
751	4 N HNO3		46	LEAF	SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
752	0	2.2	28	Leaf	SLUDGE, FIELD, MATURITY		
753	55	10.3	114.7	Leaf	SLUDGE, FIELD, MATURITY		
754	110	17	182.7	Leaf	SLUDGE, FIELD, MATURITY		
755	220	49.4	423.9	Leaf	SLUDGE, FIELD, MATURITY		
756	0	3.4	28.7	Leaf	SLUDGE, FIELD, MATURITY		
757	55	8	136.6	Leaf	SLUDGE, FIELD, MATURITY		
758	110	19.6	193	Leaf	SLUDGE, FIELD, MATURITY		
759	220	34.6	375	Leaf	SLUDGE, FIELD, MATURITY		
760	0		49.7	Leaf	SLUDGE, FIELD, MATURITY		

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
723			NO	
724			NO	
725			NO	
726			NO	
727			NO	
728			NO	
729			NO	
730			NO	
731			NO	
732			NO	
733			NO	
734			NO	
735			NO	
736			NO	
737			NO	
738			NO	
739			NO	
740			NO	
741			NO	
742			NO	
743			NO	
744			NO	
745			NO	
746			NO	
747			NO	
748			NO	
749			NO	
750			NO	
751			NO	
752			NO	YIELD NOT DETERMINED
753			NO	YIELD NOT DETERMINED
754			NO	YIELD NOT DETERMINED
755			NO	YIELD NOT DETERMINED
756			NO	YIELD NOT DETERMINED
757			NO	YIELD NOT DETERMINED
758			NO	YIELD NOT DETERMINED
759			NO	YIELD NOT DETERMINED
760			NO	YIELD NOT DETERMINED

TABLE F-4 (cont.)

	LOCATION OF STUDY
723	Riverside, California
724	Riverside, California
725	Riverside, California
726	Riverside, California
727	Riverside, California
728	Riverside, California
729	Riverside, California
730	Riverside, California
731	Riverside, California
732	Riverside, California
733	Riverside, California
734	Riverside, California
735	Riverside, California
736	Riverside, California
737	Riverside, California
738	Riverside, California
739	Riverside, California
740	Riverside, California
741	Riverside, California
742	Riverside, California
743	Riverside, California
744	Riverside, California
745	Riverside, California
746	Riverside, California
747	Riverside, California
748	Riverside, California
749	Riverside, California
750	Riverside, California
751	Riverside, California
752	Puyallup, Washington
753	Puyallup, Washington
754	Puyallup, Washington
755	Puyallup, Washington
756	Puyallup, Washington
757	Puyallup, Washington
758	Puyallup, Washington
759	Puyallup, Washington
760	Puyallup, Washington

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
761	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
762	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
763	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
764	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
765	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
766	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
767	Pepper,I.L. et al., 1988 #185	Corn	Pride 110					
768	Schauer, P.S. et al., 1980 #211	Lettuce	Salad Bowl	4.7	67.5			21
769	Schauer, P.S. et al., 1980 #211	Lettuce	Salad Bowl	4.7	67.5			21
770	Schauer, P.S. et al., 1980 #211	Lettuce	Salad Bowl	4.7	67.5			21
771	Schauer, P.S. et al., 1980 #211	Lettuce	Salad Bowl	4.7	67.5			21
772	Schauer, P.S. et al., 1980 #211	Lettuce	Salad Bowl	4.7	67.5			21
773	Schauer, P.S. et al., 1980 #211	Lettuce	Salad Bowl	4.7	67.5			21
774	Schauer, P.S. et al., 1980 #211	Radish	Cherrybelle	4.7	67.5			21
775	Schauer, P.S. et al., 1980 #211	Radish	Cherrybelle	4.7	67.5			21
776	Schauer, P.S. et al., 1980 #211	Radish	Cherrybelle	4.7	67.5			21
777	Schauer, P.S. et al., 1980 #211	Radish	Cherrybelle	4.7	67.5			21
778	Schauer, P.S. et al., 1980 #211	Radish	Cherrybelle	4.7	67.5			21
779	Schauer, P.S. et al., 1980 #211	Radish	Cherrybelle	4.7	67.5			21
780	Schauer, P.S. et al., 1980 #211	Carrot	Danvers	4.7	67.5			21
781	Schauer, P.S. et al., 1980 #211	Carrot	Danvers	4.7	67.5			21
782	Schauer, P.S. et al., 1980 #211	Carrot	Danvers	4.7	67.5			21
783	Schauer, P.S. et al., 1980 #211	Carrot	Danvers	4.7	67.5			21
784	Schauer, P.S. et al., 1980 #211	Carrot	Danvers	4.7	67.5			21
785	Schauer, P.S. et al., 1980 #211	Carrot	Danvers	4.7	67.5			21
786	Latterell, J.J. et al., 1978 #138	Snap Bean	Tendergreen				2.61	6
787	Latterell, J.J. et al., 1978 #138	Snap Bean	Tendergreen				2.61	6
788	Latterell, J.J. et al., 1978 #138	Snap Bean	Tendergreen				2.61	6
789	Latterell, J.J. et al., 1978 #138	Snap Bean	Tendergreen				2.61	6
790	Latterell, J.J. et al., 1978 #138	Snap Bean	Tendergreen				2.61	6
791	Latterell, J.J. et al., 1978 #138	Snap Bean	Tendergreen				2.61	6
792	Latterell, J.J. et al., 1978 #138	Snap Bean	Tendergreen				2.61	6
793	Latterell, J.J. et al., 1978 #138	Snap Bean	Tendergreen				2.61	6
794	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
795	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
796	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
797	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
798	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
761										Unlimed sludge, 1977
762										Unlimed sludge, 1977
763										Unlimed sludge, 1977
764										Unlimed sludge, 1977
765										Unlimed sludge, 1977
766										Unlimed sludge, 1977
767										Unlimed sludge, 1977
768		2520			560			1630		ANAEROBICALLY DIGESTED
769		2520			560			1630		ANAEROBICALLY DIGESTED
770		2520			560			1630		ANAEROBICALLY DIGESTED
771		2520			560			1630		ANAEROBICALLY DIGESTED
772		2520			560			1630		ANAEROBICALLY DIGESTED
773		2520			560			1630		ANAEROBICALLY DIGESTED
774		2520			560			1630		ANAEROBICALLY DIGESTED
775		2520			560			1630		ANAEROBICALLY DIGESTED
776		2520			560			1630		ANAEROBICALLY DIGESTED
777		2520			560			1630		ANAEROBICALLY DIGESTED
778		2520			560			1630		ANAEROBICALLY DIGESTED
779		2520			560			1630		ANAEROBICALLY DIGESTED
780		2520			560			1630		ANAEROBICALLY DIGESTED
781		2520			560			1630		ANAEROBICALLY DIGESTED
782		2520			560			1630		ANAEROBICALLY DIGESTED
783		2520			560			1630		ANAEROBICALLY DIGESTED
784		2520			560			1630		ANAEROBICALLY DIGESTED
785		2520			560			1630		ANAEROBICALLY DIGESTED
786	110	190			15		510	1080		Anaerobically Digested
787	110	190			15		510	1080		Anaerobically Digested
788	110	190			15		510	1080		Anaerobically Digested
789	110	190			15		510	1080		Anaerobically Digested
790	110	190			15		510	1080		Anaerobically Digested
791	110	190			15		510	1080		Anaerobically Digested
792	110	190			15		510	1080		Anaerobically Digested
793	110	190			15		510	1080		Anaerobically Digested
794	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
795	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
796	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
797	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
798	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
761		22.4			Fluventic Halpoxerolls	Sultan	silt loam
762		44.8			Fluventic Halpoxerolls	Sultan	silt loam
763		89.6			Fluventic Halpoxerolls	Sultan	silt loam
764		0			Aquic Xerofluvents	Puyallup	fine sandy loam
765		22.4			Aquic Xerofluvents	Puyallup	fine sandy loam
766		44.8			Aquic Xerofluvents	Puyallup	fine sandy loam
767		89.6			Aquic Xerofluvents	Puyallup	fine sandy loam
768		0	0	0	Typic Dystrochrept	Bridgehampton	silt loam
769		20	20	0	Typic Dystrochrept	Bridgehampton	silt loam
770		60	60	0	Typic Dystrochrept	Bridgehampton	silt loam
771		0	0	1	Typic Dystrochrept	Bridgehampton	silt loam
772		20	20	1	Typic Dystrochrept	Bridgehampton	silt loam
773		60	60	1	Typic Dystrochrept	Bridgehampton	silt loam
774		0	0	0	Typic Dystrochrept	Bridgehampton	silt loam
775		20	20	0	Typic Dystrochrept	Bridgehampton	silt loam
776		60	60	0	Typic Dystrochrept	Bridgehampton	silt loam
777		0	0	1	Typic Dystrochrept	Bridgehampton	silt loam
778		20	20	1	Typic Dystrochrept	Bridgehampton	silt loam
779		60	60	1	Typic Dystrochrept	Bridgehampton	silt loam
780		0	0	0	Typic Dystrochrept	Bridgehampton	silt loam
781		20	20	0	Typic Dystrochrept	Bridgehampton	silt loam
782		60	60	0	Typic Dystrochrept	Bridgehampton	silt loam
783		0	0	1	Typic Dystrochrept	Bridgehampton	silt loam
784		20	20	1	Typic Dystrochrept	Bridgehampton	silt loam
785		60	60	1	Typic Dystrochrept	Bridgehampton	silt loam
786			0	NA	Udorthentic Haploboroll	Hubbard	coarse sand
787			0	NA	Udorthentic Haploboroll	Hubbard	coarse sand
788			122	0	Udorthentic Haploboroll	Hubbard	coarse sand
789			225	0	Udorthentic Haploboroll	Hubbard	coarse sand
790			450	0	Udorthentic Haploboroll	Hubbard	coarse sand
791			350	1	Udorthentic Haploboroll	Hubbard	coarse sand
792			700	1	Udorthentic Haploboroll	Hubbard	coarse sand
793			1400	1	Udorthentic Haploboroll	Hubbard	coarse sand
794		0	0	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL
795		25	25	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL
796		50	50	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL
797		100	100	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL
798		200	200	0	TYPIC TAPLUDOLL	WAUKEGAN	SiL

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
761				13.7		4.6	55
762				13.7		4.6	110
763				13.7		4.6	220
764				9.1		4.7	0
765				9.1		4.7	55
766				9.1		4.7	110
767				9.1		4.7	220
768	34	58	8		2.8	5.6	0
769	34	58	8		2.8	5.6	33
770	34	58	8		2.8	5.6	99
771	34	58	8		2.8	5.6	0
772	34	58	8		2.8	5.6	33
773	34	58	8		2.8	5.6	99
774	34	58	8		2.8	5.6	0
775	34	58	8		2.8	5.6	33
776	34	58	8		2.8	5.6	99
777	34	58	8		2.8	5.6	0
778	34	58	8		2.8	5.6	33
779	34	58	8		2.8	5.6	99
780	34	58	8		2.8	5.6	0
781	34	58	8		2.8	5.6	33
782	34	58	8		2.8	5.6	99
783	34	58	8		2.8	5.6	0
784	34	58	8		2.8	5.6	33
785	34	58	8		2.8	5.6	99
786					1.2	5.3	0
787					1.2	5.3	0
788					1.2	5.3	149
789					1.2	5.3	298
790					1.2	5.3	597
791					1.4	5.3	379
792					1.9	5.3	756
793					3.2	5.3	1518
794						6.5	0
795						6.5	52.5
796						6.5	105
797						6.5	210
798						6.5	420

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
761	112		136.8	Leaf	SLUDGE, FIELD, MATURITY		
762	224		338	Leaf	SLUDGE, FIELD, MATURITY		
763	448		587.7	Leaf	SLUDGE, FIELD, MATURITY		
764	0		55.8	Leaf	SLUDGE, FIELD, MATURITY		
765	112		186	Leaf	SLUDGE, FIELD, MATURITY		
766	224		486.3	Leaf	SLUDGE, FIELD, MATURITY		
767	448		677.3	Leaf	SLUDGE, FIELD, MATURITY		
768	DTPA	3.4	50	Leaf	SLUDGE, FIELD, MATURITY		
769	DTPA	5.9	66	Leaf	SLUDGE, FIELD, MATURITY		
770	DTPA	11.7	90	Leaf	SLUDGE, FIELD, MATURITY		
771	DTPA	4.6	46	Leaf	SLUDGE, FIELD, MATURITY		
772	DTPA	8.2	73	Leaf	SLUDGE, FIELD, MATURITY		
773	DTPA	15.2	133	Leaf	SLUDGE, FIELD, MATURITY		
774	DTPA	3.4	62	Leaf	SLUDGE, FIELD, MATURITY		
775	DTPA	5.9	73	Leaf	SLUDGE, FIELD, MATURITY		
776	DTPA	11.7	74	Leaf	SLUDGE, FIELD, MATURITY		
777	DTPA	4.6	70	Leaf	SLUDGE, FIELD, MATURITY		
778	DTPA	8.2	88	Leaf	SLUDGE, FIELD, MATURITY		
779	DTPA	15.2	164	Leaf	SLUDGE, FIELD, MATURITY		
780	DTPA	3.4	32	Leaf	SLUDGE, FIELD, MATURITY		
781	DTPA	5.9	42	Leaf	SLUDGE, FIELD, MATURITY		
782	DTPA	11.7	59	Leaf	SLUDGE, FIELD, MATURITY		
783	DTPA	4.6	40	Leaf	SLUDGE, FIELD, MATURITY		
784	DTPA	8.2	55	Leaf	SLUDGE, FIELD, MATURITY		
785	DTPA	15.2	79	Leaf	SLUDGE, FIELD, MATURITY		
786	DTPA		32	Leaf	SLUDGE, FIELD, MATURITY		
787	DTPA		30	Leaf	SLUDGE, FIELD, MATURITY		
788	DTPA		57	Leaf	SLUDGE, FIELD, MATURITY		
789	DTPA		59	Leaf	SLUDGE, FIELD, MATURITY		
790	DTPA		60	Leaf	SLUDGE, FIELD, MATURITY		
791	DTPA		59	Leaf	SLUDGE, FIELD, MATURITY		
792	DTPA		92	Leaf	SLUDGE, FIELD, MATURITY		
793	DTPA		117	Leaf	SLUDGE, FIELD, MATURITY		
794		N.L.	205	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
795		N.L.	203	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
796		N.L.	223	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
797		N.L.	278	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
798		N.L.	331	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
761			NO	YIELD NOT DETERMINED
762			NO	YIELD NOT DETERMINED
763			NO	YIELD NOT DETERMINED
764			NO	YIELD NOT DETERMINED
765			NO	YIELD NOT DETERMINED
766			NO	YIELD NOT DETERMINED
767			NO	YIELD NOT DETERMINED
768			NO	YIELD NOT DETERMINED
769			NO	YIELD NOT DETERMINED
770			NO	YIELD NOT DETERMINED
771			NO	YIELD NOT DETERMINED
772			NO	YIELD NOT DETERMINED
773			NO	YIELD NOT DETERMINED
774			NO	YIELD NOT DETERMINED
775			NO	YIELD NOT DETERMINED
776			NO	YIELD NOT DETERMINED
777			NO	YIELD NOT DETERMINED
778			NO	YIELD NOT DETERMINED
779			NO	YIELD NOT DETERMINED
780			NO	YIELD NOT DETERMINED
781			NO	YIELD NOT DETERMINED
782			NO	YIELD NOT DETERMINED
783			NO	YIELD NOT DETERMINED
784			NO	YIELD NOT DETERMINED
785			NO	YIELD NOT DETERMINED
786			NO	YIELD NOT DETERMINED
787			NO	YIELD NOT DETERMINED
788			NO	YIELD NOT DETERMINED
789			NO	YIELD NOT DETERMINED
790			NO	YIELD NOT DETERMINED
791			NO	YIELD NOT DETERMINED
792			NO	YIELD NOT DETERMINED
793			NO	YIELD NOT DETERMINED
794			NO	
795			NO	
796			NO	
797			NO	
798			NO	

TABLE F-4 (cont.)

	LOCATION OF STUDY
761	Puyallup, Washington
762	Puyallup, Washington
763	Puyallup, Washington
764	Puyallup, Washington
765	Puyallup, Washington
766	Puyallup, Washington
767	Puyallup, Washington
768	KINGSTON, RHODE ISLAND
769	KINGSTON, RHODE ISLAND
770	KINGSTON, RHODE ISLAND
771	KINGSTON, RHODE ISLAND
772	KINGSTON, RHODE ISLAND
773	KINGSTON, RHODE ISLAND
774	KINGSTON, RHODE ISLAND
775	KINGSTON, RHODE ISLAND
776	KINGSTON, RHODE ISLAND
777	KINGSTON, RHODE ISLAND
778	KINGSTON, RHODE ISLAND
779	KINGSTON, RHODE ISLAND
780	KINGSTON, RHODE ISLAND
781	KINGSTON, RHODE ISLAND
782	KINGSTON, RHODE ISLAND
783	KINGSTON, RHODE ISLAND
784	KINGSTON, RHODE ISLAND
785	KINGSTON, RHODE ISLAND
786	Elk River, Minnesota
787	Elk River, Minnesota
788	Elk River, Minnesota
789	Elk River, Minnesota
790	Elk River, Minnesota
791	Elk River, Minnesota
792	Elk River, Minnesota
793	Elk River, Minnesota
794	MINNESOTA
795	MINNESOTA
796	MINNESOTA
797	MINNESOTA
798	MINNESOTA

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
799	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
800	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
801	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
802	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
803	HAM &DOWDY 1978	SOYBEAN	MERRILL			1.41	4.98	12
804	WILLIAMS 1977	CARROT						
805	WILLIAMS 1977	CARROT						
806	WILLIAMS 1977	CARROT						
807	WILLIAMS 1977	CARROT						
808	WILLIAMS 1977	CARROT						
809	WILLIAMS 1977	CARROT						
810	WILLIAMS 1977	CARROT						
811	WILLIAMS 1977	CARROT						
812	WILLIAMS 1977	BEET						
813	WILLIAMS 1977	BEET						
814	WILLIAMS 1977	BEET						
815	WILLIAMS 1977	BEET						
816	WILLIAMS 1977	BEET						
817	WILLIAMS 1977	BEET						
818	WILLIAMS 1977	BEET						
819	WILLIAMS 1977	BEET						
820	WILLIAMS 1977	ONION						
821	WILLIAMS 1977	ONION						
822	WILLIAMS 1977	ONION						
823	WILLIAMS 1977	ONION						
824	WILLIAMS 1977	ONION						
825	WILLIAMS 1977	ONION						
826	WILLIAMS 1977	ONION						
827	WILLIAMS 1977	ONION						
828	WILLIAMS 1977	ONION						
829	WILLIAMS 1977	ONION						
830	WILLIAMS 1977	ONION						
831	WILLIAMS 1977	ONION						
832	WILLIAMS 1977	ONION						
833	WILLIAMS 1977	ONION						
834	WILLIAMS 1977	ONION						
835	WILLIAMS 1977	ONION						
836	WILLIAMS 1977	SWEDE						

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
799	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
800	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
801	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
802	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
803	1100	2020	1.6	2.73	4.4	4.37	2560	2130	AIR DRY	ANAEROBIC DIGESTED
804		100			5100			11400	AIR DRIED	
805		100			5100			11400	AIR DRIED	
806		100			5100			11400	AIR DRIED	
807		100			5100			11400	AIR DRIED	
808		100			5100			11400	AIR DRIED	
809		100			5100			11400	AIR DRIED	
810		100			5100			11400	AIR DRIED	
811		100			5100			11400	AIR DRIED	
812		100			5100			11400	AIR DRIED	
813		100			5100			11400	AIR DRIED	
814		100			5100			11400	AIR DRIED	
815		100			5100			11400	AIR DRIED	
816		100			5100			11400	AIR DRIED	
817		100			5100			11400	AIR DRIED	
818		100			5100			11400	AIR DRIED	
819		100			5100			11400	AIR DRIED	
820		100			5100			11400	AIR DRIED	
821		100			5100			11400	AIR DRIED	
822		100			5100			11400	AIR DRIED	
823		100			5100			11400	AIR DRIED	
824		100			5100			11400	AIR DRIED	
825		100			5100			11400	AIR DRIED	
826		100			5100			11400	AIR DRIED	
827		100			5100			11400	AIR DRIED	
828		100			5100			11400	AIR DRIED	
829		100			5100			11400	AIR DRIED	
830		100			5100			11400	AIR DRIED	
831		100			5100			11400	AIR DRIED	
832		100			5100			11400	AIR DRIED	
833		100			5100			11400	AIR DRIED	
834		100			5100			11400	AIR DRIED	
835		100			5100			11400	AIR DRIED	
836		100			5100			11400	AIR DRIED	

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
799		0	0	1	TYPIC TAPLUDOLL	WAUKEGAN	SIL
800		25	25	1	TYPIC TAPLUDOLL	WAUKEGAN	SIL
801		50	50	1	TYPIC TAPLUDOLL	WAUKEGAN	SIL
802		100	100	1	TYPIC TAPLUDOLL	WAUKEGAN	SIL
803		200	200	1	TYPIC TAPLUDOLL	WAUKEGAN	SIL
804		0	0	8			LS
805		56	56	8			LS
806		112	112	8			LS
807		224	224	8			LS
808		0	0	8			LS
809		56	56	8			LS
810		112	112	8			LS
811		224	224	8			LS
812		0	0	9			LS
813		56	56	9			LS
814		112	112	9			LS
815		224	224	9			LS
816		0	0	9			LS
817		56	56	9			LS
818		112	112	9			LS
819		224	224	9			LS
820		0	0	10			LS
821		56	56	10			LS
822		112	112	10			LS
823		224	224	10			LS
824		0	0	10			LS
825		56	56	10			LS
826		112	112	10			LS
827		224	224	10			LS
828		0	0	13			LS
829		56	56	13			LS
830		112	112	13			LS
831		224	224	13			LS
832		0	0	13			LS
833		56	56	13			LS
834		112	112	13			LS
835		224	224	13			LS
836		0	0	11			LS

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
799						6.5	0
800						6.5	52.5
801						6.5	105
802						6.5	210
803						6.5	420
804					1.2	5.8	0
805					1.2	5.8	640
806					1.2	5.8	1280
807					1.2	5.8	2560
808					1.2	6.6	0
809					1.2	6.6	640
810					1.2	6.6	1280
811					1.2	6.6	2560
812					1.2	6.2	0
813					1.2	6.2	640
814					1.2	6.2	1280
815					1.2	6.2	2560
816					1.2	7	0
817					1.2	7	640
818					1.2	7	1280
819					1.2	7	2560
820					1.2	6.2	0
821					1.2	6.2	640
822					1.2	6.2	1280
823					1.2	6.2	2560
824					1.2	7	0
825					1.2	7	640
826					1.2	7	1280
827					1.2	7	2560
828					1.2	6.3	0
829					1.2	6.3	640
830					1.2	6.3	1280
831					1.2	6.3	2560
832					1.2	6.8	0
833					1.2	6.8	640
834					1.2	6.8	1280
835					1.2	6.8	2560
836					1.2	6.7	0

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
799		N.L.	42	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
800		N.L.	64	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
801		N.L.	66	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
802		N.L.	75	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
803		N.L.	64	LEAF	SLUDGE, FIELD, MATURITY	0	GRAIN
804	.5 M HOAC	29	N.L.		SLUDGE, FIELD, MATURITY	0	ROOT
805	.5 M HOAC	112	N.L.		SLUDGE, FIELD, MATURITY	94.5	ROOT
806	.5 M HOAC	212	N.L.		SLUDGE, FIELD, MATURITY	99.3	ROOT
807	.5 M HOAC	350	N.L.		SLUDGE, FIELD, MATURITY	100	ROOT
808	.5 M HOAC	29	N.L.		SLUDGE, FIELD, MATURITY	0	ROOT
809	.5 M HOAC	112	N.L.		SLUDGE, FIELD, MATURITY	36	ROOT
810	.5 M HOAC	212	N.L.		SLUDGE, FIELD, MATURITY	69.4	ROOT
811	.5 M HOAC	350	N.L.		SLUDGE, FIELD, MATURITY	93.2	ROOT
812	.5 M HOAC	NL	83	ROOT TUBER	SLUDGE, FIELD, MATURITY	0	ROOT TUBER
813	.5 M HOAC	NL	95	ROOT TUBER	SLUDGE, FIELD, MATURITY	86.1	ROOT TUBER
814	.5 M HOAC	NL	124	ROOT TUBER	SLUDGE, FIELD, MATURITY	92.9	ROOT TUBER
815	.5 M HOAC	NL	93	ROOT TUBER	SLUDGE, FIELD, MATURITY	96.7	ROOT TUBER
816	.5 M HOAC	NL	48	ROOT TUBER	SLUDGE, FIELD, MATURITY	0	ROOT TUBER
817	.5 M HOAC	NL	72	ROOT TUBER	SLUDGE, FIELD, MATURITY	0	ROOT TUBER
818	.5 M HOAC	NL	67	ROOT TUBER	SLUDGE, FIELD, MATURITY	0	ROOT TUBER
819	.5 M HOAC	NL	112	ROOT TUBER	SLUDGE, FIELD, MATURITY	52.8	ROOT TUBER
820		NL	NL		SLUDGE, FIELD, MATURITY	0	BULB
821		NL	NL		SLUDGE, FIELD, MATURITY	0	BULB
822		NL	NL		SLUDGE, FIELD, MATURITY	77.6	BULB
823		NL	NL		SLUDGE, FIELD, MATURITY	93.9	BULB
824		NL	NL		SLUDGE, FIELD, MATURITY	0	BULB
825		NL	NL		SLUDGE, FIELD, MATURITY	0	BULB
826		NL	NL		SLUDGE, FIELD, MATURITY	0	BULB
827		NL	NL		SLUDGE, FIELD, MATURITY	38.1	BULB
828		NL	46	BULB	SLUDGE, FIELD, MATURITY	0	BULB
829		NL	141	BULB	SLUDGE, FIELD, MATURITY	0	BULB
830		NL	139	BULB	SLUDGE, FIELD, MATURITY	0	BULB
831		NL	NL	BULB	SLUDGE, FIELD, MATURITY	99	BULB
832		NL	54	BULB	SLUDGE, FIELD, MATURITY	0	BULB
833		NL	71	BULB	SLUDGE, FIELD, MATURITY	0	BULB
834		NL	114	BULB	SLUDGE, FIELD, MATURITY	0	BULB
835		NL	136	BULB	SLUDGE, FIELD, MATURITY	36.4	BULB
836	.5 M HOAC	31	NL		SLUDGE, FIELD, MATURITY	0	BULB

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
799			NO	
800			NO	
801			NO	
802			NO	
803			NO	
804			NO	
805			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
806			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
807			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
808			NO	
809			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
810			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
811			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
812			NO	
813			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
814			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
815			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
816			NO	
817			NO	
818			NO	
819			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
820			NO	
821			NO	
822			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
823			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
824			NO	
825			NO	
826			NO	
827			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
828			NO	
829			NO	
830			NO	
831			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
832			NO	
833			NO	
834			NO	
835			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
836			NO	

TABLE F-4 (cont.)

	LOCATION OF STUDY
799	MINNESOTA
800	MINNESOTA
801	MINNESOTA
802	MINNESOTA
803	MINNESOTA
804	WOODTHORNE, U.K.
805	WOODTHORNE, U.K.
806	WOODTHORNE, U.K.
807	WOODTHORNE, U.K.
808	WOODTHORNE, U.K.
809	WOODTHORNE, U.K.
810	WOODTHORNE, U.K.
811	WOODTHORNE, U.K.
812	WOODTHORNE, U.K.
813	WOODTHORNE, U.K.
814	WOODTHORNE, U.K.
815	WOODTHORNE, U.K.
816	WOODTHORNE, U.K.
817	WOODTHORNE, U.K.
818	WOODTHORNE, U.K.
819	WOODTHORNE, U.K.
820	WOODTHORNE, U.K.
821	WOODTHORNE, U.K.
822	WOODTHORNE, U.K.
823	WOODTHORNE, U.K.
824	WOODTHORNE, U.K.
825	WOODTHORNE, U.K.
826	WOODTHORNE, U.K.
827	WOODTHORNE, U.K.
828	WOODTHORNE, U.K.
829	WOODTHORNE, U.K.
830	WOODTHORNE, U.K.
831	WOODTHORNE, U.K.
832	WOODTHORNE, U.K.
833	WOODTHORNE, U.K.
834	WOODTHORNE, U.K.
835	WOODTHORNE, U.K.
836	WOODTHORNE, U.K.

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
837	WILLIAMS 1977	SWEDE						
838	WILLIAMS 1977	SWEDE						
839	WILLIAMS 1977	SWEDE						
840	WILLIAMS 1977	SWEDE						
841	WILLIAMS 1977	SWEDE						
842	WILLIAMS 1977	SWEDE						
843	WILLIAMS 1977	SWEDE						
844	WILLIAMS 1977	LETTUCE						
845	WILLIAMS 1977	LETTUCE						
846	WILLIAMS 1977	LETTUCE						
847	WILLIAMS 1977	LETTUCE						
848	WILLIAMS 1977	LETTUCE						
849	WILLIAMS 1977	LETTUCE						
850	WILLIAMS 1977	LETTUCE						
851	WILLIAMS 1977	LETTUCE						
852	KING & MORRIS 1972	RYE					1.42	
853	KING & MORRIS 1972	RYE					1.42	
854	KING & MORRIS 1972	RYE					1.42	
855	KING & MORRIS 1972	RYE					1.42	
856	KING & MORRIS 1972	RYE					1.42	
857	KING & MORRIS 1972	RYE					1.42	
858	KING & MORRIS 1972	RYE					1.42	
859	KING & MORRIS 1972	RYE					1.42	
860	KING & MORRIS 1972	RYE					1.42	
861	KING & MORRIS 1972	RYE					1.42	
862	KING & MORRIS 1972	RYE					1.42	
863	KING & MORRIS 1972	RYE					1.42	
864	KING & MORRIS 1972	RYE					1.42	
865	KING & MORRIS 1972	RYE					1.42	
866	KING & MORRIS 1972	RYE					1.42	
867	WEBBER 1972	RED BEET						
868	WEBBER 1972	RED BEET						
869	WEBBER 1972	RED BEET						
870	WEBBER 1972	RED BEET						
871	WEBBER 1972	RED BEET						
872	WEBBER 1972	RED BEET						
873	WEBBER 1972	CELERY						
874	WEBBER 1972	CELERY						

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
837		100			5100			11400	AIR DRIED	
838		100			5100			11400	AIR DRIED	
839		100			5100			11400	AIR DRIED	
840		100			5100			11400	AIR DRIED	
841		100			5100			11400	AIR DRIED	
842		100			5100			11400	AIR DRIED	
843		100			5100			11400	AIR DRIED	
844		100			5100			11400	AIR DRIED	
845		100			5100			11400	AIR DRIED	
846		100			5100			11400	AIR DRIED	
847		100			5100			11400	AIR DRIED	
848		100			5100			11400	AIR DRIED	
849		100			5100			11400	AIR DRIED	
850		100			5100			11400	AIR DRIED	
851		100			5100			11400	AIR DRIED	
852		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
853		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
854		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
855		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
856		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
857		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
858		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
859		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
860		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
861		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
862		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
863		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
864		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
865		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
866		453		2.96	25	0.79		2415	0.06	ANAEROBICALLY DIGESTED
867										
868	240	1100			210			3000		
869	60	4600			58			48000		
870	60	4600			58			48000		
871	240	1100			210			3000		
872	60	4600			58			48000		
873										
874	240	1100			210			3000		

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
837		56	56	11			LS
838		112	112	11			LS
839		224	224	11			LS
840		0	0	11			LS
841		56	56	11			LS
842		112	112	11			LS
843		224	224	11			LS
844		0	0	12			LS
845		56	56	12			LS
846		112	112	12			LS
847		224	224	12			LS
848		0	0	12			LS
849		56	56	12			LS
850		112	112	12			LS
851		224	224	12			LS
852		0	0	0	TYPIC HAPLUDULT	CECIL	SCL
853		26.5	26.5	0	TYPIC HAPLUDULT	CECIL	SCL
854		52.5	52.5	0	TYPIC HAPLUDULT	CECIL	SCL
855		60	60	0	TYPIC HAPLUDULT	CECIL	SCL
856		120	120	0	TYPIC HAPLUDULT	CECIL	SCL
857		0	0	0	TYPIC HAPLUDULT	CECIL	SCL
858		15.1	41.6	0	TYPIC HAPLUDULT	CECIL	SCL
859		30	82.5	0	TYPIC HAPLUDULT	CECIL	SCL
860		60	120	0	TYPIC HAPLUDULT	CECIL	SCL
861		120	240	0	TYPIC HAPLUDULT	CECIL	SCL
862		0	0	0	TYPIC HAPLUDULT	CECIL	SCL
863		15.1	41.6	0	TYPIC HAPLUDULT	CECIL	SCL
864		30	82.5	0	TYPIC HAPLUDULT	CECIL	SCL
865		60	120	0	TYPIC HAPLUDULT	CECIL	SCL
866		120	240	0	TYPIC HAPLUDULT	CECIL	SCL
867		0	0	0			
868		125.5	125.5	2			
869		125.5	125.5	2			
870		125.5	125.5	2			
871		31.4	94.2	0			
872		31.4	94.2	0			
873		0	0	0			
874		125.5	125.5	2			

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
837					1.2	6.7	640
838					1.2	6.7	1280
839					1.2	6.7	2560
840					1.2	7.2	0
841					1.2	7.2	640
842					1.2	7.2	1280
843					1.2	7.2	2560
844					1.2	6.5	0
845					1.2	6.5	640
846					1.2	6.5	1280
847					1.2	6.5	2560
848					1.2	7	0
849					1.2	7	640
850					1.2	7	1280
851					1.2	7	2560
852						5.2	0
853						NR	71
854						NR	142
855						NR	180
856						NR	360
857						5.2	0
858						5.1	171
859						NR	342
860						4.5	486
861						4.2	972
862						LIMED	0
863						LIMED	171
864						LIMED	342
865						LIMED	486
866						LIMED	972
867						6.1	0
868						NR	377
869						NR	1004
870						NR	2008
871						NR	283
872						NR	1004
873						6.1	0
874						NR	377

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
837	.5 M HOAC	90	NL		SLUDGE, FIELD, MATURITY	0	BULB
838	.5 M HOAC	168	NL		SLUDGE, FIELD, MATURITY	70.3	BULB
839	.5 M HOAC	278	NL		SLUDGE, FIELD, MATURITY	100	BULB
840	.5 M HOAC	31	NL		SLUDGE, FIELD, MATURITY	0	BULB
841	.5 M HOAC	90	NL		SLUDGE, FIELD, MATURITY	0	BULB
842	.5 M HOAC	168	NL		SLUDGE, FIELD, MATURITY	0	BULB
843	.5 M HOAC	278	NL		SLUDGE, FIELD, MATURITY	0	BULB
844	.5 M HOAC	47	NL		SLUDGE, FIELD, MATURITY	0	LEAF
845	.5 M HOAC	115	NL		SLUDGE, FIELD, MATURITY	0	LEAF
846	.5 M HOAC	194	NL		SLUDGE, FIELD, MATURITY	30	LEAF
847	.5 M HOAC	334	NL		SLUDGE, FIELD, MATURITY	96.3	LEAF
848	.5 M HOAC	47	NL		SLUDGE, FIELD, MATURITY	0	LEAF
849	.5 M HOAC	115	NL		SLUDGE, FIELD, MATURITY	0	LEAF
850	.5 M HOAC	194	NL		SLUDGE, FIELD, MATURITY	23.7	LEAF
851	.5 M HOAC	334	NL		SLUDGE, FIELD, MATURITY	28.4	LEAF
852		NR	NR		SLUDGE, FIELD, MATURITY	0	FORAGE
853		NR	NR		SLUDGE, FIELD, MATURITY	34*	FORAGE
854		NR	NR		SLUDGE, FIELD, MATURITY	0	FORAGE
855		NR	NR		SLUDGE, FIELD, MATURITY	0	FORAGE
856		NR	NR		SLUDGE, FIELD, MATURITY	0	FORAGE
857		NR	32	FORAGE	SLUDGE, FIELD, MATURITY	0	FORAGE
858		NR	150	FORAGE	SLUDGE, FIELD, MATURITY	41*	FORAGE
859		NR	232	FORAGE	SLUDGE, FIELD, MATURITY	0	FORAGE
860		NR	340	FORAGE	SLUDGE, FIELD, MATURITY	0	FORAGE
861		NR	775	FORAGE	SLUDGE, FIELD, MATURITY	80	FORAGE
862		NR	30	FORAGE	SLUDGE, FIELD, MATURITY	0	FORAGE
863		NR	106	FORAGE	SLUDGE, FIELD, MATURITY	0	FORAGE
864		NR	186	FORAGE	SLUDGE, FIELD, MATURITY	0	FORAGE
865		NR	251	FORAGE	SLUDGE, FIELD, MATURITY	0	FORAGE
866		NR	579	FORAGE	SLUDGE, FIELD, MATURITY	58	FORAGE
867	.5 M HOAC	8.9			SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
868	.5 M HOAC	91			SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
869	.5 M HOAC	465			SLUDGE, FIELD, MATURITY	58	TOTAL BIOMASS
870	.5 M HOAC	744			SLUDGE, FIELD, MATURITY	100	TOTAL BIOMASS
871	.5 M HOAC	61			SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
872	.5 M HOAC	147			SLUDGE, FIELD, MATURITY	0	TOTAL BIOMASS
873	.5 M HOAC	8.9			SLUDGE, FIELD, MATURITY	0	STALKS
874	.5 M HOAC	91			SLUDGE, FIELD, MATURITY	0	STALKS

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
837			NO	
838			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
839			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
840			NO	
841			NO	
842			NO	
843			NO	
844			NO	
845			NO	
846			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
847			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
848			NO	
849			NO	
850			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
851			POSSIBLE	SLUDGE UNUSUALLY HIGH IN NI (5100) AND ZN (11400)
852			NO	
853			NO*	*DOSE RESPONSE NOT CONSISTENT
854			NO	
855			NO	
856			NO	
857			NO	
858			NO*	*DOSE RESPONSE & TISSUE ZN CONCENTRATION ARE NOT CONSISTENT, PH<5.5
859			NO	
860			NO	
861			POSSIBLE	PH<5.5 (=4.2)
862			NO	
863			NO	
864			NO	
865			NO	
866			POSSIBLE	LOADING IN EXCESS OF AGRONOMIC RATES, PH UNKNOWN AND QUESTIONABLE
867			NO	
868			NO	
869			POSSIBLE	HIGH ZN SLUDGE (48000 MG/KG)BLENDED WITH LOWER ZN SLUDGE WAS USED
870			POSSIBLE	HIGH ZN SLUDGE (48000 MG/KG)BLENDED WITH LOWER ZN SLUDGE WAS USED
871			NO	
872			NO	
873			NO	
874			NO	

TABLE F-4 (cont.)

	LOCATION OF STUDY
837	WOODTHORNE, U.K.
838	WOODTHORNE, U.K.
839	WOODTHORNE, U.K.
840	WOODTHORNE, U.K.
841	WOODTHORNE, U.K.
842	WOODTHORNE, U.K.
843	WOODTHORNE, U.K.
844	WOODTHORNE, U.K.
845	WOODTHORNE, U.K.
846	WOODTHORNE, U.K.
847	WOODTHORNE, U.K.
848	WOODTHORNE, U.K.
849	WOODTHORNE, U.K.
850	WOODTHORNE, U.K.
851	WOODTHORNE, U.K.
852	GEORGIA
853	GEORGIA
854	GEORGIA
855	GEORGIA
856	GEORGIA
857	GEORGIA
858	GEORGIA
859	GEORGIA
860	GEORGIA
861	GEORGIA
862	GEORGIA
863	GEORGIA
864	GEORGIA
865	GEORGIA
866	GEORGIA
867	LEEDS, U.K.
868	LEEDS, U.K.
869	LEEDS, U.K.
870	LEEDS, U.K.
871	LEEDS, U.K.
872	LEEDS, U.K.
873	LEEDS, U.K.
874	LEEDS, U.K.

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
875	WEBBER 1972	CELERY						
876	WEBBER 1972	CELERY						
877	WEBBER 1972	CELERY						
878	WEBBER 1972	CELERY						
879	WEBBER 1972	CELERY						
880	WEBBER 1972							
881	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307
882	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307
883	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307
884	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307
885	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307
886	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307
887	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307
888	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307
889	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307
890	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307
891	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307
892	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307
893	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307
894	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307
895	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307
896	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307
897	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.4	3.3	307
898	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.3	3.3	307
899	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.6	3.3	307
900	PIETZ ET AL. 1983	CORN	PIONEER 3517	7.6	46	1.5	3.3	307
901	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
902	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
903	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
904	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
905	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
906	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
907	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
908	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
909	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
910	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71
911	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53
912	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
875	60	4600			58			48000		
876	60	4600			58			48000		
877	240	1100			210			3000		
878	60	4600			58			48000		
879										
880										
881	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
882	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
883	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
884	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
885	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
886	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
887	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
888	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
889	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
890	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
891	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
892	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
893	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
894	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
895	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
896	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
897	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
898	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
899	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
900	3505	1471	5.1	5.1	369	3.42	1258	4872	0.04	SECONDARY, ANAER DIGEST, LAGOON
901	3505	1471	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON
902	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
903	3505	1471	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON
904	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
905	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
906	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
907	3505	1471	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON
908	775	460	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON
909	775	460	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON
910	775	460	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON
911	679	454	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON
912	3505	1471	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
875		125.5	125.5	2			
876		125.5	125.5	2			
877		31.4	94.2	0			
878		31.4	94.2	0			
879							
880							
881	POLYMER,FECL3	0	0		STRIP MINE SPOIL		
882	POLYMER,FECL3	0	0		STRIP MINE SPOIL		
883	POLYMER,FECL3	0	0		STRIP MINE SPOIL		
884	POLYMER,FECL3	0	0		STRIP MINE SPOIL		
885	POLYMER,FECL3	0	0		STRIP MINE SPOIL		
886	POLYMER,FECL3	3	3		STRIP MINE SPOIL		
887	POLYMER,FECL3	12.8	15.8	0	STRIP MINE SPOIL		
888	POLYMER,FECL3	12.4	28.1	0	STRIP MINE SPOIL		
889	POLYMER,FECL3	14.3	42.4	0	STRIP MINE SPOIL		
890	POLYMER,FECL3	19.5	61.9	0	STRIP MINE SPOIL		
891	POLYMER,FECL3	6	6	0	STRIP MINE SPOIL		
892	POLYMER,FECL3	25.5	31.5	0	STRIP MINE SPOIL		
893	POLYMER,FECL3	29.8	61.3	0	STRIP MINE SPOIL		
894	POLYMER,FECL3	28.6	89.9	0	STRIP MINE SPOIL		
895	POLYMER,FECL3	39	128.9	0	STRIP MINE SPOIL		
896	POLYMER,FECL3	11.9	11.9	0	STRIP MINE SPOIL		
897	POLYMER,FECL3	51	62.9	0	STRIP MINE SPOIL		
898	POLYMER,FECL3	59.6	122.5	0	STRIP MINE SPOIL		
899	POLYMER,FECL3	57.1	179.6	0	STRIP MINE SPOIL		
900	POLYMER,FECL3	78	257.6	0	STRIP MINE SPOIL		
901	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL		
902	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL		
903	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL		
904	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL		
905	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL		
906	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL		
907	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL		
908	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL		
909	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL		
910	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL		
911	POLYMER,FECL3	0	0	0	STRIP MINE SPOIL		
912	POLYMER,FECL3	16.1	78	0	STRIP MINE SPOIL		

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
875						NR	1004
876						NR	2008
877						NR	283
878						NR	377
879							
880							
881				12.6	0.25	7.8	0
882				12.6	0.25	7.8	0
883				12.6	0.33	7.8	0
884				12.6	0.33	7.8	0
885				12.6	0.33	7.8	0
886				12.6	0.33	7.8	15
887				12.6	0.27	7.8	79
888				12.6	0.41	7.8	142
889				12.6	0.41	7.8	212
890				12.6	0.59	7.8	331
891				12.6	0.35	7.8	30
892				12.6	0.3	7.8	158
893				12.6	0.3	7.8	284
894				12.6	0.5	7.8	424
895				12.6	0.5	7.8	662
896				12.6	0.33	7.8	60
897				12.6	0.33	7.8	316
898				12.6	0.76	7.8	568
899				12.6	0.76	7.8	848
900				12.6	1.22	7.8	1324
901					0.33	7.5	0
902					0.44	7.5	0
903					0.44	7.5	0
904					0.36	7.5	0
905					0.36	7.5	0
906					0.46	7.5	0
907					0.46	7.5	0
908					0.73	7.5	0
909					0.73	7.5	0
910					0.7	7.5	0
911					0.7	7.5	0
912					0.59	7.5	415

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
875	.5 M HOAC	465			SLUDGE, FIELD, MATURITY	0	STALKS
876	.5 M HOAC	744			SLUDGE, FIELD, MATURITY	58	STALKS
877	.5 M HOAC	61			SLUDGE, FIELD, MATURITY	0	STALKS
878	.5 M HOAC	147			SLUDGE, FIELD, MATURITY	0	STALKS
879							
880							
881	0.1 M HCl	3.4	15	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
882	0.1 M HCl	4.5	13	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
883	0.1 M HCl	3.9	21	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
884	0.1 M HCl	9.5	33	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
885	0.1 M HCl	9.4	33	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
886	0.1 M HCl	4.3	34	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
887	0.1 M HCl	6.5	43	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
888	0.1 M HCl	20.8	74	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
889	0.1 M HCl	30.6	109	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
890	0.1 M HCl	18.1	81	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
891	0.1 M HCl	3.7	43	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
892	0.1 M HCl	9.1	51	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
893	0.1 M HCl	50.3	93	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
894	0.1 M HCl	43.3	124	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
895	0.1 M HCl	32.6	132	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
896	0.1 M HCl	3.6	80	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
897	0.1 M HCl	10.3	72	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
898	0.1 M HCl	114	121	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
899	0.1 M HCl	82	191	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
900	0.1 M HCl	77.5	200	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
901	0.1 M HCl	14	49	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
902	0.1 M HCl	20.4	65	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
903	0.1 M HCl	25.8	42	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
904	0.1 M HCl	22.5	54	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
905	0.1 M HCl	22.3	53	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
906	0.1 M HCl	28.1	34	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
907	0.1 M HCl	33.4	56	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
908	0.1 M HCl	42	88	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
909	0.1 M HCl	58.6	24	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
910	0.1 M HCl	58.3	28	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
911	0.1 M HCl	74.5	31	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
912	0.1 M HCl	49.6	114	LEAF	FIELD, SLUDGE, MATURITY	29.5*	GRAIN

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
875			NO	
876			POSSIBLE	HIGH ZN SLUDGE (48000 MG/KG)BLENDED WITH LOWER ZN SLUDGE WAS USED
877			NO	
878			NO	
879				
880				
881	0	STOVER	NO	
882	0	STOVER	NO	
883	0	STOVER	NO	
884	0	STOVER	NO	
885	0	STOVER	NO	
886	0	STOVER	NO	
887	0	STOVER	NO	
888	0	STOVER	NO	
889	0	STOVER	NO	
890	0	STOVER	NO	
891	0	STOVER	NO	
892	0	STOVER	NO	
893	0	STOVER	NO	
894	0	STOVER	NO	
895	0	STOVER	NO	
896	0	STOVER	NO	
897	0	STOVER	NO	
898	0	STOVER	NO	
899	0	STOVER	NO	
900	0	STOVER	NO	
901	0	STOVER	NO	
902	0	STOVER	NO	
903	0	STOVER	NO	
904	0	STOVER	NO	
905	0	STOVER	NO	
906	0	STOVER	NO	
907	0	STOVER	NO	
908	0	STOVER	NO	
909	0	STOVER	NO	
910	0	STOVER	NO	
911	0	STOVER	NO	
912	0	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENRATION NOT CONSISTANT, OTHER FACTORS

TABLE F-4 (cont.)

	LOCATION OF STUDY
875	LEEDS, U.K.
876	LEEDS, U.K.
877	LEEDS, U.K.
878	LEEDS, U.K.
879	
880	
881	FULTON COUNTY, ILLINOIS
882	FULTON COUNTY, ILLINOIS
883	FULTON COUNTY, ILLINOIS
884	FULTON COUNTY, ILLINOIS
885	FULTON COUNTY, ILLINOIS
886	FULTON COUNTY, ILLINOIS
887	FULTON COUNTY, ILLINOIS
888	FULTON COUNTY, ILLINOIS
889	FULTON COUNTY, ILLINOIS
890	FULTON COUNTY, ILLINOIS
891	FULTON COUNTY, ILLINOIS
892	FULTON COUNTY, ILLINOIS
893	FULTON COUNTY, ILLINOIS
894	FULTON COUNTY, ILLINOIS
895	FULTON COUNTY, ILLINOIS
896	FULTON COUNTY, ILLINOIS
897	FULTON COUNTY, ILLINOIS
898	FULTON COUNTY, ILLINOIS
899	FULTON COUNTY, ILLINOIS
900	FULTON COUNTY, ILLINOIS
901	FULTON COUNTY, ILLINOIS
902	FULTON COUNTY, ILLINOIS
903	FULTON COUNTY, ILLINOIS
904	FULTON COUNTY, ILLINOIS
905	FULTON COUNTY, ILLINOIS
906	FULTON COUNTY, ILLINOIS
907	FULTON COUNTY, ILLINOIS
908	FULTON COUNTY, ILLINOIS
909	FULTON COUNTY, ILLINOIS
910	FULTON COUNTY, ILLINOIS
911	FULTON COUNTY, ILLINOIS
912	FULTON COUNTY, ILLINOIS

TABLE F-4 (cont.)

	LITERATURE CITATION	PLANT NAME	CULTIVAR	SLUDGE pH	SLUDGE VOL SOLIDS %	SLUDGE Al %	SLUDGE Ca %	SLUDGE Cd mg/kg
913	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
914	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
915	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
916	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
917	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
918	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
919	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
920	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
921	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71
922	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53
923	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
924	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
925	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
926	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
927	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
928	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
929	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
930	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
931	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
932	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71
933	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53
934	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
935	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
936	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
937	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
938	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	265
939	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
940	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	46	1.4	3.3	160
941	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
942	PIETZ ET AL. 1991	CORN	PIONEER 3517	7.6	20	3.1	0.71	71
943	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	30	3.1	0.71	71
944	PIETZ ET AL. 1991	CORN	PIONEER 3377	7.6	20	0.67	3.9	53

TABLE F-4 (cont.)

	SLUDGE Cr mg/kg	SLUDGE Cu mg/kg	SLUDGE Fe %	SLUDGE N %	SLUDGE Ni mg/kg	SLUDGE P mg/kg	SLUDGE Pb mg/kg	SLUDGE Zn mg/kg	SLUDGE SOLIDS CONTNT	SLUDGE BIOLOGICAL PROCESSING
913	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
914	3505	1471	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON
915	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
916	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
917	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
918	3505	1471	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON
919	775	460	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON
920	775	460	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON
921	775	460	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON
922	679	454	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON
923	3505	1471	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON
924	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
925	3505	1471	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON
926	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
927	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
928	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
929	3505	1471	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON
930	775	460	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON
931	775	460	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON
932	775	460	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON
933	679	454	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON
934	3505	1471	4.3	4.5	425	3.42	850	3600	0.045	SECONDARY, ANAER DIGEST, LAGOON
935	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
936	3505	1471	4.3	4.5	425	3.42	850	3600	0.054	SECONDARY, ANAER DIGEST, LAGOON
937	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
938	3505	1471	4.3	4.5	425	3.42	850	3600	0.052	SECONDARY, ANAER DIGEST, LAGOON
939	3505	1471	4.3	4.5	425	3.42	850	3600	0.05	SECONDARY, ANAER DIGEST, LAGOON
940	3505	1471	4.3	4.5	425	3.42	850	3600	0.046	SECONDARY, ANAER DIGEST, LAGOON
941	775	460	2.2	0.5	116	0.87	293	1100	0.66	SECONDARY, ANAER DIGEST, LAGOON
942	775	460	2.2	0.5	116	0.87	293	1100	0.65	SECONDARY, ANAER DIGEST, LAGOON
943	775	460	2.2	0.5	116	0.87	293	1100	0.3	SECONDARY, ANAER DIGEST, LAGOON
944	679	454	1.9	0.5	121	0.62	259	1146	0.69	SECONDARY, ANAER DIGEST, LAGOON

TABLE F-4 (cont.)

	SLUDGE CHEMICAL STABILIZATN	ANNL SLUDGE LOADNG RATE Mg/ha	CUMML SLUDGE LOADNG RATE Mg/ha	YEARS SINCE LAST APPLICATN	SOIL TAXONOMIC NAME	SOIL SERIES NAME	SOIL TEXTURE
913	POLYMER,FECL3	19.9	97.9	0	STRIP MINE SPOIL		
914	POLYMER,FECL3	17.4	115.3	0	STRIP MINE SPOIL		
915	POLYMER,FECL3	11.4	126.7	0	STRIP MINE SPOIL		
916	POLYMER,FECL3	16.8	143.5	0	STRIP MINE SPOIL		
917	POLYMER,FECL3	17.9	161.4	0	STRIP MINE SPOIL		
918	POLYMER,FECL3	16.8	178.2	0	STRIP MINE SPOIL		
919	POLYMER,FECL3	16.8	195	0	STRIP MINE SPOIL		
920	POLYMER,FECL3	16.8	211.8	0	STRIP MINE SPOIL		
921	POLYMER,FECL3	16.8	228.6	0	STRIP MINE SPOIL		
922	POLYMER,FECL3	16.8	245.4	0	STRIP MINE SPOIL		
923	POLYMER,FECL3	32.2	161.1	0	STRIP MINE SPOIL		
924	POLYMER,FECL3	39.8	200.9	0	STRIP MINE SPOIL		
925	POLYMER,FECL3	34.8	235.7	0	STRIP MINE SPOIL		
926	POLYMER,FECL3	22.8	258.5	0	STRIP MINE SPOIL		
927	POLYMER,FECL3	34.9	293.4	0	STRIP MINE SPOIL		
928	POLYMER,FECL3	35.8	329.2	0	STRIP MINE SPOIL		
929	POLYMER,FECL3	33.6	362.8	0	STRIP MINE SPOIL		
930	POLYMER,FECL3	33.6	396.4	0	STRIP MINE SPOIL		
931	POLYMER,FECL3	33.6	430	0	STRIP MINE SPOIL		
932	POLYMER,FECL3	33.6	463.6	0	STRIP MINE SPOIL		
933	POLYMER,FECL3	33.6	497.2	0	STRIP MINE SPOIL		
934	POLYMER,FECL3	64.3	321.9	0	STRIP MINE SPOIL		
935	POLYMER,FECL3	79.7	401.6	0	STRIP MINE SPOIL		
936	POLYMER,FECL3	69.8	471.4	0	STRIP MINE SPOIL		
937	POLYMER,FECL3	45.5	516.9	0	STRIP MINE SPOIL		
938	POLYMER,FECL3	68.8	585.7	0	STRIP MINE SPOIL		
939	POLYMER,FECL3	71.7	657.4	0	STRIP MINE SPOIL		
940	POLYMER,FECL3	67.2	724.6	0	STRIP MINE SPOIL		
941	POLYMER,FECL3	67.2	791.8	0	STRIP MINE SPOIL		
942	POLYMER,FECL3	67.2	859	0	STRIP MINE SPOIL		
943	POLYMER,FECL3	67.2	926.2	0	STRIP MINE SPOIL		
944	POLYMER,FECL3	67.2	993.4	0	STRIP MINE SPOIL		

TABLE F-4 (cont.)

	SAND CONTENT %	SILT CONTENT %	CLAY CONTENT %	SOIL CEC cmol/kg	SOIL OC %	SOIL pH	CUMM Zn LOADING RATE (kg/ha)
913					0.94	7.5	508
914					0.94	7.5	592
915					0.67	7.5	635
916					0.67	7.5	695
917					0.87	7.5	746
918					0.87	7.5	795
919					1.41	7.5	851
920					1.41	7.5	890
921					1.25	7.5	940
922					1.25	7.5	973
923					0.94	7.5	830
924					0.94	7.5	1016
925					1.56	7.5	1184
926					1.56	7.5	1270
927					1.04	7.5	1390
928					1.04	7.5	1492
929					1.48	7.5	1590
930					1.48	7.5	1702
931					2.15	7.5	1780
932					2.15	7.5	1880
933					1.9	7.5	1946
934					1.22	7.5	1660
935					3.02	7.5	2032
936					3.02	7.5	2368
937					1.58	7.5	2540
938					1.58	7.5	2780
939					2.38	7.5	2984
940					2.38	7.5	3180
941					3.47	7.5	3404
942					3.47	7.5	3560
943					2.77	7.5	3760
944					2.77	7.5	3892

TABLE F-4 (cont.)

	SOIL EXTRACTANT	SOIL Zn CONCENTRTN mg/kg	PLANT Zn CONCENTRTN mg/kg	PLANT TISSUE SAMPLED	DESCRIPTION OF EXPERIMENTAL DESIGN	YIELD REDUCTION %	YIELD COMPONENT MEASURED
913	0.1 M HCl	59.7	101	LEAF	FIELD, SLUDGE, MATURITY	NA	GRAIN
914	0.1 M HCl	133	97	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
915	0.1 M HCl	90.6	76	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
916	0.1 M HCl	82.2	53	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
917	0.1 M HCl	118	60	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
918	0.1 M HCl	113	94	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
919	0.1 M HCl	171	88	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
920	0.1 M HCl	196	34	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
921	0.1 M HCl	175	41	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
922	0.1 M HCl	174	38	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
923	0.1 M HCl	89.1	201	LEAF	FIELD, SLUDGE, MATURITY	21.5*	GRAIN
924	0.1 M HCl	102	197	LEAF	FIELD, SLUDGE, MATURITY	NA	GRAIN
925	0.1 M HCl	268	183	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
926	0.1 M HCl	211	115	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
927	0.1 M HCl	195	132	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
928	0.1 M HCl	269	121	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
929	0.1 M HCl	261	174	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
930	0.1 M HCl	317	128	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
931	0.1 M HCl	326	55	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
932	0.1 M HCl	293	42	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
933	0.1 M HCl	335	41	LEAF	FIELD, SLUDGE, MATURITY	43.7*	GRAIN
934	0.1 M HCl	182	317	LEAF	FIELD, SLUDGE, MATURITY	23*	GRAIN
935	0.1 M HCl	214	346	LEAF	FIELD, SLUDGE, MATURITY	NA	GRAIN
936	0.1 M HCl	358	325	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
937	0.1 M HCl	442	252	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
938	0.1 M HCl	332	245	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
939	0.1 M HCl	534	294	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
940	0.1 M HCl	491	298	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
941	0.1 M HCl	689	195	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
942	0.1 M HCl	398	87	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
943	0.1 M HCl	492	64	LEAF	FIELD, SLUDGE, MATURITY	0	GRAIN
944	0.1 M HCl	519	48	LEAF	FIELD, SLUDGE, MATURITY	59.2*	GRAIN

TABLE F-4 (cont.)

	YIELD REDUCTION %	YIELD COMPONENT MEASURED	METAL PHYTOTOXICITY	COMMENTS
913	NA	STOVER	NO	
914	0	STOVER	NO	
915	0	STOVER	NO	
916	0	STOVER	NO	
917	0	STOVER	NO	
918	0	STOVER	NO	
919	0	STOVER	NO	
920	0	STOVER	NO	
921	0	STOVER	NO	
922	0	STOVER	NO	
923	0	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENRATION NOT CONSISTANT, OTHER FACTORS
924	NA	STOVER	NO	
925	0	STOVER	NO	
926	0	STOVER	NO	
927	0	STOVER	NO	
928	0	STOVER	NO	
929	0	STOVER	NO	
930	0	STOVER	NO	
931	0	STOVER	NO	
932	0	STOVER	NO	
933	0	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENRATION NOT CONSISTANT, OTHER FACTORS
934	0	STOVER	*NO	*DOSE RESPONSE AND TISSUE ZN CONCENRATION NOT CONSISTANT, OTHER FACTORS
935	NA	STOVER	NO	
936	0	STOVER	NO	
937	0	STOVER	NO	
938	0	STOVER	NO	
939	0	STOVER	NO	
940	0	STOVER	NO	
941	0	STOVER	NO	
942	0	STOVER	NO	
943	0	STOVER	NO	
944	0	STOVER	*NO	*DOSE RESPONSE & TISSUE ZN CONCENTRATION NOT CONSISTENT, OTHER FACTORS

TABLE F-4 (cont.)

	LOCATION OF STUDY
913	FULTON COUNTY, ILLINOIS
914	FULTON COUNTY, ILLINOIS
915	FULTON COUNTY, ILLINOIS
916	FULTON COUNTY, ILLINOIS
917	FULTON COUNTY, ILLINOIS
918	FULTON COUNTY, ILLINOIS
919	FULTON COUNTY, ILLINOIS
920	FULTON COUNTY, ILLINOIS
921	FULTON COUNTY, ILLINOIS
922	FULTON COUNTY, ILLINOIS
923	FULTON COUNTY, ILLINOIS
924	FULTON COUNTY, ILLINOIS
925	FULTON COUNTY, ILLINOIS
926	FULTON COUNTY, ILLINOIS
927	FULTON COUNTY, ILLINOIS
928	FULTON COUNTY, ILLINOIS
929	FULTON COUNTY, ILLINOIS
930	FULTON COUNTY, ILLINOIS
931	FULTON COUNTY, ILLINOIS
932	FULTON COUNTY, ILLINOIS
933	FULTON COUNTY, ILLINOIS
934	FULTON COUNTY, ILLINOIS
935	FULTON COUNTY, ILLINOIS
936	FULTON COUNTY, ILLINOIS
937	FULTON COUNTY, ILLINOIS
938	FULTON COUNTY, ILLINOIS
939	FULTON COUNTY, ILLINOIS
940	FULTON COUNTY, ILLINOIS
941	FULTON COUNTY, ILLINOIS
942	FULTON COUNTY, ILLINOIS
943	FULTON COUNTY, ILLINOIS
944	FULTON COUNTY, ILLINOIS

APPENDIX G

Accumulation of Pollutant in Treated Soil, and Calculation of Square Wave for the Ground Water Pathway

APPENDIX G

ACCUMULATION OF POLLUTANT IN TREATED SOIL, AND CALCULATION OF "SQUARE WAVE" FOR GROUND-WATER PATHWAY

Derivation of reference application rates is based on the concept that both metals and organic pollutants accumulate in soil with repeated application of sewage sludge. It is assumed that all competing loss processes for pollutant in soil can be approximated as first-order, and that coefficients describing the rate of loss to each process can be summed to yield a total or "lumped" coefficient for first-order loss.

For organic pollutants, it is assumed that sewage sludge will be applied repeatedly until steady-state is achieved. In other words, organic pollutants will accumulate in the soil until total yearly losses through erosion, degradation, leaching, and volatilization (which are assumed to be proportional to the concentration in soil) catch up with yearly loadings of pollutant to soil.

All loss processes are assumed to be first-order, and are combined into a "lumped" first-order loss process for which losses at any time t can be described as:

$$\frac{dM_t}{dt} = -K_{tot}\,M_t \qquad (1)$$

where:

M_t = mass of pollutant in treated soil at time t (kg/ha)
K_{tot} = lumped, first-order loss rate for pollutant (yr^{-1})

Figure G-1 shows expected concentrations of BAP in treated soil as a function of time, based on a unit yearly loading of 1 kg/ha and a yearly total loss rate of 0.484. At the beginning of each year, a new application of sludge raises the concentration by about 1 kg/ha. Subsequent losses to leaching, degradation, erosion, and volatilization (at total estimated rate of K_{tot}=0.484 yr^{-1}) then reduce the concentration until the next year's application. If pollutant loading to

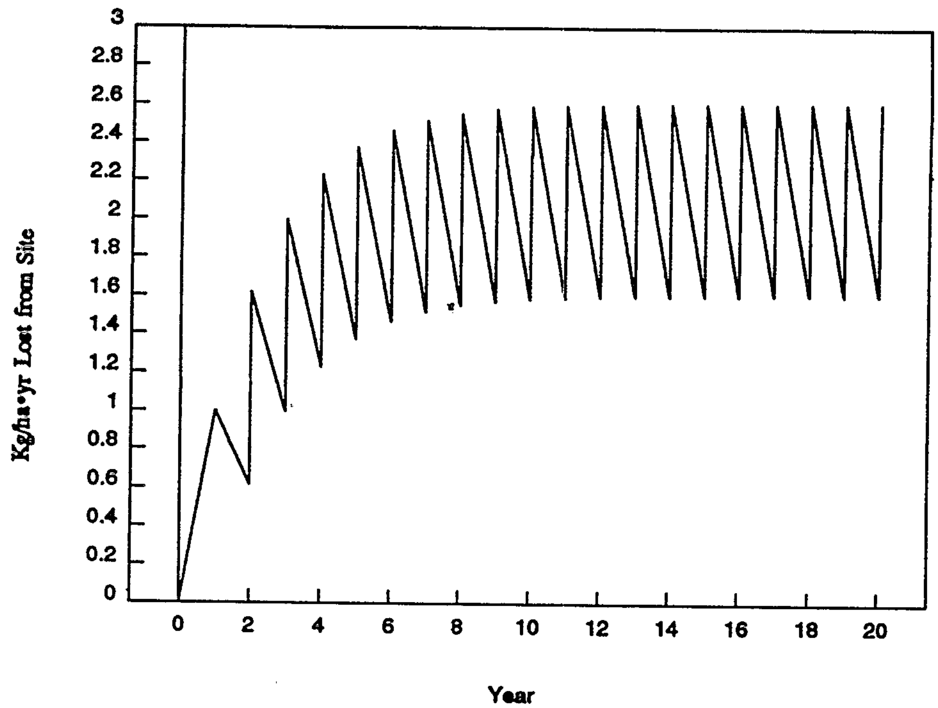

Figure G-1. BAP in soil by time (kg/ha), per annual loading (1 kg/ha).

treated soil is approximated as a continuous process, the mass of pollutant in soil after t years of sewage sludge applications can be approximated by:

$$M_t = \int_0^t AR\ e^{-K_{tot}x}\ dx = \frac{AR}{K_{tot}}\left(1 - e^{-K_{tot}t}\right) \qquad (2)$$

where:

M_t	=	mass of pollutant in treated soil at time t (kg/ha)
AR	=	annual loading of pollutant to soil (kg/ha•yr)
K_{tot}	=	lumped, first-order loss rate for pollutant (yr^{-1})

As t approaches infinity M_t approaches AR/K_{tot} and yearly loss approaches yearly loading.

Figure G-2 plots annual losses of BAP as a function of the number of repeat applications of sewage sludge (and 1 kg/ha annual loading of BAP). As can be seen from the graph, the theoretical limit of 1 kg/ha annual loss has been nearly achieved after about 10 years of repeat applications. Because BAP has the lowest estimated total loss rate of any organic pollutant considered in this analysis, other organic pollutants should approach steady-state conditions more quickly. Calculation of reference application of pollutant is based on the assumption that steady-state has been achieved.

For metals, the reference application of pollution is expressed in terms of cumulative loadings. According to the loss coefficients calculated for metals in this analysis, arsenic is lost most rapidly from treated soil, and lead least rapidly. Figure G-3 shows how the cumulative loading of arsenic in treated soil would vary with 50 years of repeat applications of sludge with 1 kg/ha loading of arsenic. With a total loss rate of 0.12 per year, arsenic approaches a steady-state concentration equal to about 8 times its annual loading. Figure G-4 shows corresponding yearly losses of arsenic. After about 10-20 years, yearly losses closely approximate yearly loadings of 1 kg/ha. Lead, the least mobile of the metals evaluated, is depleted from treated soil at an estimated annual rate of only 0.0073 per year. Under an idealized scenario of unlimited applications of sludge (not used for this analysis) and a unit loading of 1 kg/ha, the accumulation of lead in soil would be described by Figure G-5. Because of its low rate of loss,

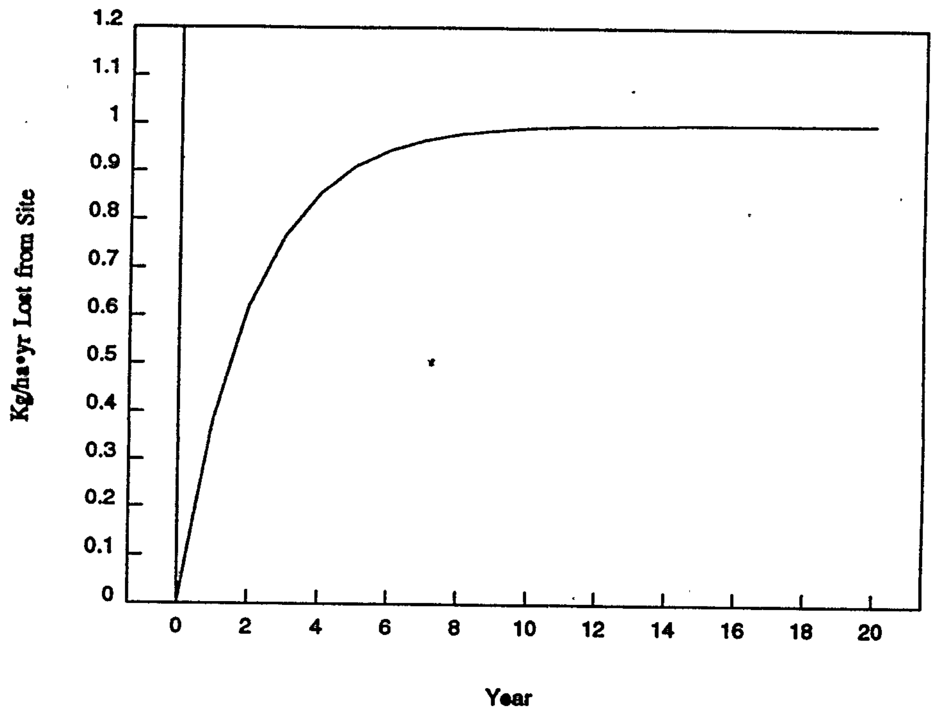

Figure G-2. Annual loss of BAP from soil (kg/ha•yr), per annual loading (1 kg/ha).

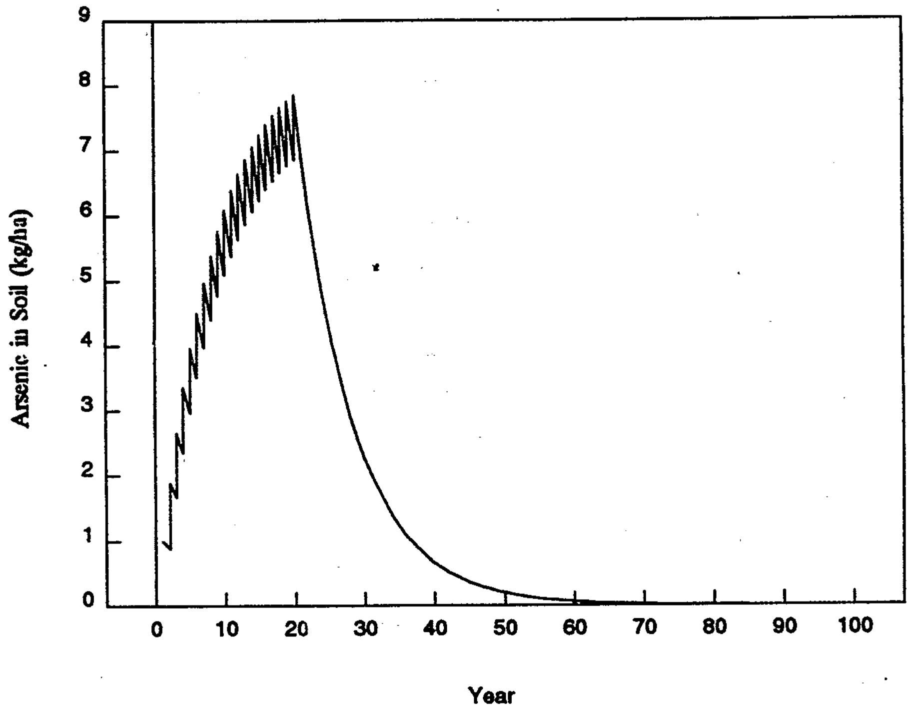

Figure G-3. Arsenic in soil as function of time given 20 applications (1 kg/ha•yr).

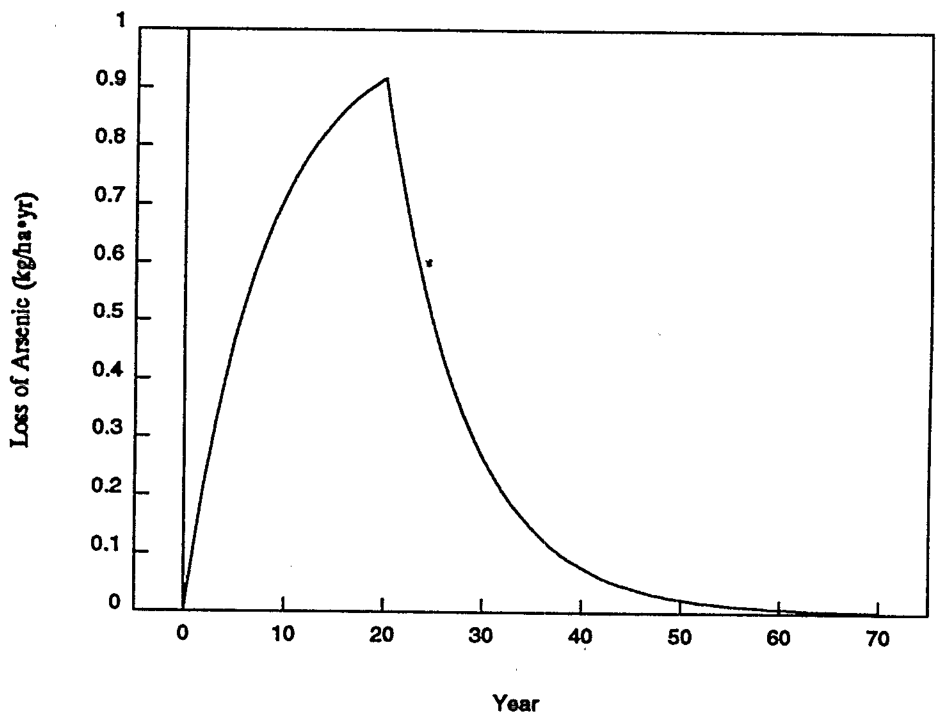

Figure G-4. Loss of arsenic per year (kg/ha•yr), assuming limit of 20 applications (1 kg/ha•yr).

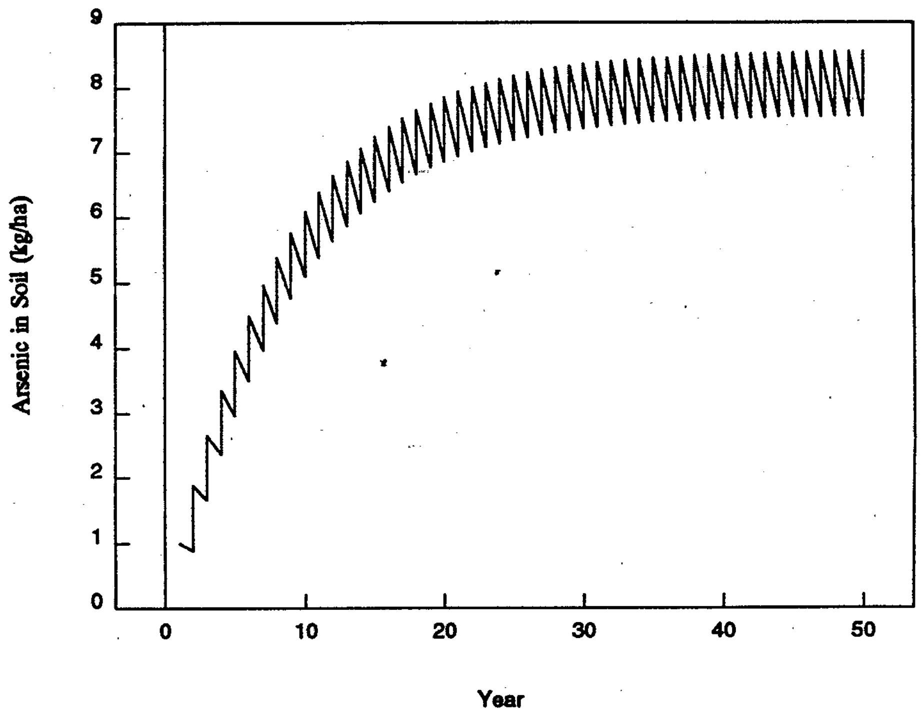

Figure G-5. Arsenic in soil as function of time, given unlimited applications (1 kg/ha).

lead concentrations would increase significantly each year for the first 500-600 years of repeat applications. As shown in Figure G-6, yearly losses would not begin to approximate yearly loadings for several centuries.

Reference application rates of pollutant for metals are based on cumulative loadings to treated soil, but the contamination of well-water or surface water bodies is also affected by the period of time in which this cumulative loading takes place. Assumptions are therefore required if maximum allowable cumulative loadings are to be calculated. It is assumed that metals are loaded into treated soil through 20 consecutive, yearly applications of sewage sludge; after 20 years, applications are discontinued. Figure G-7 and Figure G-8 show how these assumptions affect the predicted concentration and annual losses of arsenic for these calculations. With 20 consecutive loadings of arsenic at 1 kg/ha, yearly concentrations and losses are expected to increase each year, until they reach a maximum of about 0.9 kg/ha in the 20th year. Thereafter, annual losses decline as the store of accumulated arsenic is depleted from the soil.

Ideally, derivation of reference application rates would be based on functions similar to the one graphed in Figure G-8, but for computational reasons a simplified loading is used as input for the unsaturated zone (VADOFT) component of the ground-water model. It is assumed that pollutant is loaded into the top of the unsaturated zone as a "square wave" of constant magnitude and finite duration. To capture the risks associated with the peak rate at which pollutant leaves the soil layer, the peak loss rate (calculated for the 20th year of application) is used for the calculations. To conserve mass, the assumed duration of this loading is constrained so that the product of the loss rate and the length of the square wave is equal to the cumulative total mass of pollutant loading for the site. For arsenic, the peak loss rate is calculated as:

$$\begin{aligned} L_{max} &= 1 - e^{(-0.20 \times 20)} \\ &= 0.909 (kg/ha \cdot yr) \end{aligned} \tag{3}$$

where:

L_{max} = maximum loss rate of pollutant (kg/ha•yr)

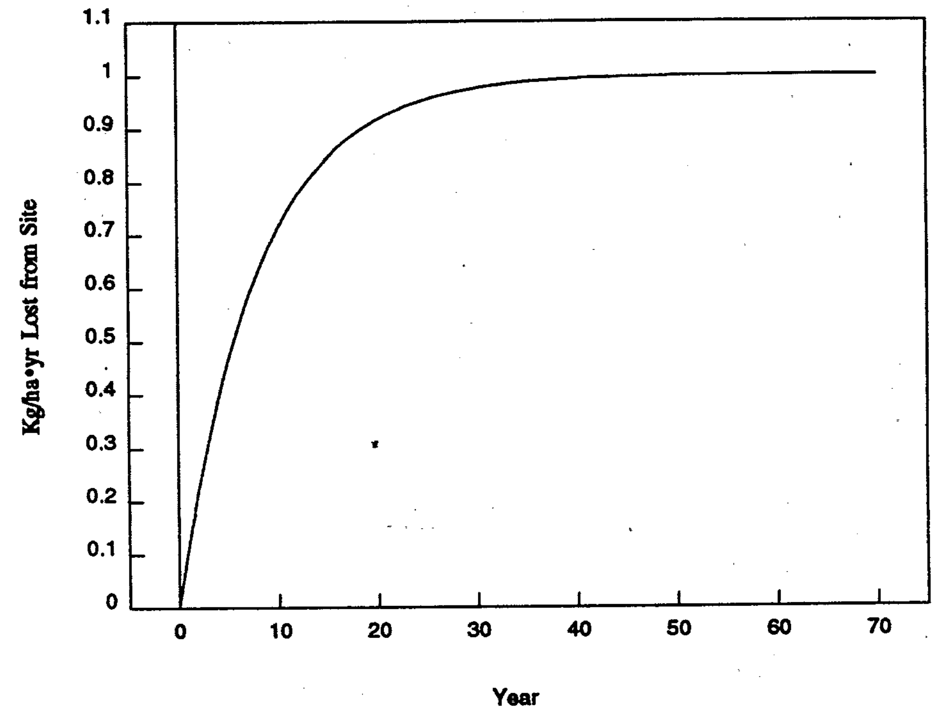

Figure G-6. Total loss of arsenic per year, per annual loading (1 kg/ha).

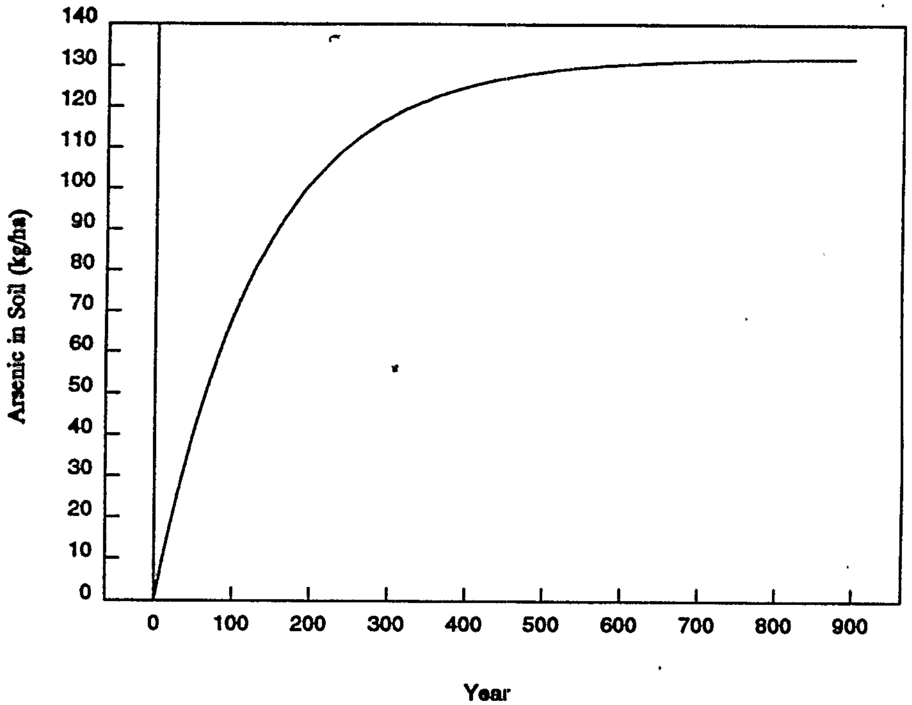

Figure G-7. Lead in soil by time (kg/ha), given unlimited applications (1 kg/ha).

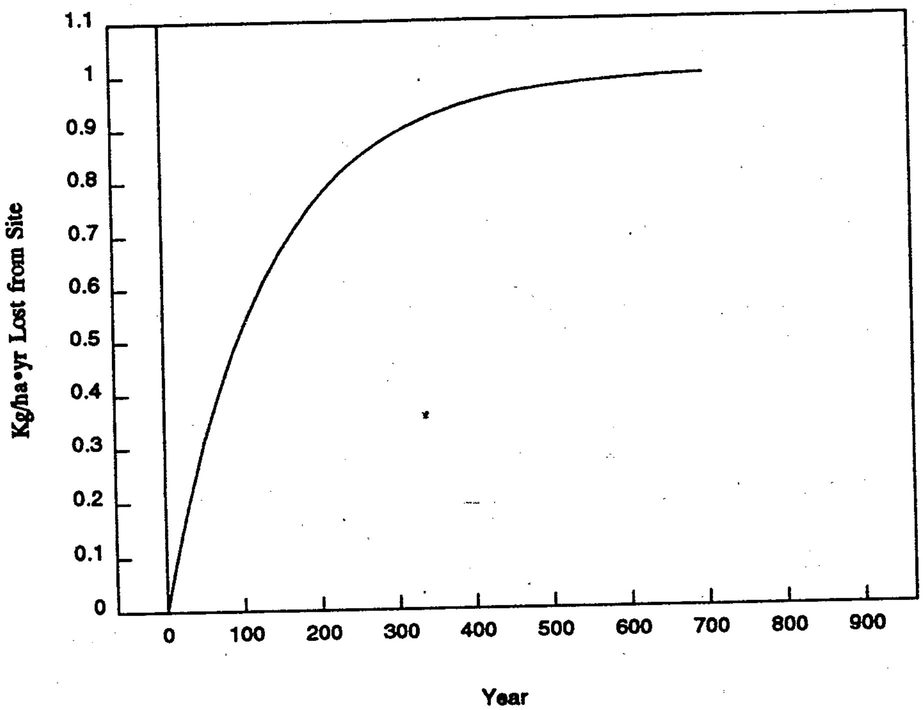

Figure G-8. Total loss of lead per year (hg/ha•yr), per annual loading (1 kg/ha).

At this maximum rate, a cumulative loading of 20 kg/ha would be depleted in:

$$\frac{\sum A_Y(kg/ha)}{L_{MAX}(kg/ha \cdot yr)} = \frac{20}{0.909} = 22yr \tag{4}$$

where:

L_{max} = maximum loss rate of pollutant (kg/ha•yr)

The square wave thus computed for arsenic is included in Figure G-8.

As mentioned earlier, reference application rates for organic pollutants on land application sites are derived for steady-state conditions. At steady state, the amplitude of the "square wave" pulse for the groundwater pathway model is therefore equal to the unit loading of pollutant (1 kg/ha) multiplied by the fraction of annual loss attributable to leaching. The length of the square wave is equal to the length of the simulation (300 years). For landfills and surface impoundments, both organic and metal pollutants are regulated based on the concentration of pollutant in the sludge. Steady-state assumptions are therefore inappropriate, and the loading of both organic and metal pollutants to the unsaturated zone is represented as a square wave. In summary, all of the calculations in our derivation of reference application rates are based on the assumption that pollutant losses to competing loss processes can be described as first-order. All calculations within the mass balance, air pathway, and erosion pathway components of our model are based on first-order loss processes. Calculation of a reference application rate for the groundwater pathway also involves the assumption that losses are first-order, but a simplifying step is required in executing the groundwater pathway model. For metals in land-applied sewage sludge, and for both metals and organic pollutants in sewage sludge disposed in landfills or surface impoundments, the pollutant pulse into the unsaturated zone is approximated as a square wave. Dimensions of this square wave pulse are set to approximate conditions based on first-order, mass balance calculations.

APPENDIX H

Partitioning of Pollutants Among Air, Water, and Solids in Soil

APPENDIX H

PARTITIONING OF POLLUTANT AMONG AIR, WATER, AND SOLIDS IN SOIL

Calculations used to derive reference application rates for ground water, surface water, and air pathways are based on the assumption that equilibrium is maintained between concentrations of pollutant in the air-filled pore space, the water-filled pore-space, and the solid particles of soil. Equilibrium partitioning between dissolved and gaseous phases is described by Henry's Law constants; partitioning between adsorbed and dissolved phases is described by soil-water partition coefficients. From these assumptions and the definitions of concentration are derived the equations used to describe partitioning.

$$C_s = \frac{M_{cs}}{M_s} \qquad C_w = \frac{M_{cw}}{V_w} \qquad C_a = \frac{M_{ca}}{V_a} \tag{1}$$

and:

$$\begin{aligned} C_t &= \frac{M_{ct}}{V_t} \\ &= \frac{M_{cs} + M_{cw} + M_{ca}}{V_a + V_w + V_s} \end{aligned} \tag{2}$$

where:

C_s	=	concentration of adsorbed pollutant on soil particles (kg/kg)
M_{cs}	=	mass of adsorbed pollutant (kg)
M_s	=	mass of soil (kg)
C_w	=	concentration of dissolved pollutant in soil (kg/m^3)
M_{cw}	=	mass of dissolved pollutant (kg)
V_w	=	volume of water in soil (m^3)
C_a	=	concentration of gaseous pollutant in soil (kg/m^3)
M_{ca}	=	mass of gaseous pollutant (kg)
V_a	=	volume of air in soil (m^3)
C_t	=	total concentration of pollutant in soil (kg/m^3)
M_{ct}	=	total mass of pollutant in soil (kg)
V_t	=	total volume of soil (m^3)
V_s	=	volume of solids in soil (m^3)

The equilibrium distribution coefficient between adsorbed and dissolved phases (KD, m^3/kg) can be defined as:

$$KD = \frac{\left(\frac{M_{cs}}{M_s}\right)}{\left(\frac{M_{cw}}{V_w}\right)} \tag{3}$$

$$= \frac{M_{cs}\, V_w}{M_s\, M_{cw}}$$

where:

KD	=	partitioning coefficient between solids and liquids (l/kg)
M_{cs}	=	mass of adsorbed pollutant (kg)
M_s	=	mass of soil (kg)
M_{cw}	=	mass of dissolved pollutant (kg)
V_w	=	volume of water in soil (m^3)

The dimensionless Henry's Law constant ($\dot{H}$) describing the partitioning between gaseous and dissolved phases is defined as:

$$\dot{H} = \frac{C_a}{C_w} = \frac{\left(\frac{M_{CA}}{V_A}\right)}{\left(\frac{M_{CW}}{V_W}\right)} \tag{4}$$

$$= \frac{M_{CA}\, V_W}{V_A\, M_{CW}}$$

where:

M_{ca}	=	mass of gaseous pollutant (kg)
V_a	=	volume of air in soil (m^3)
M_{cw}	=	mass of dissolved pollutant (kg)
V_w	=	volume of water in soil (m^3)

The bulk density of soil (BD, kg/m^3) is defined as:

$$BD = \frac{M_s}{V_t} \tag{5}$$

where:

BD	=	bulk density of soil in mixing zone (kg/m^3)
M_s	=	mass of soil (kg)
V_t	=	total volume of soil (m^3)

The air-filled porosity of soil (θ_a) is defined as:

$$\theta_a = \frac{V_a}{V_t} \qquad (6)$$

where:

θ_a	=	air-filled porosity of soil (unitless)
V_a	=	volume of air in soil (m^3)
V_t	=	total volume of soil (m^3)

as:

$$\theta_w = \frac{V_w}{V_t} \qquad (7)$$

where:

θ_w	=	water-filled porosity of soil (unitless)
V_w	=	volume of water in soil (m^3)
V_t	=	total volume of soil (m^3)

and, the total porosity of soil (θ_t) is defined as:

$$\theta_t = \frac{(V_t - V_a)}{V_t} = \theta_a + \theta_w \qquad (8)$$

where:

θ_t	=	total porosity of soil (unitless)
V_t	=	total volume of soil (m^3)
V_a	=	volume of air in soil (m^3)
θ_a	=	air-filled porosity of soil (unitless)
θ_w	=	water-filled porosity of soil (unitless)

The above definitions can be combined to yield:

$$\frac{C_t}{C_a} = \frac{KD\ BD}{\dot{H}} + \frac{\theta_w}{\dot{H}} + \theta_a \qquad (9)$$

and:

$$\frac{C_t}{C_w} = BD\ KD + \theta_w + \dot{H}\ \theta_a \qquad (10)$$

and:

$$\frac{C_t}{C_a} = BD + \frac{\theta_w}{KD} + \frac{\theta_a \dot{H}}{KD} \tag{11}$$

where:

C_t	=	total concentration of pollutant in soil (kg/m^3)
C_a	=	concentration of gaseous pollutant in soil (kg/m^3)
KD	=	soil-water distribution coefficient for pollutant (m^3/kg)
BD	=	bulk density of soil (kg/m^3)
$\dot{H}$	=	nondimensional Henry's Law constant for the pollutant
θ_w	=	water-filled porosity of soil (unitless)
θ_a	=	air-filled porosity of soil (unitless)
C_w	=	concentration of dissolved pollutant in soil ($kg \bullet pollutant/m^3$)
C_s	=	concentration of adsorbed pollutant in treated soil (kg/kg)

These relations are used throughout the calculations used to derive reference application rates. Where dry-weight concentrations of pollutant in sewage sludge or sewage sludge-treated soil are involved, the equations are modified slightly, based on the definition:

$$\begin{aligned} C_{dw} &= \frac{M_{ct}}{M_s} \\ &= \frac{M_{ct}}{V_t\, BD} \\ &= \frac{C_t}{BD} \end{aligned} \tag{12}$$

where:

C_{dw}	=	dry-weight concentration of pollutant in soil (kg pollutant/kg)
M_{ct}	=	total mass of pollutant in soil (kg)
M_s	=	mass of soil (kg)
V_t	=	total volume of soil (m^3)
BD	=	bulk density of soil (kg/m^3)
C_t	=	total concentration of pollutant in soil (kg/m^3)

APPENDIX I

Derivation of First-Order Coefficient for Losses to Leaching

APPENDIX I

DERIVATION OF FIRST-ORDER COEFFICIENT FOR LOSSES TO LEACHING

U.S. EPA (1987e) provides an equation for computing a first-order loss rate to leaching for pollutant in treated soil:

$$K_{lec} = \frac{NR}{BD\ KD\ d_i} \tag{1}$$

where:

K_{lec}	=	first-order loss rate coefficient for leaching (yr^{-1})
NR	=	annual recharge rate (m/yr)
BD	=	bulk density of soil (kg/m^3)
KD	=	soil-water distribution coefficient for pollutant (m^3/kg)
d_i	=	depth of incorporation of sewage sludge (M)

This appendix describes a modified version of that equation.

The basic strategy for deriving a coefficient for first-order loss to leaching is to estimate the mass of pollutant expected to be lost each year and divide by the available mass of pollutant. The mass of pollutant that will be lost to leaching in any interval of time can be described by the volume of water percolating through the treated soil multiplied by the average concentration of pollutant in that water:

$$FA_{GW} = NR\ C_{lec}\ 1{,}000 \tag{2}$$

where:

FA_{GW}	=	flux of leached pollutant from treated soil (kg/ha•yr)
NR	=	recharge to ground water beneath the treated soil (m^3/m^2•yr, or m/yr)
C_{lec}	=	concentration of pollutant in water infiltrating through the treated soil (kg/m^3)
1,000	=	constant to convert units from (kg/m^2•yr) to (kg/ha•yr)

From Appendix H, the concentration of pollutant in leachate is related to the total concentration (by volume) of pollutant in soil as:

$$C_w = \frac{C_t}{BD \cdot KD + \theta_w + \dot{H} \cdot \theta_a} \qquad (3)$$

where:

C_w	=	concentration of dissolved pollutant in soil (kg•pollutant/m³)
C_t	=	total concentration of pollutant in treated soil (kg/m³)
BD	=	bulk density of soil (kg/m³)
KD	=	soil-water distribution coefficient for pollutant (m³/kg)
θ_w	=	water-filled porosity of soil (unitless)
$\dot{H}$	=	Henry's Law Constant for pollutant (unitless)
θ_a	=	air-filled porosity of soil (unitless)

This flux of pollutant must be translated into a first-order loss coefficient so that:

$$\frac{dC_t}{dt} = -K_{lec} C_t \qquad (4)$$

where:

C_t	=	total concentration of pollutant in treated soil (kg/m³)
t	=	time (yr)
K_{lec}	=	first-order loss rate coefficient for leaching (yr⁻¹)

K_{lec} is estimated with the approximation:

$$K_{lec} = \frac{\left(\frac{dC_t}{dt}\right)}{C_t} \approx \frac{\left(\frac{\Delta C_t}{\Delta t}\right)}{C_t} = \frac{\left(\frac{\Delta M_{ct}}{\Delta t}\right)}{M_{ct}} \qquad (5)$$

where:

K_{lec}	=	first-order loss rate coefficient for leaching (yr^{-1})
C_t	=	total concentration of pollutant in treated soil (kg/m^3)
t	=	time (yr)
Δt	=	one year
M_{ct}	=	mass of pollutant in soil (kg)

The volume of treated soil beneath one square meter of soil surface (m^3/m^2) is equal to the depth to which sewage sludge has been incorporated into the soil (d_i, m). The total mass of pollutant beneath one square meter of surface can therefore be described by:

$$
\begin{aligned}
M_{ct} &= C_t \, V_t \\
&= C_t \, d_i
\end{aligned}
\tag{6}
$$

Combining these equations with results from Appendix H yields:

$$
K_{lec} \approx \frac{FA_{GW} \, 10^{-3}}{M_{ct}} = \frac{NR \, C_{lec}}{C_t \, V_t} = \frac{NR}{\left(BD \, KD + \theta_w + \dot{H} \cdot \theta_a\right) d_i} \tag{7}
$$

APPENDIX J

Input Parameters Used to Derive Reference Application Rates for Pathways 12 through 14

APPENDIX J

INPUT PARAMETERS USED TO DERIVE REFERENCE APPLICATION RATES FOR PATHWAYS 12 THROUGH 14

This appendix discusses input parameters used to derive reference application rates for land application.

J.1 SITE PARAMETERS

Values for input parameters used to characterize land application sites are listed in Table J-1, and discussed below.

J.1.1 Area of Land Application Site

The land application site area (A_{sma}) of 1,074 ha is based on an analysis of the National Sewage Sludge Survey (NSSS) and represents the 90th percentile of land area estimated to have been treated by those POTWs in the analytic component of the survey reporting the application of sewage sludge to agricultural land.

J.1.2 Watershed Area

The area of the watershed (A_{ws}) is assumed to be 440,300 ha, the mean size hydrologic cataloguing unit as defined by the U.S Geological Survey (U.S. EPA, 1990a). It is assumed that the entire watershed is used for agricultural purposes, so that the topography, cover, and other characteristics of the remainder of the watershed are identical to those of the sludge management area (SMA).

TABLE J-1

SITE AND SLUDGE PARAMETERS FOR LAND APPLICATION

Sludge Management Area (A, ha)	1,074[a]
Watershed Area (A_{WS}, ha)	440,300[b]
Depth of Incorporation for Sewage Sludge (d_i, m)	0.15[c]
Lateral Distance to Well (m)	0
Width of Buffer Zone (m)	10
Wind Velocity (*w*m/sec)	4.5[d]
Average Air Temperature (T, °K)	288[e]
Number of Applications of Sewage Sludge	20[f]
Yearly Loss to Soil Erosion (d_e, m/yr)	0.00060[g]

[a] 90th percentile of land area estimated to be treated annually by those POTWs in the analytic component of the National Sewage Sludge Survey.
[b] Mean size hydrologic cataloging unit (U.S. EPA, 1990a).
[c] U.S. EPA (1987e).
[d] Typical value for U.S. (U.S. EPA, 1990c).
[e] *Federal Register* (1986c).
[f] Typical site life (U.S. EPA, 1983d).
[g] USDA (1987).

J.1.3 Depth of Incorporation for Sludge

It is assumed that sewage sludge is incorporated into treated soil to a depth (d_i) of 6 inches or 15 cm (U.S EPA, 1987e).

J.1.4 Distance to Well

As a worst-case exposure scenario, it is assumed that the highly exposed individual lives at the down-gradient edge of the land application site: the distance from the down-gradient edge of the SMA to the potential well is assumed to be 0 meters.

J.1.5 Width of Buffer Zone

The width of the buffer zone between the SMA and the nearest body of surface water is assumed to be 10 meters. A buffer zone of identical width is also assumed to protect all remaining surface water within the watershed.

J.1.6 Velocity of Wind at the Ground Surface

Wind velocity (w) affects the transport of volatilized pollutant from the site. A value of 4.5 m/sec (10 mph) has been selected for wind velocity at the ground surface. This value represents a typical annual wind speed in the United States (U.S. EPA, 1990c).

J.1.7 Air Temperature

The model air temperature (T) of 15°C represents the annual average for the U.S. (*Federal Register*, 1986c).

J.1.8 Number of Applications of Sludge

For organic pollutants, reference application rates are expressed as an annual loading (kg/ha•yr) at which sewage sludge can be applied indefinitely without exceeding reference water or air concentrations. For metals, reference application rates are expressed as a maximum cumulative loading (kg/ha) independent of the number of times sewage sludge is applied. Nevertheless, deriving reference application rates for metals requires that the number of applications of sewage sludge be specified to determine the length of time required for pollutant to be depleted from the site. It is assumed that the modeled land application site receives annual applications of sewage sludge for 20 consecutive years. This value M is consistent with the "useful life of application sites" described by U.S. EPA (1983d).

J.1.9 Yearly Loss of Soil to Erosion

The model erosion rate (d_e) of 0.00060 m/yr represents a weighted average of annual soil loss rates presented in the Soil Conservation Survey Summary Report (USDA, 1987). The average value has been converted from 3.8 tons/acre•yr based on an assumed bulk density of 1,400 kg/m^3 for treated soil.

J.2 SOIL PARAMETERS

The unsaturated zone is characterized by pore space containing both air and water, whereas the pore space in the saturated zone contains water only. Because of differences in fluid mechanics, these two zones require different equations and input parameters for tracking pollutant transport. A simplifying assumption used for deriving reference application rates is that the basic soil characteristics (including soil type, porosity, and bulk density) of the two zones are identical. Values for parameters describing the mixing, unsaturated, and saturated soil zones are provided in Table J-2.

TABLE J-2

SOIL AND HYDROLOGIC PARAMETERS FOR LAND APPLICATION

Soil Type	Sand
Porosity of Sewage Sludge/Soil	0.4[a]
Bulk Density of Sewage Sludge/Soil (kg/m^3)	1400[b]
Bulk Density of Soil in Unsaturated and Saturated Zones (kg/m^3)	1600[c]
Saturated Hydraulic Conductivity of Soil (m/hr)	0.61[d]
Water Retention Parameters	
θ_r	0.045[e]
α (m^{-1})	14.5[e]
β	2.68[e]
Fraction of Organic Carbon in Soil or Sewage Sludge	
Mixing Layer	0.01
Unsaturated Zone	0.001[f]
Saturated Zone	0.0001
Depth to Groundwater (m)	1[g]
Net Recharge or Seepage (m/yr)	0.5[h]
Thickness of Aquifer (m)	1[g]
Hydraulic Gradient	0.005[i]
Total Suspended Solids in Surface Water (mg/l)	16[j]

[a] Todd (1980), Carsel and Parrish (1988).
[b] Chaney (1992b).
[c] Based on porosity of 0.4. Freeze and Cherry (1979).
[d] 95th percentile value from Carsel and Parrish (1988).
[e] Mean values reported for sand in Carsel and Parrish (1988).
[f] Lower bound of range reported in *Federal Register* (1986c).
[g] Conservative value.
[h] Average of range reported in *Federal Register* (1986c).
[i] Average value for groundwater surveyed in *Federal Register* (1986c).
[j] Geometric mean of values reported in U.S. EPA's STORET data base, U.S. EPA (1992a).

J.2.1 Soil Type

The type of soil in the mixing zone, unsaturated and saturated zones affects the ability of a pollutant to move vertically to the aquifer and laterally to a nearby well. In general, the pollution potential of a soil is largely affected by the type of clay present, the shrink/swell potential of that clay, and the grain size of the soil; that is, the less the clay shrinks and swells and the smaller the grain size of the soil, the less the pollution potential associated with that soil. Soil types in the unsaturated zone in order of increasing pollution potential are: (1) nonshrinking clay, (2) clay loam, (3) silty loam, (4) loam, (5) sandy loam, (6) shrinking clay, (7) sand, (8) gravel, and (9) thin or absent soil (U.S. EPA, 1985a).

Sand has been selected as a reasonable worst case soil to use in model scenarios for defining numerical reference application rates for sludge. Wherever possible values for parameters describing soil characteristics for model simulations are based on values estimated for sand.

J.2.2 Porosity of Sewage Sludge/Soil Mixture

Porosity is the ratio of the void volume of a given soil or rock mass to the total volume of that mass. If the total volume is represented by V_t and the volume of the voids by V_v, the porosity can be defined as $\theta_t = V_v / V_t$. Porosity is usually reported as a decimal fraction or percentage, and ranges from zero (no pore space) to one (no solids). For soil types with small particle sizes such as clay, porosity increases to a maximum of around 0.5. Porosities of coarser media like gravel decrease to a minimum of around 0.3.

For deriving reference application rates, a total porosity of 0.4 has been taken from Todd (1980). This value is consistent with the average value for sand (0.43) reported in Carsel and Parrish (1988). It is used to represent total porosity within the mixing unsaturated and saturated soil zones.

Effective porosity (θ_e) is calculated as the difference between the average saturated water content and the approximate average residual water content, and refers to the amount of interconnected pore space available for fluid flow. For deriving reference application rates, average residual water content in the unsaturated zone is assumed to be less than 0.05, and effective porosity has been approximated with the same value used for total porosity (0.4) in mass balance and ground-water transport calculations.

J.2.3 Bulk Density of Sludge/Soil

The bulk density of soil (BD) is defined as the mass of dry soil divided by its total (or bulk) volume. Bulk density directly influences the retardation of solutes and is related to soil structure. In general, as soils become more compact, their bulk density increases. Bulk density can be related to the particle density and porosity of a given soil as:

$$BD = \rho_{so}(1 - \theta_t) \tag{1}$$

where:

BD	=	bulk density of soil (kg/m^3)
ρ_{so}	=	particle density of soil (kg/m^3)
Θ_t	=	porosity of soil (unitless)

Typical mineral soils have particle densities of about 2,650 kg/m^3 (Freeze and Cherry, 1979). This value and a soil porosity of 0.4 suggest a bulk density of about 1,600 kg/m^3 for pure soil, somewhat higher than the 1,300-1,500 kg/m^3 range typically encountered for soil mixed with sewage sludge (Chaney, 1992b). For deriving reference application rates, it is assumed that the bulk density of the mixing zone is 1,400 kg/m^3, and the bulk density of soil in the unsaturated and saturated zones is 1,600 kg/m^3.

J.2.4 Saturated Hydraulic Conductivity of Soil

Saturated hydraulic conductivity refers to the ability of soil to transmit water, which is governed by the amount and interconnection of void spaces in the unsaturated or saturated zones. These voids may occur as a consequence of inter-granular porosity, fracturing, or bedding planes. In general, high hydraulic conductivities are associated with high potential for pollution. The value for saturated hydraulic conductivity used for deriving reference application rates (0.61 m/hr) is the 95th percentile of a probability distribution for hydraulic conductivity in sand derived by Carsel and Parrish (1988). It thus represents a conservative or "reasonable worst case" value.

J.2.5 Unsaturated Hydraulic Conductivity of Soil

The hydraulic conductivity or effective permeability of soil in the unsaturated zone is a function of its moisture content, which is in turn a function of pressure head. These relationships are central to the simulation of water flow through the unsaturated zone. The VADOFT model used to derive reference application rates accepts as inputs sets of data points describing effective permeability-saturation curves and the saturation-pressure head curves. Alternatively, it accepts van Genuchten water retention parameters defining the curves (U.S. EPA, 1989c; Carsel and Parrish, 1988); this latter option is used for deriving reference application rates.

Based on soils data from the USDA Soil Conservation Survey (SCS), Carsel and Parrish (1988) derived distributions for the three parameters required (Θ_r, α, and β) according to twelve SCS textural classifications. Values used for deriving reference application rates (0.045, 14.5 m^{-1}, and 2.68 for Θ_r, α, and β, respectively) correspond to mean values reported for sand.

J.2.6 Fraction of Organic Carbon in Soil or Sludge

The model combines the fraction of organic carbon in the soil with each pollutant's organic carbon partition coefficient to determine the partitioning of pollutant between soil and water. In general, a lower fraction of organic carbon implies greater mobility for organic pollutants. The organic carbon content for sludge varies among sludge types, with mean values for various types showing a relatively narrow range of 27.6-32.6 percent (U.S. EPA, 1983d). It is conservatively assumed that soil within the upper 15 cm of the soil column (or "mixing zone") contains 1 percent organic carbon. A value of 10^{-3} has been selected for the fraction of organic carbon in the unsaturated zone because it is a typical value for sand, and falls at the lower end of the range (0.001-0.01) reported for soil beneath hazardous waste disposal facilities (*Federal Register*, 1986c). The fraction of organic carbon (f_{oc}) in the saturated zone is expected to be lower than that of the unsaturated zone, and has been assigned a value of 10^{-4}, or one-tenth the fraction assumed for the unsaturated zone.

J.2.7 Depth to Ground Water

The depth to ground water is defined as the distance from the bottom of the mixing zone to the water table. The water table is itself defined as the subsurface boundary between the unsaturated zone (where the pore spaces contain both water and air) and the saturated zone (where the pore spaces contain water only). It may be present in any type of medium and may be either permanent or seasonal. The depth to ground water determines the distance a pollutant must travel before reaching the aquifer, and affects the attenuation of pollutant concentration during vertical transport. As this depth increases, attenuation also tends to increase, thus reducing potential pollution of the ground water. A conservative value of 1 m is assumed for the distance between treated soil and ground water.

J.3 HYDROLOGIC PARAMETERS

Key hydrologic parameters include net recharge or seepage, the thickness of the aquifer, and the hydraulic gradient. Values used to derive reference application rates are included in Table J-2 and discussed below.

J.3.1 Net Recharge

The primary source of most ground water is precipitation, which passes through the ground surface and percolates to the water table. Net recharge is the volume of water reaching the water table per unit of land, and determines the quantity of water available for transporting pollutants vertically to the water table and laterally within the aquifer. The greater the recharge rate, the greater the potential for pollution, up to the point at which the amount of recharge is large enough to dilute the pollutant. Beyond that point, the pollution potential ceases to increase and may actually decrease (U.S. EPA, 1985b).

For land application sites, the selected net recharge rate (NR), (0.5 m/yr) represents the average of a range of values presented in (*Federal Register*, 1986c).

J.3.2 Thickness of Aquifer

Saturated zones are considered aquifers unless they lack the permeability to yield sufficient water. Only true aquifers are considered when selecting input parameters for calculating reference application rates. For deriving reference application rates, the thickness of the aquifer is assumed to be 1 m. This thickness is assumed to represent reasonable worst-case conditions and has been selected as a matter of policy to ensure that reference application rates for sewage sludge are sufficiently protective.

J.3.3 Hydraulic Gradient

The hydraulic gradient is a function of the local topography, ground-water recharge volumes and locations, and the influence of withdrawals (e.g., well fields). It is also very likely to be indirectly related to properties of porous media. Although steep gradients are rarely associated with very high conductivities, no functional relationship exists to express this relationship.

The hydraulic gradient value selected for deriving reference application rates is 0.005 m/m or 0.5 percent, and is based on an average value for ground waters surveyed for the Hazardous Waste Management System Land Disposal Restrictions Regulation (*Federal Register*, 1986c).

J.3.4 Total Suspended Solids

Calculating the amounts of pollutant partitioning to liquid and solid phases in surface water requires a value for suspended solids content. Raw data for total suspended solids in streams and rivers in the U.S. were obtained from the EPA's STORET data base, under the field "Total Residue" (U.S. EPA, 1992a). The data consist of annual mean total residues for the U.S. for the years 1903 through 1991. The geometric mean of these annual values is calculated as 16.2 mg/l and the median as 16.41 mg/l. A rounded value of 16 mg/l is chosen for the total suspended solids (TSS) content of the surface water modeled for this analysis.

J.4 CHEMICAL-SPECIFIC PARAMETERS

J.4.1 Distribution Coefficients

Pollutant transport in soil systems is influenced by interactions between the pollutant and soil. The affinity of pollutants for soil particles may result from ion exchange on charged sites or adsorption due to surface forces. When the soil's capacity to attract pollutant is exceeded, soluble pollutants will move through the soil at the same velocity as the bulk leachate. The affinity between a soil and a pollutant is characterized by the distribution coefficient (KD). Representative KD values (l/kg or m^3/kg) are defined as the equilibrium ratio of the pollutant concentration in soil (mg/kg) to that in associated water (mg/l or mg/m^3). Values used for this analysis are listed in Table J-3.

For organic pollutants KD is calculated from a pollutant's partition coefficient between organic carbon and water:

$$KD = KOC\ f_{oc} \tag{2}$$

where:

KD	=	equilibrium partition coefficient for pollutant (m^3/kg)
KOC	=	organic carbon partition coefficient (m^3/kg)
f_{oc}	=	fraction of soil consisting of organic carbon

As discussed in Section J.2.6, f_{oc} values of 0.01, 0.001 and 0.0001 are assumed for the mixing, unsaturated, and saturated zones, respectively.

The organic carbon partition coefficient for a pollutant is estimated from its octanol-water partition coefficient, as measured in laboratory experiments. Values of KOC used to determine reference application rates are shown in Table J-4, and are calculated from the following regression equation by Hassett et al. (1983):

$$\log(KOC) = 0.0884 + 0.909\log(KOW) \tag{3}$$

where:

KOW = octanol-water partition coefficient for pollutant

With the exception of PCBs, the KOW values used for this analysis have been obtained from the CHEMEST procedures in the Graphical Exposure Modeling Systems (GEMS and PCGEMS), U.S. EPA (1988d, 1989c).

TABLE J-3

DISTRIBUTION COEFFICIENTS FOR ORGANIC AND INORGANIC POLLUTANTS

	Within Sludge Management Area (l/kg)	Unsaturated Zone (l/kg)	Saturated Zone (l/kg)
Arsenic	20	20	20
Cadmium	431	431	431
Chromium	59	59	59
Copper	98	98	98
Lead	621	621	621
Mercury	330	330	330
Nickel	63	63	63
Benzene	1.06	0.106	0.0106
Benzo(a)pyrene	4,480	448	44.8
Bis(2-ethylhexyl)phthalate	541	54.1	5.41
Chlordane	1,330	133	13.3
DDT	7,720	772	77.2
Lindane	23.4	2.34	0.234
n-Nitrosodimethylamine	0.00371	0.000371	0.0000371
Polychlorinated biphenyls	15,100	1,510	151
Toxaphene	295	29.5	2.95
Trichloroethylene	1.94	0.194	0.0194

Note: The distribution coefficient for organic pollutants (KD) is the product of the organic carbon partition coefficient (KOC) and the fraction of organic carbon in the medium (f_{oc}). Assumes foc of 1 percent for mixing layer, and 0.1 percent and 0.01 percent in the unsaturated and saturated soil zones, respectively. Distribution coefficients for metals are geometric means of values reported for "sandy loam" soil in Gerritse et al. (1982).

TABLE J-4

OCTANOL-WATER AND ORGANIC CARBON PARTITION COEFFICIENTS FOR ORGANIC POLLUTANTS

	Log of Octanol-Water Partition Coefficient[a]	Organic Carbon Partition Coefficient[b]
Benzene	2.13	106
Benzo(a)pyrene	6.12	448,000
Bis(2-ethylhexyl)phthalate	5.11	54,100
Chlordane	5.54	133,000
DDT	6.38	772,000
Lindane	3.61	2,340
n-Nitrosodimethylamine	-0.57	0.371
Polychlorinated biphenyls[c]	6.70	1,510,000
Toxaphene	4.82	29,500
Trichloroethylene	2.42	194

[a] All values except for PCBs taken from the CHEMEST procedure of the Graphical Exposure Modeling System (GEMS), U.S. EPA (1989c).
[b] KOC for organic pollutants derived from KOW with Equation 6 from Chapter 15 of Hassett et al. (1983): log(KOC)= 0.0884 + 0.909 log(KOW).
[c] Based on aroclor 1254, the most common PCB in sewage sludge. Derived from O'Connor (1992) and representative values from Anderson and Parker (1990).

Polychlorinated biphenyls (PCBs) are a class of chemicals containing 209 possible congeners. The most common constituent of PCB mixtures is Aroclor 1254, which is dominated by penta-congeners, with about equal amounts of tetra- and hexa-congeners. In a well-aged soil contaminated with PCBs, however, Aroclor 1260, which contains more penta- and hexa-congeners than tetra-congeners, is more representative (O'Connor, 1992). To determine a representative organic carbon partition coefficient for PCBs, an average has been calculated from log KOW coefficients listed in Table J-5 (from Anderson and Parker, 1990). The log KOW for the penta-congener has been estimated to be approximately 6.5 by noting that the log KOW values are approximately linearly related to the number of chlorines in the congener. Averaging that value with the hexa-congener value gives 6.7 for the log KOW. As with other organic pollutants, the regression equation from Hassett et al. (1983) is used to convert this KOW value to an estimate of KOC.

For metals, separate KD values are used to describe the partitioning between water and soil within the mixing, unsaturated, and saturated zones, and the partitioning between water and sediment in the surface water. Values for KD in the mixing zone and the soil zones are taken from a study by Gerritse et al. (1982) and represent the results of laboratory tests with a sludge-amended sandy loam topsoil. These values are listed in Table J-3, and represent geometric means of the ranges provided by Gerritse et al. (1982). Partition coefficients for metals in surface water are calculated according to the following regression equation provided in (U.S. EPA, 1982c):

$$KD_{sw} = \alpha \, TSS^{\beta} \tag{4}$$

where:

KD_{sw}	=	partition coefficient for pollutant in stream (m^3/kg)
TSS	=	total suspended solids content of the stream (mg/l)
α, β	=	pollutant-specific empirical constants

Values for the regression constants for each pollutant are based on data for streams (U.S. EPA, 1982c), and are presented in Table J-6. Estimates are based on an assumed Total Suspended Solids (TSS) of 16 mg/l, as discussed in Section J.3.4.

TABLE J-5

OCTANOL-WATER PARTITION COEFFICIENTS FOR PCBs[a]

Congener	Number of Chlorines	Log KOW
2,4'	2	5.1
2,2',5,5'	4	6.1
All Penta	5	6.5[b]
2,2',4,4',5,5'	6	6.9
Average[c]	5.5	6.7

[a] Source: Anderson and Parker (1990).
[b] Estimated based on apparent linear relationship between number of chlorines on congener and log KOW.
[c] log KOW values for penta- and hexa-congeners averaged for representative log KOW.

TABLE J-6

STATISTICAL PARAMETERS FOR PREDICTING THE EQUILIBRIUM PARTITIONING OF METALS IN SURFACE WATER[a]

	α	β	KD_{sw} (l/kg)[b]
Arsenic	0.48×10^6	-0.7286	63,700
Cadmium	4.00×10^6	-1.1307	174,000
Chromium	3.36×10^6	-0.9304	255,000
Copper	1.04×10^6	-0.7436	132,000
Lead	0.31×10^6	-0.1856	185,000
Mercury	2.91×10^6	-1.1356	125,000
Nickel	0.49×10^6	-0.5719	100,000

[a] Source: U.S. EPA (1982c).
[b] KD_{sw} as $KD_{sw} = \alpha TSS^{\beta}$. Assumes TSS=16 mg/l.

J.4.2 Degradation Rates

Pollutant concentrations in the subsurface regime may be decreased by various degradation processes, including abiotic hydrolysis and aerobic or anaerobic microbial degradation. Although rates of hydrolysis are dependent only on pH and temperature (and can be estimated with reasonable accuracy), estimates of rates for microbial degradation are fraught with uncertainty. This uncertainty is due to many confounding influences in the field, such as substrate availability (fraction of organic carbon present), temperature, the microbial consortium, and microbial acclimation to a given pollutant. Nevertheless, the range of microbial degradation rates obtained in the laboratory by measuring the rate of disappearance of a pollutant in various soil and water grab samples, soil column studies, etc., provides a rough estimate of the rate at which microbial activity is likely to degrade a particular pollutant in the field.

As shown in Table J-7, this work utilizes several sources for representative microbial degradation rates. Where a range of values is reported by these sources, values from the lower end of the range have been selected to derive estimates most protective of public health. Studies of biodegradation in soil have been favored over studies of biodegradation in aquatic environments. If estimates of only aerobic biodegradation rates are available for a given pollutant, a half-life for anaerobic biodegradation has been conservatively estimated to be four times longer (Howard et al., 1991a.) However, if available data fail to show any indication that a pollutant degraded in a particular regime, a value of zero has been assumed for the degradation rate.

For the zone of incorporation for land treated with sewage sludge, estimated rates of degradation are based on studies of microbial degradation under anaerobic conditions.

For the unsaturated soil zone, aerobic microbial degradation and hydrolysis are assumed to be the two dominant degradation processes. Lindane and trichloroethylene are the only two compounds that undergo hydrolysis: since hydrolysis rates are far more accurately quantifiable than microbial degradation rates, hydrolysis rates are used for these two chemicals. For the other eight organic pollutants, 10 percent of the aerobic biodegradation decay rate is assumed to

TABLE J-7

DEGRADATION RATES (K_{deg})

	Aerobic Degradation Rate (yr^{-1})[a]	Anaerobic Degradation Rate (yr^{-1})[b]	Unsaturated Zone Degradation Rate (yr^{-1})[c]	Saturated Zone Degradation Rate (yr^{-1})[d]
Benzene	16[e]	0[f]	1.6	0.8
Benzo(a)pyrene	0.48[g]	0.12[h]	0.048	0.084
Bis(2-ethylhexyl) phthalate	11[i,j]	0[k,l]	1.1	0.55
Chlordane	0[m]	36[i]	0	18
DDT	0.04[l]	2.5[k]	0.004	1.3
Lindane	1.2[m]	8.3[n]	1.2	4.8
n-Nitrosodimethylamine	5.1[o]	1.3[h]	0.51	0.9
PCBs	0.063[p]	0.00063[q]	0.0063	0.0035
Toxaphene	1.2[q]	6[r]	0.12	3.1
Trichloroethene	0.78[s]	3.3[t]	0.78	2.0

[a] Based on microbial degradation rates, except for lindane and trichloroethene, where hydrolysis rates are used.
[b] Based on microbial degradation rates.
[c] Estimated as 10 percent of aerobic biodegradation rates. Hydrolysis rates for lindane and trichloroethene assumed same as aerobic rates.
[d] Estimated as arithmetic average of the unsaturated zone degradation rates and the anaerobic degradation rate.
[e] Vaishnav and Babeu (1987).
[f] Horowitz et al. (1982).
[g] Coover and Sims (1987).
[h] Anaerobic rate assumed to equal 25 percent of aerobic rate; see text for discussion.
[i] Howard et al. (1991a).
[j] Shelton et al. (1984b).
[k] Castro and Yoshida (1971).
[l] Stewart and Chisholm (1971).
[m] Ellington et al. (1988).
[n] Zhang et al. (1982).
[o] Tate and Alexander (1975).
[p] Fries (1982).
[q] Consensus value agreed upon by the PRC at their March 8, 1991 meeting.
[r] Howard (1991a).
[s] Dilling et al. (1975).
[t] Bouwer and McCarthy (1983).

be appropriate for the unsaturated zone. This decision is based on the observation that f_{oc} tends to decrease with depth in the soil, thereby reducing the amount of suitable substrate for microbial populations which might degrade these chemicals (O'Connor, 1992).

In the saturated zone, all three degradation processes can occur because some ground water is anaerobic and some aerobic. To capture this mix of processes, an arithmetic mean has been calculated from the aerobic and anaerobic biodegradation decay rates discussed above. For lindane and trichloroethylene, the only two chemicals where hydrolysis is a significant degradation process, estimated anaerobic decay rates are significantly higher than hydrolysis rates.

For PCBs, it is difficult to assign an anaerobic degradation rate. Highly chlorinated congeners may be partially degraded very slowly in reducing conditions, but then oxidative conditions must be established for further degradation to occur. Inadequate information on anaerobic degradation rates exists in the scientific literature. For deriving reference application rates, it is conservatively assumed that anaerobic degradation of PCBs occurs at 1 percent of the aerobic biodegradation rate.

J.4.3 Molecular Weight

The values presented in Table J-8 are standard molecular weights for the pollutants of concern. These weights are used in the vapor loss component of the mass-balance calculations.

J.4.4 Henry's Law Constants

Henry's Law constants are used to calculate the rate at which organic pollutants volatilize from sludge. Determining appropriate values for these constants is complicated by the wide variation in estimates provided by various sources. Table J-9 shows values taken from four different sources, along with the value selected for this analysis. Whenever possible, values are taken from Lyman et al. (1990); Otherwise values are taken from: the GEMS data base (U.S.

TABLE J-8

MOLECULAR WEIGHTS FOR ORGANIC POLLUTANTS

	Molecular Weight
Benzene	78.1
Benzo(a)pyrene	252.3
Bis(2-ethylhexyl)phthalate	390.6
Chlordane	409.8
DDT	354.5
Lindane	290.8
n-Nitrosodimethylamine	74.1
Polychlorinated biphenyls (Aroclor 1254)	325.1
Toxaphene	431.8
Trichloroethylene	131.4

[a] Calculated according to Wilke and Lee's method, as described in Lyman et al. (1990).

TABLE J-9

HENRY'S LAW CONSTANTS

	GEMS[a,b] (atm·m³/mol)	PCGEMS[c,b] (atm·m³/mol)	Lyman et al.[d] (atm·m³/mol)	Aquatic Fate[e,b] (atm·m³/mol)	Selected Values[f] (unitless)	Reference
Benzene	$3.5x10^{-3}$	$5.6x10^{-3}$ (M)	$5.5x10^{-3}$	$5.5x10^{-3}$	$2.3x10^{-1}$	(d)
Benzo(a)pyrene	$1.9x10^{-10}$	--	--	--	$8.0x10^{-9}$	(a)
Bis(2-ethylhexyl)phthalate	$4.4x10^{-8}$	$1.5x10^{-5}$	--	$3.0x10^{-7}$	$1.9x10^{-6}$	(a)
Chlordane	--	$4.9x10^{-5}$ (M)	--	$9.4x10^{-5}$	$3.0x10^{-3}$	(c,e)
DDT	$2.8x10^{-8}$	--	$3.8x10^{-5}$	$1.6x10^{-5}$	$1.6x10^{-3}$	(d)
n-Nitrosodimethylamine	$6.5x10^{-4}$	$2.6x10^{-7}$	--	$3.3x10^{-5}$	$1.1x10^{-5}$	(c)
Lindane	$4.3x10^{-6}$	$1.4x10^{-5}$	$4.8x10^{-7}$	--	$2.0x10^{-5}$	(d)
Polychlorinated biphenyls	--	--	--	--	$1.4x10^{-2}$	(g)
Toxaphene	--	$6.0x10^{-6}$ (M)	--	$2.1x10^{-1}$	$2.5x10^{-4}$	(c)
Trichloroethylene	$2.9x10^{-3}$	$1.0x10^{-2}$ (M)	$1.0x10^{-2}$	$9.1x10^{-3}$	$4.2x10^{-1}$	(d)

[a] CHEMEST procedure in U.S. EPA (1988d).

[b] Values estimated using $\dot{H}$ = VP/WSOL where VP is the vapor pressure and WSOL is the water solubility, unless designated as a measurement (M).

[c] CHEMEST procedure in U.S. EPA (1989c).

[d] Lyman, Reehl and Rosenblatt, Handbook of Chemical Property Estimation Methods, McGraw-Hill, 1990.

[e] U.S. EPA (1982b).

[f] Converted to non-dimensional value using $\dot{H}$ = H/(RT) where T = 288°K, R is the Universal Gas Constant and H is the dimensional Henry's Law constant.

[g] Average values from Anderson and Parker (1990) adjusted to 15°C.

EPA, 1988d), the PCGEMS data base (U.S. EPA, 1989c), or the Aquatic Fate Process Data for Organic Priority Pollutants (U.S. EPA, 1982b). The decision process is as follows: if a value is published in Lyman et al. (1990) it is used. If not, but if two values are similar, the mean of those two values is used. If there is no value in Lyman et al. (1990) and no two values agree, a measured value is chosen in preference to an estimated one. If only estimated, dissimilar values are available, the value most conservative for ground water (i.e., the lowest Henry's Law constant) is chosen. This last circumstance occurs only for n-nitrosodimethylamine and bis(2-ethylhexyl)phthalate.

The only exception to the decision process described above is for polychlorinated biphenyls (PCBs), which include a variety of possible congeners with different chemical characteristics. Anderson and Parker (1990) provides a compilation of nondimensional Henry's Law constants for one penta-congener and three hexa-congeners. To derive a representative Henry's Law Constant for PCBs, the three values for hexa-congeners were averaged to a single value which was then averaged with the penta-congener value to obtain the single constant reported in Table J-9.

For all organic pollutants except PCBs, the dimensioned estimate of Henry's Law Constant reported in Table J-9 has been converted to an equivalent nondimensional constant based on an assumed temperature of 15°C (288°K) and the following equation:

$$\dot{H} = \frac{H}{RT} \qquad (5)$$

where:

T	=	Temperature (assumed to be 288°K)
R	=	Universal Gas Constant ($m^3 \bullet atm/mol \bullet K$)
H	=	dimensional Henry's law constant ($m \bullet atm/mol$)
$\dot{H}$	=	nondimensional Henry's Law constant (unitless)

Because Anderson and Parker (1990) report nondimensional values for PCBs at 25°C, the average value derived from this source has been adjusted to an equivalent nondimensional value at 15°C.

J.4.5 Diffusion Coefficients

As discussed elsewhere in this report, the volatilization of pollutant from a land application site is modeled with equations provided by Hwang and Falco (1986). These equations require estimates for the diffusivity of each pollutant in air. Wilke and Lee's method provides estimates for the diffusivity of each pollutant in air and Hayduk and Laudie's method provides estimates for each pollutant's diffusivity in water (Lyman et al., 1990). The resulting estimates, which are based on a temperature of 15°C, are listed in Table J-10.

J.4.6 Reference Water Concentrations for Ground Water

For the ground-water pathway of human exposure, reference application rates are calculated based on the reference water concentration or adjusted reference water concentration (RC_{gw} mg/l). Reference application rates for land application of sludge are calculated to result in ground-water concentrations equal to or less than the RC_{gw} at the receptor well. Values for RC_{gw} are listed in Table J-11.

For all pollutants except n-nitrosodimethylamine, the reference water concentration for ground water has been calculated by adjusting the maximum pollutant level for background concentrations of pollutant expected in ground water. For n-nitrosodimethylamine, the RC_{gw} has been derived from the human cancer potency. It is assumed that the highly exposed individual ingests 2 l of water per day and weighs 70 kg. The RC_{gw} for n-nitrosodimethylamine is calculated based on a risk level of 10^{-4}.

To ensure that well water does not exceed the MCL, any pre-existing ground-water concentrations must be considered in addition to pollutant contributions from the surface disposal of sewage sludge. Metals are ubiquitous in the environment, and can be expected to occur naturally in ground water; values for background concentrations of inorganic pollutants in ground water are taken from the National Inorganic and Radionuclides Survey, and presented in Table J-11. Where concentrations of a given metal in a particular sample fall beneath the limit of detection, a value of 1/2 the detection limit has been assigned to the sample to derive these

TABLE J-10

DIFFUSION COEFFICIENTS FOR CONTAMINANT IN AIR

	Diffusivity in Air (cm^2/sec)[a]
Benzene	9.06×10^{-2}
Benzo(a)pyrene	4.58×10^{-2}
Bis(2-ethylhexyl)phthalate	3.27×10^{-2}
Chlordane	4.51×10^{-2}
DDT	4.13×10^{-2}
Lindane	4.98×10^{-2}
n-Nitrosodimethylamine	9.29×10^{-2}
Polychlorinated biphenyls	5.69×10^{-2}
Toxaphene	5.25×10^{-2}
Trichloroethylene	8.18×10^{-2}

[a] Calculated according to Wilke and Lee's method, as described in Lyman et al. (1990).

TABLE J-11

ADJUSTED REFERENCE WATER CONCENTRATION FOR GROUND WATER

	Reference Water Concentration[a] (mg/l)	Background Concentration in Ground Water[b] (mg/l)	Adjusted Reference Water Concentration[c] (mg/l)
Arsenic	0.05	0.0032	0.0468
Cadmium	0.005	0.0011	0.0039
Chromium	0.1	0.0014	0.0986
Copper	1.3	0.0499	1.2501
Lead	0.015	0.0035	0.0115
Mercury	0.002	0.0001	0.0019
Nickel	0.1	0.0030	0.097
Benzene	0.005	0	0.005
Benzo(a)pyrene	0.0002	0	0.0002
Bis(2-ethylhexyl)phthalate	0.004	0	0.004
Chlordane	0.002	0	0.002
DDT	0.0102	0	0.0102
Lindane	0.0002	0	0.0002
n-Nitrosodimethylamine[d]	0.00007	0	0.00007
Polychlorinated biphenyls	0.000454	0	0.000454
Toxaphene	0.003	0	0.003
Trichloroethylene	0.005	0	0.005

[a] All values except those for DDT and n-nitrosodimethylamine are based on the maximum contaminant level (MCL) under the Safe Drinking Water Act (SDWA).
[b] National Inorganic and Radionuclides Survey
[c] Values represent the RWC less background concentrations (see Section A.5.4)
[d] Calculated from human cancer potency at the 10^{-4} risk level.

averages. Organic pollutants are less likely to be found in uncontaminated sources, so background concentrations are assumed to equal zero.

J.4.7 Reference Water Concentration for Surface Water

The reference water concentration for the surface water pathway is based on either human health criteria, adjusted for total background intake, or chronic fresh water criteria, whichever is more limiting. The calculation of human health criteria for surface water is similar to the calculation for ground water, with the additional exposure through fish consumption. Concentration of pollutants in ingested fish are calculated from the expected concentration in surface water, the bioconcentration factor (BCF) and a food chain multiplier (FM) for each pollutant. The ratio between concentrations in the edible and total fish (P_f) is also considered.

Estimated values for BCF and FM are listed in Table J-12. With the exception of PCBs, the pollutant concentration in fillet is assumed equal to the pollutant concentration in the whole fish (P_f=1). This is a worst-case assumption, because many pollutants are known to bioconcentrate in nonedible tissues and organs. Based on data for dioxin (Branson et al., 1985), the concentration in the fillet for PCBs is assumed to be 50 percent of the concentration of the whole fish (P_f = 0.5).

Table J-13 lists calculated human health criteria, chronic fresh water criteria, and the limiting reference water concentration for each pollutant in surface water. The fresh water criteria are based on chronic freshwater criteria from the latest Ambient Water Quality Criteria, where available. Where chronic values are not available, acute values are substituted. If no criteria are available, the Lowest Observable Adverse Effect Level (LOAEL) is used. For chemicals with hardness-dependent chronic or acute freshwater criteria, a hardness of 100 mg/l is assumed. The human body weight (BW) is set to 70 kg; the water ingestion rate (Iw) at 2 l/day; and the daily consumption of fish (Ic) at 40 g/day (Javitz, 1980).

TABLE J-12

DATA FOR REFERENCE WATER CONCENTRATIONS FOR SURFACE WATER

	Bioconcentration Factor[a] (l/kg)	Food Chain Multiplier[b] (unitless)
Arsenic	350	1
Cadmium	330	1
Chromium	130	1
Copper	120	1
Lead	180	1
Mercury	100	1
Nickel	50	1
Benzene	7.6	1
Benzo(a)pyrene	11,000	10
Bis(2-ethylhexyl)phthalate	1,700	10
Chlordane	3,700	10
DDT	17,000	10
Lindane	110	1
n-Nitrosodimethylamine	0.056	1
Polychlorinated biphenyls	31,000	10
Toxaphene	1,000	1
Trichloroethylene	13	1

[a] BCF values for inorganic contaminants are taken from U.S. EPA (1989b). BCF values for organic contaminants are derived from the following regression equation, taken from U.S. EPA (1990b): $\log(BCF) = 0.79 \log(K_{ow}) - 0.40 - \log(7.6/3.0)$. The $\log(K_{ow})$ values are presented in Table J-4.

[b] Food chain multipliers are determined from the procedure in U.S. EPA (1990b), assuming a Trophic Level of 3 for fish.

TABLE J-13

DATA FOR REFERENCE WATER CONCENTRATIONS FOR SURFACE WATER
REFERENCE WATER CONCENTRATIONS FOR SURFACE WATER

	Chronic Freshwater Reference Application Rates[a] (mg/l)	Human Health Criteria[b] (mg/l)	Limiting Reference Water Concentration (mg/l)
Arsenic	1.90×10^{-1} [c]	3.40×10^{-2}	1.90×10^{-1}
Cadmium	1.10×10^{-3}	2.52×10^{-3}	1.10×10^{-4}
Chromium	2.10×10^{-1}	1.07×10^{-1}	1.07×10^{-1}
Copper	1.20×10^{-2} [d]	2.45×10^{0}	1.20×10^{-2}
Lead	3.20×10^{-3} [d]	1.00×10^{-2}	3.20×10^{-3}
Mercury	1.20×10^{-5}	1.29×10^{-4}	1.20×10^{-5}
Nickel	1.60×10^{-1} [d]	4.17×10^{-1}	1.60×10^{-1}
Benzene	5.30×10^{0} [e]	1.15×10^{-1}	1.15×10^{-1}
Benzo(a)pyrene	- [f]	9.82×10^{-6}	9.82×10^{-6}
Bis(2-ethylhexyl)phthalate	- [f]	1.77×10^{-2}	1.77×10^{-2}
Chlordane	4.30×10^{-6}	1.91×10^{-7}	1.91×10^{-7}
DDT	1.00×10^{-6}	1.92×10^{-7}	1.92×10^{-7}
Lindane	8.00×10^{-5}	2.63×10^{-3}	8.00×10^{-5}
n-Nitrosodimethylamine	5.85×10^{0} [e]	6.86×10^{-5}	6.86×10^{-5}
Polychlorinated biphenyls	1.40×10^{-5}	1.46×10^{-8}	1.46×10^{-8}
Toxaphene	2.00×10^{-7}	2.41×10^{-5}	2.00×10^{-7}
Trichloroethylene	4.50×10^{1} [e]	2.88×10^{-1}	2.88×10^{-1}

[a] Chronic fresh water criteria based upon latest Ambient Water Quality Criteria. Because chronic values were not available for benzene, n-nitrosodimethylamine, and trichloroethylene, acute values were used instead. No values were found for benzo(a)pyrene and bis(2-ethylhexyl)phthalate.
[b] Human health criteria calculated using assumed rates of water and fish consumption, bioconcentration factors and food chain multipliers for fish.
[c] based on arsenic (V)
[d] Hardness dependent (assumed 100 mg/l)
[e] No criteria available; value given is a LOAEL
[f] No criteria available.

J.4.7 Bioconcentration Factors and Food Chain Multipliers

Bioaccumulation in surface water is the process by which aquatic organisms accumulate pollutants, from both water and food, at concentrations higher than the ambient concentration. The process by which a compound is absorbed from water through gill membranes or other external body surfaces is termed bioconcentration, and the measure of a chemical's tendency to bioconcentrate is described by the bioconcentration factor. Biomagnification, in contrast, denotes the process by which the concentration of a compound increases in different organisms occupying successive trophic levels. The combined accumulation from these two sources is represented by the bioaccumulation factor, which is calculated as the product of the bioconcentration factor and a food chain multiplier (U.S. EPA, 1990b):

$$BAF = FM\ BCF \tag{6}$$

where:

BAF	=	bioaccumulation factor (l/kg)
FM	=	food chain multiplier (kg/kg)
BCF	=	bioconcentration factor (l/kg)

The food chain multiplier and the bioconcentration factor are both derived from the pollutant's octanol-water partition coefficient (KOW). In addition, the food-chain multiplier is a function of the trophic level of the species under consideration. Based on a trophic level of 3 for fish, U.S. EPA (1990b) recommends the following values:

Range of Log(KOW)	Food Chain Multiplier
≤5	1
5 - 5.5	10
≥5.5	10

According to U.S. EPA (1990b), BCF values can be calculated from the log of KOW values (based on a 3 percent lipid content) according to the following regression equation:

$$\log(BCF) = 0.79\ \log(KOW) - 0.40 - \log\left(\frac{7.6}{3.0}\right) \tag{7}$$

The BCF and the FM values used to derive criteria are listed in Table J-12. BCFs for organic pollutants are calculated from the regression equation above using the KOW values presented in Table J-4. For metals, BCF values are taken from U.S. EPA (1989b).

J.4.8 Reference Air Concentration

Reference application rates for the air pathway are derived based on calculations of reference air concentrations (RC_{air} $\mu g/m^3$) for each pollutant. Reference application rates are calculated such that the concentration of each pollutant in ambient air at the point of compliance is not expected to exceed the reference concentration.

Values for the reference air concentration of all organic pollutants are calculated from the pollutants' estimated human cancer potencies, as summarized in Table J-14. Estimates are based on a risk level of 10^{-4} and a body weight of 70 kg. The highly exposed individual is assumed to inhale 20 m^3 of contaminated air daily for his or her entire lifetime.

TABLE J-14

REFERENCE AIR CONCENTRATIONS

	Human Cancer Potency (mg/kg•day)$^{-1}$	Reference Air Concentrations[a] ($\mu g/m^3$)
Benzene	0.029	12.0
Benzo(a)pyrene	11.5	0.032
Bis(2-ethylhexyl)phthalate	0.0141	25.0
Chlordane	1.3	0.27
DDT	0.34	1.0
Lindane	1.33	0.26
n-Nitrosodimethylamine	51	0.0071
Polychlorinated biphenyls	7.7	0.045
Toxaphene	1.1	0.32
Trichloroethylene	0.011	32.0

[a] Calculated from Human Cancer Potency based on a risk level of 10^{-4}, body weight of 70 kg, and inhalation volume of 20 m^3/day.

APPENDIX K

Justification for the Annual Application for Domestic Septage in the Standards for the Use or Disposal of Sewage Sludge

JUSTIFICATION FOR THE ANNUAL APPLICATION RATE FOR DOMESTIC SEPTAGE IN THE STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

Office of Science and Technology
U.S. Environmental Protection Agency
401 M Street, S.W.
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November 23, 1992

JUSTIFICATION FOR THE ANNUAL APPLICATION RATE FOR DOMESTIC SEPTAGE IN THE STANDARDS FOR THE USE OR DISPOSAL OF SEWAGE SLUDGE

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SECTION ONE

INTRODUCTION

On February 6, 1989, the U.S. Environmental Protection Agency (EPA) proposed Standards for the Use or Disposal of Sewage Sludge **(40 CFR Part 503)** in the Federal Register (54 FR 5746). Included in those standards were pollutant limits for different sewage sludge use or disposal practices.

In the Part 503 proposal, septage was included in the definition of sewage sludge. For this reason, the requirements for the use or disposal of sewage sludge also applied to the use or disposal of septage. Several commenters on the proposal indicated that it is not feasible for the use or disposal of septage to be subject to the same requirements as the use or disposal of sewage sludge. Those commenters indicated that the proposed Part 503 requirements were too costly for the use or disposal of septage. Also, the requirements may have a negative affect on the environment because they could lead to illegal use or disposal of septage or result in a lower frequency of pumping for septic tanks.

After reviewing the comments on the Part 503 proposal, the Agency decided to re-examine the pollutant limits for land application of domestic septage. A new approach to the pollutant limits was published in the Federal Register on November 9, 1990, (55 FR 47240) and comments were requested on that approach.

Under the new approach, the volume (i.e., gallons) of domestic septage that can be applied to an acre of land in a year would be calculated using an equation in the final Part 503 regulation. This volume would be based on the amount of nitrogen needed by the crop or vegetation grown on the land where the domestic septage is applied and on the concentration of available nitrogen.

There are two important aspects about the annual application rate approach for land application of domestic septage. First, the approach only applies to domestic septage. Domestic septage is either liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receives only domestic sewage.

The annual application rate approach does not apply to land application of commercial or industrial septage or to land application of a combination of domestic septage and either commercial or industrial septage. The reason for this is that the final Part 503 regulation does not apply to the use or disposal of commercial or industrial septage. Commercial and industrial septage have characteristics that are different than the characteristics of domestic septage. Because those characteristics are different, the pathway exposure analyses used to develop the Part 503 land application pollutant limits, which were used to justify the annual application rate for domestic septage, are not applicable to the use or disposal of commercial and industrial septage.

The second aspect is that the annual application rate approach only is applicable to domestic septage applied to agricultural land, forest, or a reclamation site. This approach does not apply to domestic septage applied to a public contact site or placed on a surface disposal site. In these two cases, the requirements in the final Part 503 regulation for application of sewage sludge to a public contact site and placement of sewage sludge on a surface disposal site, respectively, have to be met.

Most of the commenters on the annual application approach for domestic septage agreed with the approach. Several of the commenters indicated that, in addition to limiting the volume of domestic septage that can be applied to the land per year, the domestic septage also must meet pathogen and vector attraction reduction requirements. The Agency agrees and included pathogen and vector attraction reduction requirements in the final Part 503 regulation for domestic septage applied to agricultural land, forest, or a reclamation site. These requirements are discussed in the technical support document for the Part 503 land application requirements and in the technical support document for the Part 503 pathogen and vector attraction reduction requirements.

EPA decided to use the approach in the November 9, 1990, notice for domestic septage applied to agricultural land, forest, or a reclamation site in the final Part 503 regulation. This paper discusses the equation in the final Part 503 regulation used to calculate the annual application rate for land application of domestic septage; presents an example that illustrates how to use the equation; and presents results of an evaluation to determine whether the annual application rate protects public health and the environment from reasonably anticipated adverse effects of pollutants in domestic septage that is applied to agricultural land, forest, or a reclamation site.

SECTION TWO

ANNUAL APPLICATION RATE

2.1 Equation

The following equation is used to calculate the annual application rate for domestic septage applied to agricultural land, forest, or a reclamation site.

$$AAR = \frac{N}{ANC \times 8.34} \qquad (1)$$

Where:

AAR = Annual application rate in millions gallons per acre per year.

N = Amount of nitrogen needed by the crop or vegetation grown on the agricultural land, forest, or reclamation site in pounds per acre per year.

ANC = Available nitrogen concentration in milligrams per liter.

8.34 = A conversion factor.

2.2 Amount of Nitrogen

The amount of nitrogen needed depends on the crop or vegetation grown on the land where the domestic septage is applied. This amount is published for the crop yield desired by various government agencies (e.g., the Agriculture Extension Service).

2.3 Concentration of Available Nitrogen

Various assumptions were made to determine the available nitrogen concentration (ANC) in equation (1). These assumptions are discussed below.

The available nitrogen concentration consists of the concentration of ammonia-nitrogen in the domestic septage and the concentration of organic nitrogen that becomes available over time. Together, ammonia-nitrogen and organic nitrogen are Total Kjeldahl Nitrogen (TKN). To determine the TKN concentration in domestic septage, a sampling and analyses program was conducted. Nine samples of domestic septage were collected and analyzed for TKN. The Agency chose to use only data from these nine samples to estimate the TKN concentration in domestic septage because EPA has knowledge of how those samples were collected and how the samples were analyzed.

Summary statistics were developed for the analytical results from the nine samples of domestic septage. This information is presented in Appendix A.

As shown in Appendix A, the 95th percentile concentration for TKN is 352 milligrams per liter. EPA believes that this value is a conservative estimate of the TKN concentration in domestic septage because 95 percent of the domestic septage is expected to have a TKN concentration of 352 milligrams per liter or less. That value is used, therefore, as the value for the TKN concentration in domestic septage for this analysis.

The relationship between ammonia-nitrogen and TKN is represented by equation (2), which was derived during the development of the summary statistics for the analytical results of the nine domestic septage samples.

$$\text{Ammonia-N} = \text{TKN} \times 0.427247 \qquad (2)$$

Using equation (2), the estimated ammonia-nitrogen concentration in domestic septage is 150 milligrams per liter (i.e., 352 x 0.427247).

Subtracting the ammonia-nitrogen concentration for the TKN concentration leaves 202 milligrams per liter for organic nitrogen in domestic septage. Fifty percent of the organic nitrogen is assumed to become available to the crop or vegetation in the first year after application of domestic septage; 20 percent in the second year; 10 percent in the third year; and the remainder at three percent per year until no more of the organic nitrogen from a particular application of domestic septage remains. For the purpose of this analysis, the concentration of organic nitrogen available to the crop or vegetation in the fourth year and subsequent years after application the domestic septage was assumed to be zero because of the low concentration of organic nitrogen remaining in those years.

Another assumption for the calculation of the available nitrogen concentration is that the domestic septage is injected below the land surface. In that case, none of the ammonia-nitrogen is lost through volatilization. In addition, the Agency assumed that none of the ammonia-nitrogen is lost through volatilization if the pH of the domestic septage is raised to 12, which is one of the alternative pathogen and vector attraction reduction requirements in the final Part 503 regulation for domestic septage applied to agricultural land, forest, or a reclamation site. These two assumptions lead to a conservative estimate of the ammonia-nitrogen available to the crop or vegetation grown on the land where the domestic septage is applied.

The available nitrogen concentration used in equation (1) was calculated as shown below.

GIVEN: Domestic septage is injected below the land surface.
TKN = 352 mg/l
NH3 = 150 mg/l
Organic-N = 202 mg/l

	Year 1	Year 2	Year 3
Ammonia-N	150	150	150
Organic-N	101	101	101
		41	41
			21
Total	251	292	313

Beginning with the third year, the Agency assumes "steady state conditions" are achieved with respect to the available nitrogen concentration. After three years, the available nitrogen concentration is equal to 313 milligrams per liter each year. This is the value used in equation (1).

2.4 Calculation of Annual Application Rate

Substituting 313 milligrams per liter for ANC in equation (1) results in the following equation:

$$AAR = \frac{N}{0.0026} \qquad (3)$$

Where:

AAR = annual application rate in gallons per acre per year.

N = amount of nitrogen needed by the crop or vegetation grown on the land in pounds per acre per year.

0.0026 = a factor obtained by multiplying 313 mg/l times 8.34/1,000,000.

Note that the annual application rate in equation (3) is in gallons per acre per year not million gallons per acre per year. Equation (3) is included in the land application subpart (Subpart B) of the final Part 503 regulation.

2.5 Example Calculation

The following example illustrates how to calculate the annual application rate for domestic septage applied to agricultural land, forest, or a reclamation site using equation (3).

GIVEN:

Number of acres in application site = 3
Amount of nitrogen needed by the crop = 100 pounds per acre

RATE:

$$\text{Annual application rate} = \frac{100}{0.0026} \times 3$$

$$\text{Annual application rate} = 38{,}462\ \frac{\text{gallons}}{\text{acre}} \times 3\ \text{acres}$$

Annual application rate for the site = 115,386 gallons

For this example, 115,386 gallons of domestic septage can be applied to a three acre site on which a crop that requires 100 pounds of nitrogen per acre is grown. This is the application rate for a single year. In subsequent years, the annual application rate has to be re-calculated using the amount of nitrogen needed by the crop or vegetation grown on the site that year.

SECTION THREE

JUSTIFICATION FOR ANNUAL APPLICATION RATE

As discussed above, EPA decided to use the annual application rate approach for the pollutant limit in the final Part 503 regulation for domestic septage applied to agricultural land, forest, or a reclamation site after receiving favorable comment on this approach in the November 1990 Notice of Availability of Data from the National Sewage Sludge Survey (55 FR 47210). To use that approach, the Agency has to justify that applying domestic septage at an annual application rate protects public health and the environment from reasonably anticipated adverse effects of pollutants in domestic septage. This justification is presented below.

Step 1

The first step in the justification is to determine the concentration of each pollutant listed in Table 2 of the final Part 503 regulation in domestic septage. EPA used the 95th percentile estimate for the nine domestic septage samples discussed above for those pollutant concentrations (see Attachment A). The maximum likelihood estimation (MLE) procedure was used to develop the 95th percentile values. These values are presented below in Table 1.

TABLE 1 - POLLUTANT CONCENTRATIONS IN DOMESTIC SEPTAGE

Pollutant	Concentration (mg/l)*
Arsenic**	0.02
Cadmium	0.02
Chromium	0.16
Copper	2.0
Lead	0.14
Mercury	0.004
Molybdenum***	0.02
Nickel	0.11
Selenium	0.07
Zinc	27

* Values are reported to two significant figures and may not be the same as the values reported in Attachment A because of rounding.

** Value is the detection limit because the pollutant was not detected in any of the samples.

*** Value is the maximum observed value for the nine samples of domestic septage collected.

Step 2

The second step is to calculate an annual application rate for a high crop nitrogen requirement. For this justification, 300 pounds of nitrogen per acre for orchard grass was used. This is considered a conservative value for the amount of nitrogen because most crops require less than this amount of nitrogen. The annual application rate for a 300 pound nitrogen requirement is:

$$\text{Annual application rate} = \frac{300}{0.0026} \qquad (3)$$

Annual application rate = 116,000 gallons per acre

Step 3

The third step of the justification is to calculate the annual load for each of the pollutants listed in Table 1 above in the domestic septage applied to the land. This was done using the following equation:

$$AL = PC \times AAR \times 8.34 \qquad (4)$$

Where:

AL = annual loading rate for each pollutant in pounds per acre per year.

PC = 95th percentile concentration for each pollutant in milligrams per liter (see Table 1 above).

AAR = annual application rate in million gallons per acre per year.

8.34 = a conversion factor.

The annual loading rates for the pollutants listed in Table 1 above calculated using an application rate of 116,000 gallons (i.e., 0.116 million gallons) in equation (4) are presented in Table 2.

TABLE 2 - CALCULATED ANNUAL POLLUTANT LOADING RATES

Pollutant	Concentration (mg/l)*	Loading Rate**
Arsenic	0.02	0.02
Cadmium	0.02	0.02
Chromium	0.16	0.15
Copper	2.0	1.9
Lead	0.14	0.14
Mercury	0.004	0.004
Molybdenum	0.02	0.02
Nickel	0.11	0.11
Selenium	0.07	0.07
Zinc	27	26

* From Table 1 above.
** Pounds per acre per year - calculated using equation (4).

Step 4

The fourth and final step is to divide the annual pollutant loading rate in Table 2 above into the cumulative pollutant loading rate for the pollutant from Table 2 in the final Part 503 regulation. This provides the number of years that domestic septage with the pollutant concentrations in Table 1 above can be applied to the land at a rate of 116,000 gallons per year without causing the cumulative pollutant loading rate for the pollutants in Table 2 from the final Part 503 regulation to be exceeded. Results of this calculation are presented below in Table 3.

TABLE 3 - YEARS DOMESTIC SEPTAGE CAN BE APPLIED TO THE LAND

Pollutant	Part 503 Loading Rate*	Years**
Arsenic	36	1800
Cadmium	32	1600
Chromium	2670	17800
Copper	1335	702
Lead	267	1907
Mercury	15	3750
Molybdenum	16	800
Nickel	373	3390
Selenium	89	1271
Zinc	2492	96

* pounds per acre

** Part 503 cumulative pollutant loading rate in pounds per acre divided by calculated annual loading rate (i.e., pounds per acre per year) in Table 1 above.

As shown in Table 3, domestic septage with the pollutant concentrations in Table 1 can be applied to agricultural land, forest, or a reclamation site for 96 years at a rate of 116,000 gallons per year without causing any of the cumulative pollutant loading rates in Table 2 of the final Part 503 regulation to be exceeded. After 96 years, the cumulative pollutant loading rate for zinc is exceeded.

The Agency concluded that domestic septage most likely will not be applied to the same site for 96 years at a rate of 116,000 gallons per year. EPA also concluded that domestic septage will be not applied to most sites at rate of 116,000 gallons per year because the nitrogen requirement of the crop grown on the land most likely will be less than 300 pounds, which is the amount of nitrogen used to calculate the 116,000 rate.

For the above reasons and because a conservative value for available nitrogen was used to calculate the constant in equation (3), the Agency concluded that public health and the environment are protected from reasonably anticipated adverse effects of arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc in domestic septage applied to agricultural land, forest, or a reclamation site when the domestic septage is applied at a rate that is equal to or less than the rate calculated using equation (3). Part 503 requires, therefore, that the annual volume of domestic septage applied to agricultural land, forest, or a reclamation site be equal to or less than the volume determined using equation (3) above.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

NOV 6 1992

OFFICE OF
WATER

MEMORANDUM

Subject: Summary Statistics for EPA's Study on the Quality of Domestic Septage

From: Charles E. White, Statistician
Statistical Analysis Section

To: Alan Rubin, Chief
Sludge Risk Assessment Branch

Through: Henry D. Kahn, Chief HDK
Statistical Analysis Section

At your request, I will present and document summary statistics based on EPA's Study on the Quality of Domestic Septage. These summary statistics will include basic statistics on pollutants of concern, other requested pollutants, and the estimated relationship between Total Kjeldahl Nitrogen and Ammonia. EPA's Study on the Quality of Domestic Septage (1991) was conducted in order to support the development of hydraulic loading rates for the land application of domestic septage under the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal. This loading rate is intended to be a protective and affordable method for regulating the beneficial reuse of septage. Development of the loading rate itself will not be discussed in this memo.

Results

There are two basic results from these analyses. First, truckloads of domestic septage are not expected to contain pollutant concentrations as high as could be found in sewage sludge used or disposed from Publicly Owned Treatment Works that practice secondary or better wastewater treatment. Second, Total Kjeldahl Nitrogen is found to be approximately 43% Ammonia in wet domestic septage.

Data

Nine trucks delivering domestic septage to the Madison Metropolitan Sewerage District (MMSD) in Madison, Wisconsin were each sampled once. As septage was being discharged, a grab sample was collected and delivered to the MMSD lab for splitting, labeling, icing, and shipping to appropriate labs under contract to the EPA. Each

ATTACHMENT A

independent sample was physically analyzed for 324 pollutants. Only data regarding pollutants of concern and some data for pollutants that are also micro-nutrients will be considered in this report.

Physical Analytical Procedures

Physical analytical methods used here are the same as those used for the National Sewage Sludge Survey (NSSS), though some pollutants are reported differently. Individual PCB aroclors were reported in the NSSS; total PCB aroclors are reported here. Aldrin and Dieldrin were reported separately in the NSSS; the totals for Aldrin and Dieldrin are reported here. Total Chlordane is reported in the NSSS; the alpha and gamma portions of chlordane are reported here. DDT, DDS, and DDD are reported separately in the NSSS; totals for DDT, DDS, and DDD are reported here. Lindane is reported in the NSSS; Lindane (Gamma-BHC) is reported here.

Some pollutant concentrations were not measured above the Minimum Level for the particular pollutant. Minimum Levels are a form of "detection limit" used in physical analytical methods developed for the Office of Science and Technology. Under contract, each contractor lab must demonstrate that it is able to achieve the Minimum Levels stated for the particular EPA method to be used. In general, a Minimum Level is defined as the lowest concentration at which the physical analytical process can be reliably calibrated. Pollutant concentrations not measured above the Minimum Level for a particular pollutant are not reported; the Minimum Level is reported instead.

Statistical Methods for Basic Summary Statistics

Statistical analysis methods were primarily selected to estimate a concentration level for each pollutant such that, under certain assumptions, "most" septage concentrations for a particular pollutant will be below it's respective level, i.e., we are primarily estimating percentiles. These methods will also be used to characterize both wet and dry weight pollutant concentration measurements, mixed with "detection limits." Substitution and Maximum Likelihood Methods will be used to estimate summary statistics. One overall assumption of this study is that residential septage samples across the country follow approximately the same probability distributions for pollutant concentrations as those distributions found in the area around Madison, Wisconsin. Additional statistical assumptions are discussed in the section on the Substitution Method, in the section on the Maximum Likelihood Method for estimating summary statistics in the presence of censored, or "non-detect," data and in the section on estimating the relationship between Ammonia and Total Kjeldahl Nitrogen.

Dry Weight Conversion

Physical analyses were conducted on liquid septage samples. However, both because pollutants are assumed to be concentrated in the solid phase of the septage sample and because pollutants were reported this way in the NSSS, a dry weight conversion is also used in presentation of these data. More detailed discussion of the reasons for dry weight conversion and analyses in support of this practice are presented in the *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal.* Conversion of a concentration reported in ug/l is illustrated below:

Let: Pollutant Concentration for Sample i = x_i µg/l
Solids Concentration for Sample i = y_i mg/l

$$\text{Dry Weight Pollutant Concentration in } \mu g/kg = \frac{x_i \mu g/l}{y_i mg/l}\left(\frac{1{,}000{,}000 \text{ mg}}{\text{kg}}\right) = \left(\frac{1{,}000{,}000 x_i}{y_i}\right) \mu g/kg$$

Substitution Methods

The substitution methods used here make no assumptions about the probability distributions of the pollutant concentration data, but they do make assumptions about the concentration of pollutants in samples where pollutants could not be measured above their "detection limit." The first of two substitution methods used assumes that pollutant concentrations, in samples where pollutants could not be measured, are at the "detection limit." The second substitution method assumes that pollutant concentrations, in samples where pollutants could not be measured, are zero. Together, these two substitution methods give a kind of upper and lower bound on non-parametric summary statistics for pollutant concentrations in septage. More detailed discussion of these methods and the reasons for their selection are presented in the *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal.*

Tables of wet weight summary statistics developed using these substitution methods are presented on pages 13 through 23 and tables of dry weight summary statistics developed using these substitution methods are presented on pages 27 through 36.

Maximum Likelihood Estimation

The maximum likelihood estimation (MLE) procedure used here assumes pollutant concentrations are approximately lognormal in probability distribution. When this assumption is true, estimates produced using this procedure will be more efficient than those produced without assumptions about probability distributions. The procedure uses sample size, measured pollutant concentrations, and the range of possible values for "detection limit" data in order to pick optimum estimates for the log mean and log variance of a two parameter lognormal distribution. If the assumption of a lognormal distribution is not closely approximated, this procedure is expected to produce good estimates for upper percentiles while the mean and variance estimates may not be optimal.

The two parameter lognormal distribution is fully described by the log mean and log variance, or the mean and standard deviation. Any desired summary statistic can be calculated using an appropriate pair of sufficient statistics. More detailed discussion of this method and the reasons why it was selected are presented in *Statistical Support Document for the 40 CFR Part 503 Final Rule for Sewage Sludge Use or Disposal* (1992).

In order to assess the quality of the MLEs, cumulative probability distributions were plotted for both the wet and dry weight distributions. Each plot shows the estimated cumulative distribution for all three estimation methods. The substitution methods are illustrated with points for each observation. The probability plotting position for each point is determined by a ranking procedure developed by Blom. The line indicating the estimated lognormal distribution is a plot of the 10th through 90th percentiles. These plots do not indicate any obvious deviations from the assumption that the pollutant concentration data are approximately lognormal in distribution. These plots are presented in the appendix.

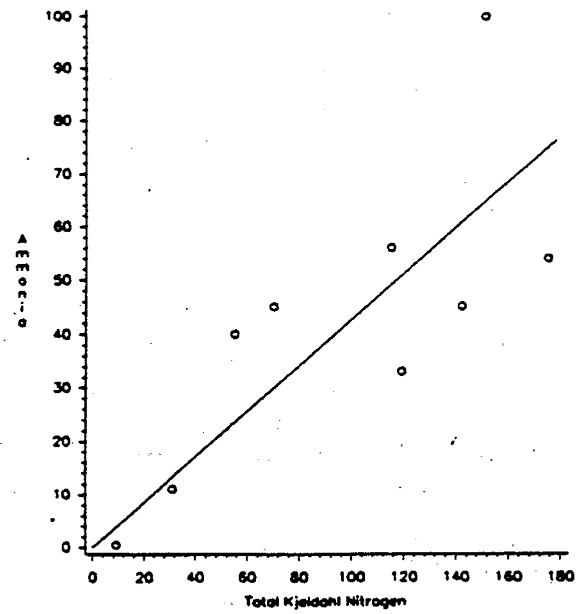
Tables for wet weight summary statistics are presented on pages 10 through 12 and tables for dry weight summary statistics are presented on pages 24 through 26. Pollutants measured above their sample specific Minimum Level, or "detection limit," one time or less are not included in these tables as it is not possible to obtain MLEs under those conditions.

Note that truckloads of domestic septage are not expected to contain pollutant concentrations as high as could be found in sewage sludge used or disposed from Publicly Owned Treatment Works that practice secondary or better wastewater treatment. This statement is based on the previously mentioned distributional assumptions of the MLE estimation procedure and the additional assumption that domestic septage trucks across the country have approximately the same probability distribution for pollutant concentrations as domestic septage in trucks found in the area around Madison, Wisconsin. This result is found by comparing the 98th percentile estimates from the National Sewage Sludge Survey, presented in *Statistical Support Documentation for the 40 CFR, Part 503 Final Standards for the Use or Disposal of Sewage Sludge* (1992), to 98th percentile estimates developed here for dry weight concentrations of septage.

Statistical Methods for Estimating the Relationship Between Ammonia & TKN

Ammonia is the constituent of Total Kjeldahl Nitrogen (TKN) that is immediately available for plant uptake. Over time, Total Kjeldahl Nitrogen is expected to completely break down into Ammonia. The purpose of this analysis is to assist in determining an appropriate hydraulic loading rate for domestic septage that allows sufficient nitrogen for crop growth while not allowing for so much nitrogen that crop growth would be adversely affected. The loading rate itself will be estimated in another document.

Relation of Total Kjeldahl Nitrogen to Ammonia:



Units are mg/l

The observed relationship between the Ammonia and the Total Kjeldahl Nitrogen data indicates, as expected, that both pollutants increase together. A statistical model was fit to these data that assumes the concentration of Ammonia is zero when the concentration of TKN is zero, that the Ammonia concentration will increase in a linear fashion as TKN increases, that the Ammonia concentrations about that line are approximately normal in distribution, and that the deviations from that line are independent and identically distributed. Under these assumptions, Total Kjeldahl Nitrogen is approximately 43% Ammonia in wet domestic septage.

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	3785.12042	3785.12042	9.806	0.0166
Error	7	2702.12438	386.01777		
C Total	8	6487.24480			

Root MSE	19.64733	R-square	0.5835
Dep Mean	42.72000	Adj R-sq	0.5240
C.V.	45.99095		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.292426	13.34986889	0.471	0.6517
TKN	1	0.377705	0.12061931	3.131	0.0166

Variable	DF	Variable Label
INTERCEP	1	Intercept
TKN	1	Total Kjeldahl Nitrogen

Evaluation of Assumptions

For the assumption that the concentration of Ammonia is zero when the concentration of TKN is zero, a model was fit that estimated a non-zero constant when TKN is zero and a hypothesis test was conducted that failed to reject the hypothesis that the constant was statistically different than zero. The

Analysis of Variance table for this model indicates that the intercept term is not statistically significant at the 0.05 level. The significance test used is robust to many departures from assumptions.

For the assumption of linearity, both the Analysis of Variance table for the model with an intercept term and for the model without an intercept term indicate that a statistically significant linear relationship exists between Ammonia and TKN. Again, the significance test used is robust to many departures from assumptions.

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	1	20124.34510	20124.34510	57.748	0.0001
Error	8	2787.88530	348.48566		
U Total	9	22912.23040			

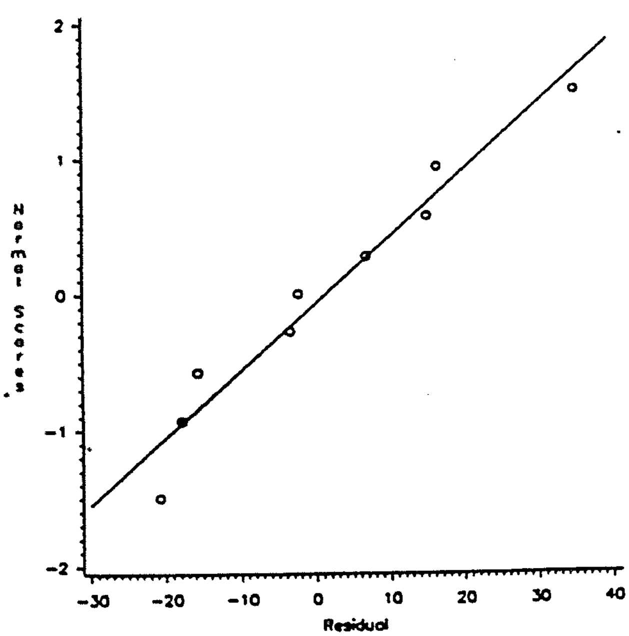
Root MSE	18.66777	R-square	0.8783
Dep Mean	42.72000	Adj R-sq	0.8631
C.V.	43.69797		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
TKN	1	0.427247	0.05622261	7.599	0.0001

Variable	DF	Variable Label
TKN	1	Total Kjeldahl Nitrogen

Relation of Total Kjeldahl Nitrogen to Ammonia:
Normal Scores Plot of Residuals from Regression

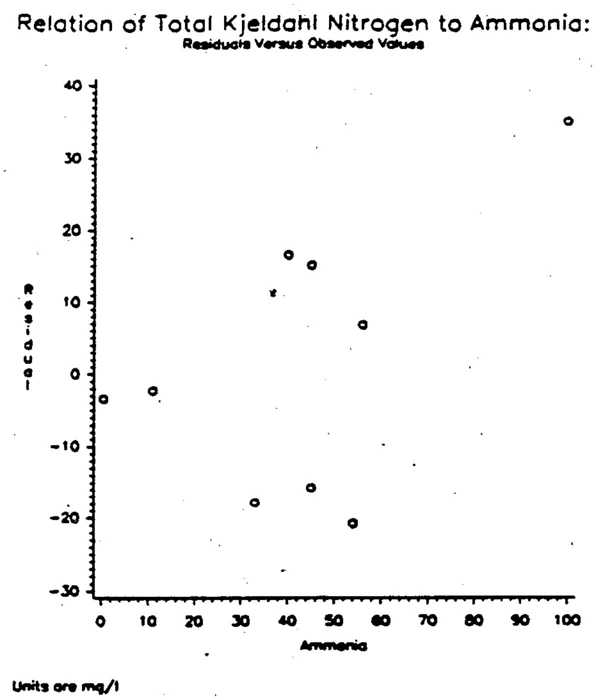


Units are mg/l

For the assumption that Ammonia concentrations about that line are approximately normal in distribution, the Shapiro-Wilk test for the normal distribution fails to reject the hypothesis that the residuals from the fitted line come from a normal distribution. Residuals are the arithmetic difference between the observed concentration of Ammonia at a particular TKN concentration and the Ammonia concentration predicted by the statistical model. Further evidence is that the plot of the residuals versus their expected position in a normal distribution, a normal scores plot, is approximately linear.

For the assumption that deviations from the line are independent, the physical process of sampling from different truck loads of septage would tend to make the sample results independent.

For the assumption that deviations from the line are identically distributed, the plot of residuals versus observed Ammonia values does not appear to indicate strong deviation from this assumption.



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Blom, G. (1958), *Statistical Estimates and Transformed Beta Variables,* New York: John Wiley & Sons, Inc.

USEPA (1992), *Statistical Support Documentation for the 40 CFR, Part 503 Final Standards for the Use or Disposal of Sewage Sludge*

Appendix A

Summary Statistics

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Sample Size	Non-Detect	Log Mean	Log Variance
ALDRIN/DIELDRIN(TOTAL)	UG/L	9	7	-4.872	15.2471
AMMONIA (AS N)	MG/L	9	0	3.231	2.5560
CADMIUM	UG/L	9	6	1.207	1.1385
CHROMIUM	UG/L	9	1	3.494	0.8888
COPPER	UG/L	9	0	5.373	1.8551
DDT,DDE,DDD(TOTAL)	UG/L	9	7	-2.783	6.1436
LEAD	UG/L	9	6	3.642	0.5873
LINDANE(GAMMA-BHC)	UG/L	9	7	-2.360	0.2981
MERCURY	UG/L	9	4	-1.348	2.7855
NICKEL	UG/L	9	4	3.747	0.3319
NITRATE+NITRITE (AS N)	MG/L	9	2	-1.345	1.0699
PERCENT SOLIDS	%	9	0	-0.488	2.8024
SELENIUM	UG/L	9	7	0.442	5.4810
TOTAL KJELDAHL NITROGEN	MG/L	9	0	4.284	0.9236
TOTAL PHOSPHORCUS	MG/L	9	0	2.960	1.2521
ZINC	UG/L	9	0	7.806	2.1128

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation
ALDRIN/DIELDRIN(TOTAL)	UG/L	15.7000	10700.000	32100.000	2050.0000
AMMONIA (AS N)	MG/L	90.8000	104.0000	313.0000	3.4500
CADMIUM	UG/L	5.9100	2.8700	8.6100	1.4600
CHROMIUM	UG/L	51.3000	20.5000	61.4000	1.2000
COPPER	UG/L	545.0000	422.0000	1270.0000	2.3200
DDT,DDE,DDD(TOTAL)	UG/L	1.3300	9.5900	28.8000	21.6000
LEAD	UG/L	51.2000	15.3000	45.8000	0.8940
LINDANE(GAMMA-BHC)	UG/L	0.1100	0.0215	0.0646	0.5890
MERCURY	UG/L	1.0500	1.3600	4.0800	3.9000
NICKEL	UG/L	50.0000	10.5000	31.4000	0.6270
NITRATE+NITRITE (AS N)	MG/L	0.4450	0.2050	0.6160	1.3800
PERCENT SOLIDS	%	2.4900	3.2700	9.8100	3.9300
SELENIUM	UG/L	24.1000	124.0000	373.0000	15.5000
TOTAL KJELDAHL NITROGEN	MG/L	115.0000	47.3000	142.0000	1.2300
TOTAL PHOSPHOROUS	MG/L	36.1000	19.0000	57.0000	1.5800
ZINC	UG/L	7060.0000	6350.0000	19000.000	2.7000

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Median	90th Percentile	95th Percentile	98th Percentile
ALDRIN/DIELDRIN(TOTAL)	UG/L	0.0077	1.1600	4.7200	23.4000
AMMONIA (AS N)	MG/L	25.3000	197.0000	351.0000	676.0000
CADMIUM	UG/L	3.3400	13.2000	19.3000	30.0000
CHROMIUM	UG/L	32.9000	111.0000	155.0000	228.0000
COPPER	UG/L	216.0000	1240.0000	2030.0000	3540.0000
DDT,DDE,DDD(TOTAL)	UG/L	0.0619	1.4900	3.6500	10.1000
LEAD	UG/L	38.2000	102.0000	135.0000	184.0000
LINDANE(GAMMA-BHC)	UG/L	0.0944	0.1900	0.2320	0.2900
MERCURY	UG/L	0.2600	2.2200	4.0400	8.0200
NICKEL	UG/L	42.4000	88.9000	109.0000	138.0000
NITRATE+NITRITE (AS N)	MG/L	0.2610	0.9840	1.4300	2.1800
PERCENT SOLIDS	%	0.6140	5.2800	9.6400	19.1000
SELENIUM	UG/L	1.5600	31.5000	73.2000	191.0000
TOTAL KJELDAHL NITROGEN	MG/L	72.5000	249.0000	352.0000	523.0000
TOTAL PHOSPHOROUS	MG/L	19.3000	81.3000	122.0000	192.0000
ZINC	UG/L	2460.0000	15900.000	26800.000	48700.000

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------ Pollutant=ALDRIN/DIELDRIN(TOTAL) -- Sample Size=9 -- Units=UG/L ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.4480	0.2660	0.7980	178.0	0.1000	0.1000	2.500
SM-O	0.3610	0.2800	0.8400	232.0	0.0000	0.0000	2.500

---------------- Pollutant=ALPHA-CHLORDANE -- Sample Size=9 -- Units=UG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.1090	0.0093	0.0280	25.6	0.1000	0.1000	0.184
SM-O	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

---------------- Pollutant=AMMONIA (AS N) -- Sample Size=9 -- Units=MG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	42.7000	9.4900	28.5000	66.7	0.4800	45.0000	100.000
SM-O	42.7000	9.4900	28.5000	66.7	0.4800	45.0000	100.000

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

------------------- Pollutant=ARSENIC -- Sample Size=9 -- Units=UG/L --------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	20.0000	0.0000	0.0000	0.0	20.0000	20.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

------------------- Pollutant=BENZENE -- Sample Size=7 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.4000	1.4300	3.7800	33.1	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

---------------- Pollutant=BENZO(A)PYRENE -- Sample Size=9 -- Units=UG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.1000	1.1100	3.3300	30.0	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

------------------- Pollutant=BERYLLIUM -- Sample Size=9 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	5.0000	0.0000	0.0000	0.0	5.0000	5.0000	5.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

---------- Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE -- Sample Size=9 -- Units=UG/L ----------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.1000	1.1100	3.3300	30.0	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

------------------- Pollutant=CADMIUM -- Sample Size=9 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	7.1300	1.4900	4.4700	62.7	5.0000	5.0000	18.400
SM-0	3.8000	2.1700	6.5000	171.0	0.0000	0.0000	18.400

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

------------------- Pollutant=CHROMIUM -- Sample Size=9 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	46.7000	12.7000	38.1000	81.6	10.0000	33.5000	128.000
SM-0	45.6000	13.1000	39.4000	86.5	0.0000	33.5000	128.000

------------------- Pollutant=COPPER -- Sample Size=9 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	503.0000	223.0000	669.0000	133.0	62.0000	115.0000	1850.000
SM-0	503.0000	223.0000	669.0000	133.0	62.0000	115.0000	1850.000

-------------- Pollutant=DDT,DDE,DDD(TOTAL) -- Sample Size=9 -- Units=UG/L --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.6850	0.2810	0.8440	123.0	0.3380	0.3380	2.880
SM-0	0.4220	0.3230	0.9690	230.0	0.0000	0.0000	2.880

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

---------------- Pollutant=GAMMA-CHLORDANE -- Sample Size=9 -- Units=UG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.1230	0.0104	0.0313	25.4	0.1130	0.1130	0.207
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

------------------ Pollutant=HEPTACHLOR -- Sample Size=9 -- Units=UG/L ------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.0896	0.0209	0.0626	69.9	0.0630	0.0630	0.250
SM-0	0.0278	0.0278	0.0833	300.0	0.0000	0.0000	0.250

--------------- Pollutant=HEXACHLOROBENZENE -- Sample Size=9 -- Units=UG/L ---------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.1000	1.1100	3.3300	30.0	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

-------------- Pollutant=HEXACHLOROBUTADIENE -- Sample Size=9 -- Units=UG/L --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.1000	1.1100	3.3300	30.0	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

--------------------- Pollutant=LEAD -- Sample Size=9 -- Units=UG/L ---------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	63.4000	8.0800	24.2000	38.2	50.0000	50.0000	121.000
SM-0	30.1000	15.7000	47.1000	157.0	0.0000	0.0000	121.000

-------------- Pollutant=LINDANE(GAMMA-BHC) -- Sample Size=9 -- Units=UG/L --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.1620	0.0170	0.0511	31.6	0.1250	0.1380	0.253
SM-0	0.0417	0.0295	0.0884	212.0	0.0000	0.0000	0.250

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

------------------- Pollutant=MERCURY -- Sample Size=9 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.8220	0.4200	1.2600	153.0	0.2000	0.3000	4.050
SM-0	0.7330	0.4380	1.3100	179.0	0.0000	0.3000	4.050

------------------ Pollutant=MOLYBDENUM -- Sample Size=9 -- Units=UG/L ------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	10.5000	0.4890	1.4700	14.0	10.0000	10.0000	14.400
SM-0	1.6000	1.6000	4.8000	300.0	0.0000	0.0000	14.400

------------ Pollutant=N-NITROSODIMETHYLAMINE -- Sample Size=9 -- Units=UG/L ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	55.6000	5.5600	16.7000	30.0	50.0000	50.0000	100.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

------------------- Pollutant=NICKEL -- Sample Size=9 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	54.5000	7.8300	23.5000	43.1	40.0000	41.6000	105.000
SM-0	36.7000	13.2000	39.7000	108.0	0.0000	41.6000	105.000

------------ Pollutant=NITRATE+NITRITE (AS N) -- Sample Size=9 -- Units=MG/L ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.3890	0.0964	0.2890	74.4	0.1000	0.2000	0.900
SM-0	0.3670	0.1050	0.3160	86.2	0.0000	0.2000	0.900

----------------- Pollutant=PCB(TOTAL) -- Sample Size=9 -- Units=UG/L -----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	1.9100	0.1630	0.4890	25.6	1.7500	1.7500	3.220
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Wet Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

--------------- Pollutant=PERCENT SOLIDS -- Sample Size=9 -- Units='   %' ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	2.2100	1.5100	4.5400	205.0	0.0653	0.6580	14.200
SM-0	2.2100	1.5100	4.5400	205.0	0.0653	0.6580	14.200

------------------- Pollutant=SELENIUM -- Sample Size=9 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	20.8000	6.6400	19.9000	95.6	5.0000	5.0000	50.000
SM-0	6.9400	4.6000	13.8000	199.0	0.0000	0.0000	32.000

------------ Pollutant=TOTAL KJELDAHL NITROGEN -- Sample Size=9 -- Units=MG/L ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	96.4000	19.2000	57.6000	59.7	9.0000	115.0000	175.000
SM-0	96.4000	19.2000	57.6000	59.7	9.0000	115.0000	175.000

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

--------------- Pollutant=TOTAL PHOSPHOROUS -- Sample Size=9 -- Units=MG/L ---------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	27.6000	5.7400	17.2000	62.3	1.7000	32.0000	48.000
SM-0	27.6000	5.7400	17.2000	62.3	1.7000	32.0000	48.000

------------------- Pollutant=TOXAPHENE -- Sample Size=9 -- Units=UG/L -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.3000	1.6700	5.0100	44.3	0.9100	11.4000	20.900
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

---------------- Pollutant=TRICHLOROETHENE -- Sample Size=7 -- Units=UG/L ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	11.4000	1.4300	3.7800	33.1	10.0000	10.0000	20.000
SM-0	0.0000	0.0000	0.0000	.	0.0000	0.0000	0.000

Wet Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

--------------------- Pollutant=ZINC -- Sample Size=9 -- Units=UG/L ---------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	5300.0000	2420.0000	7270.0000	137.0	182.0000	3190.0000	23800.000
SM-O	5300.0000	2420.0000	7270.0000	137.0	182.0000	3190.0000	23800.000

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Sample Size	Non-Detect	Log Mean	Log Variance
ALDRIN/DIELDRIN(TOTAL)	UG/KG	9	7	0.741	8.92238
AMMONIA (AS N)	MG/KG	9	0	8.325	3.90825
CADMIUM	MG/KG	9	6	-1.766	5.86238
CHROMIUM	MG/KG	9	1	1.542	2.39400
COPPER	MG/KG	9	0	3.559	4.39988
DDT,DDE,DDD(TOTAL)	UG/KG	9	7	1.665	7.27425
LEAD	MG/KG	9	6	0.561	3.87225
LINDANE(GAMMA-BHC)	UG/KG	9	7	0.967	2.14650
MERCURY	MG/KG	9	4	-3.571	2.86875
NICKEL	MG/KG	9	4	1.330	1.57612
NITRATE+NITRITE (AS N)	MG/KG	9	2	3.522	0.82463
PERCENT SOLIDS	%	9	0	-0.488	2.80237
SELENIUM	MG/KG	9	7	-2.098	6.97725
TOTAL KJELDAHL NITROGEN	MG/KG	9	0	9.378	2.81813
TOTAL PHOSPHOROUS	MG/KG	9	0	8.054	1.42312
ZINC	MG/KG	9	0	5.992	1.05525

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation
ALDRIN/DIELDRIN(TOTAL)	UG/KG	182.0000	5240.0000	15700.000	86.6000
AMMONIA (AS N)	MG/KG	29100.000	67800.000	203000.00	6.9900
CADMIUM	MG/KG	3.2100	20.0000	60.0000	18.7000
CHROMIUM	MG/KG	15.5000	16.3000	48.8000	3.1600
COPPER	MG/KG	317.0000	948.0000	2840.0000	8.9700
DDT,DDE,DDD(TOTAL)	UG/KG	201.0000	2540.0000	7620.0000	38.0000
LEAD	MG/KG	12.1000	27.8000	83.3000	6.8600
LINDANE(GAMMA-BHC)	UG/KG	7.6900	7.0500	21.1000	2.7500
MERCURY	MG/KG	0.1180	0.1600	0.4810	4.0800
NICKEL	MG/KG	8.3200	5.4300	16.3000	1.9600
NITRATE+NITRITE (AS N)	MG/KG	51.1000	19.3000	57.9000	1.1300
PERCENT SOLIDS	%	2.4900	3.2700	9.8100	3.9300
SELENIUM	MG/KG	4.0200	43.8000	131.0000	32.7000
TOTAL KJELDAHL NITROGEN	MG/KG	48400.000	64000.000	192000.00	3.9700
TOTAL PHOSPHOROUS	MG/KG	6410.0000	3790.0000	11400.000	1.7700
ZINC	MG/KG	678.0000	309.0000	928.0000	1.3700

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Maximum Likelihood Estimation

Pollutant	Units	Median	90th Percentile	95th Percentile	98th Percentile
ALDRIN/DIELDRIN(TOTAL)	UG/KG	2.1000	97.4000	286.0000	972.0000
AMMONIA (AS N)	MG/KG	4130.0000	52300.000	107000.00	240000.00
CADMIUM	MG/KG	0.1710	3.8400	9.1800	24.8000
CHROMIUM	MG/KG	4.6700	34.1000	59.6000	112.0000
COPPER	MG/KG	35.1000	520.0000	1110.0000	2620.0000
DDT,DDE,DDD(TOTAL)	UG/KG	5.2900	169.0000	447.0000	1350.0000
LEAD	MG/KG	1.7500	22.0000	44.6000	100.0000
LINDANE(GAMMA-BHC)	UG/KG	2.6300	17.3000	29.3000	53.4000
MERCURY	MG/KG	0.0281	0.2480	0.4560	0.9140
NICKEL	MG/KG	3.7800	19.0000	29.8000	49.9000
NITRATE+NITRITE (AS N)	MG/KG	33.9000	109.0000	151.0000	219.0000
PERCENT SOLIDS	%	0.6140	5.2800	9.6400	19.1000
SELENIUM	MG/KG	0.1230	3.6600	9.4600	27.9000
TOTAL KJELDAHL NITROGEN	MG/KG	11800.000	102000.00	187000.00	372000.00
TOTAL PHOSPHOROUS	MG/KG	3150.0000	14600.000	22400.000	36500.000
ZINC	MG/KG	400.0000	1500.0000	2170.0000	3300.0000

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------ Pollutant=ALDRIN/DIELDRIN(TOTAL) -- Sample Size=9 -- Units=UG/KG ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	77.200	36.300	109.000	141.0	8.55000	17.6000	325.00
SM-0	38.000	35.900	108.000	283.0	0.00000	0.0000	325.00

--------------- Pollutant=ALPHA-CHLORDANE -- Sample Size=9 -- Units=UG/KG ---------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	44.100	19.500	58.500	133.0	0.70400	15.2000	153.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

---------------- Pollutant=AMMONIA (AS N) -- Sample Size=9 -- Units=MG/KG ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	12700.000	6390.000	19200.000	151.0	77.50000	8210.0000	61300.00
SM-0	12700.000	6390.000	19200.000	151.0	77.50000	8210.0000	61300.00

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------------ Pollutant=ARSENIC -- Sample Size=9 -- Units=MG/KG --------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	8.710	3.920	11.800	135.0	0.14100	3.0400	30.60
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

------------------ Pollutant=BENZENE -- Sample Size=7 -- Units=UG/KG --------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	1540.000	519.000	1370.000	89.1	70.40000	1080.0000	4330.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

---------------- Pollutant=BENZO(A)PYRENE -- Sample Size=9 -- Units=UG/KG ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4420.000	1950.000	5840.000	132.0	70.40000	1520.0000	15300.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

-------------------- Pollutant=BERYLLIUM -- Sample Size=9 -- Units=MG/KG --------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	2.180	0.981	2.940	135.0	0.03520	0.7600	7.66
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

--------- Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE -- Sample Size=9 -- Units=UG/KG ----------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4420.000	1950.000	5840.000	132.0	70.40000	1520.0000	15300.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

-------------------- Pollutant=CADMIUM -- Sample Size=9 -- Units=MG/KG --------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	2.430	0.954	2.860	118.0	0.03520	0.9950	7.66
SM-0	0.632	0.349	1.050	166.0	0.00000	0.0000	2.77

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------------- Pollutant=CHROMIUM -- Sample Size=9 -- Units=MG/KG -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	10.900	3.640	10.900	100.0	0.22600	7.6300	35.30
SM-0	9.360	3.800	11.400	122.0	0.00000	6.9200	35.30

-------------------- Pollutant=COPPER -- Sample Size=9 -- Units=MG/KG -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	113.000	40.900	123.000	108.0	0.81000	105.0000	328.00
SM-0	113.000	40.900	123.000	108.0	0.81000	105.0000	328.00

-------------- Pollutant=DDT,DDE,DDD(TOTAL) -- Sample Size=9 -- Units=UG/KG -------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	176.000	64.500	194.000	110.0	2.38000	69.3000	518.00
SM-0	33.800	28.100	84.400	250.0	0.00000	0.0000	254.00

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

---------------- Pollutant=GAMMA-CHLORDANE -- Sample Size=9 -- Units=UG/KG ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	49.800	22.000	66.100	133.0	0.79600	17.2000	173.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

------------------ Pollutant=HEPTACHLOR -- Sample Size=9 -- Units=UG/KG ------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	32.000	12.400	37.100	116.0	0.44400	9.5700	96.50
SM-0	5.690	5.690	17.100	300.0	0.00000	0.0000	51.20

-------------- Pollutant=HEXACHLOROBENZENE -- Sample Size=9 -- Units=UG/KG --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4420.000	1950.000	5840.000	132.0	70.40000	1520.0000	15300.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------- Pollutant=HEXACHLOROBUTADIENE -- Sample Size=9 -- Units=UG/KG -------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4420.000	1950.000	5840.000	132.0	70.40000	1520.0000	15300.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

-------------------- Pollutant=LEAD -- Sample Size=9 -- Units=MG/KG --------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	23.800	9.600	28.800	121.0	0.35200	7.6000	76.60
SM-0	3.960	2.730	8.200	207.0	0.00000	0.0000	24.80

------------- Pollutant=LINDANE(GAMMA-BHC) -- Sample Size=9 -- Units=UG/KG -------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	61.900	26.700	80.000	129.0	0.88000	22.1000	211.00
SM-0	2.560	2.450	7.340	287.0	0.00000	0.0000	22.10

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

------------------- Pollutant=MERCURY -- Sample Size=9 -- Units=MG/KG -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	0.138	0.044	0.132	95.4	0.00211	0.0760	0.35
SM-0	0.059	0.037	0.112	189.0	0.00000	0.0021	0.35

------------------- Pollutant=MOLYBDENUM -- Sample Size=9 -- Units=MG/KG -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4.460	1.950	5.850	131.0	0.07040	1.5200	15.30
SM-0	0.328	0.328	0.984	300.0	0.00000	0.0000	2.95

------------ Pollutant=N-NITROSODIMETHYLAMINE -- Sample Size=9 -- Units=UG/KG ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	22100.000	9740.000	29200.000	132.0	352.00000	7600.0000	76600.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------------- Pollutant=NICKEL -- Sample Size=9 -- Units=MG/KG -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	18.900	7.800	23.400	124.0	0.56200	6.0800	61.30
SM-0	4.470	2.870	8.620	193.0	0.00000	0.5620	26.80

------------ Pollutant=NITRATE+NITRITE (AS N) -- Sample Size=9 -- Units=MG/KG ------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	68.600	17.200	51.700	75.4	6.34000	53.1000	153.00
SM-0	36.400	11.600	34.900	95.9	0.00000	32.4000	91.20

----------------- Pollutant=PCB(TOTAL) -- Sample Size=9 -- Units=UG/KG -----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	771.000	341.000	1020.000	133.0	12.30000	266.0000	2680.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

Dry Weight Concentrations of Pollutants in Septage: Summary Statistics from Substitution Methods

------------------ Pollutant=SELENIUM -- Sample Size=9 -- Units=MG/KG ------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4.370	1.240	3.720	85.2	0.03520	2.7400	10.20
SM-0	0.487	0.335	1.000	206.0	0.00000	0.0000	2.74

----------- Pollutant=TOTAL KJELDAHL NITROGEN -- Sample Size=9 -- Units=MG/KG -----------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	23600.000	8350.000	25100.000	106.0	218.00000	13000.0000	84200.00
SM-0	23600.000	8350.000	25100.000	106.0	218.00000	13000.0000	84200.00

-------------- Pollutant=TOTAL PHOSPHOROUS -- Sample Size=9 -- Units=MG/KG --------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	4580.000	1050.000	3150.000	68.7	176.00000	3500.0000	10700.00
SM-0	4580.000	1050.000	3150.000	68.7	176.00000	3500.0000	10700.00

Dry Weight Concentrations of Pollutants in Septage:
Summary Statistics from Substitution Methods

------------------ Pollutant=TOXAPHENE -- Sample Size=9 -- Units=UG/KG -------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	3240.000	1600.000	4800.000	148.0	80.10000	1390.0000	15500.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

--------------- Pollutant=TRICHLOROETHENE -- Sample Size=7 -- Units=UG/KG ----------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	1540.000	519.000	1370.000	89.1	70.40000	1080.0000	4330.00
SM-0	0.000	0.000	0.000	.	0.00000	0.0000	0.00

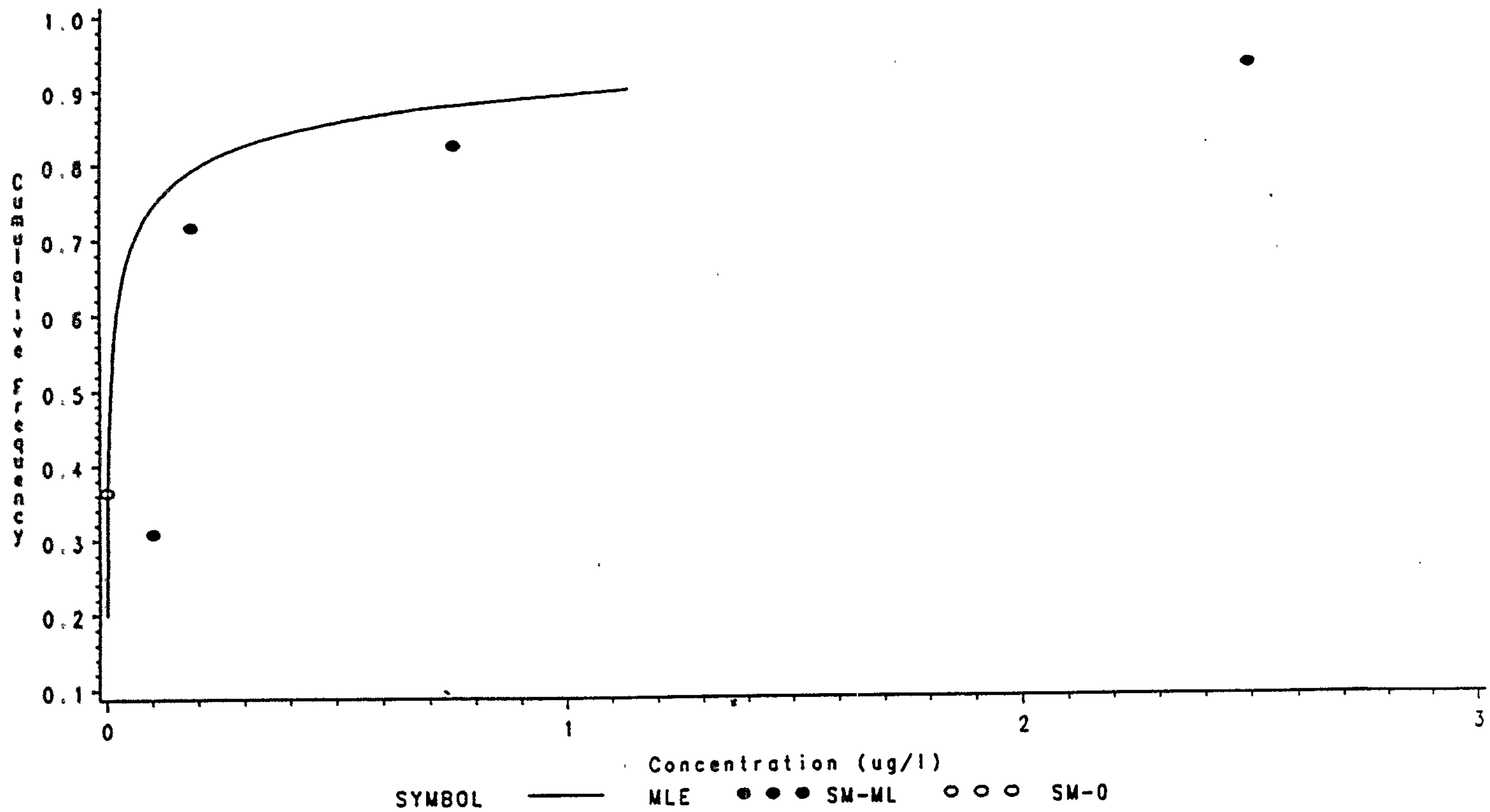
-------------------- Pollutant=ZINC -- Sample Size=9 -- Units=MG/KG --------------------

Substitution Method	Mean	Standard Deviation of the Mean	Standard Deviation	Coefficient of Variation	Minimum	Median	Maximum
SM-ML	570.000	146.000	439.000	77.1	43.70000	433.0000	1290.00
SM-0	570.000	146.000	439.000	77.1	43.70000	433.0000	1290.00

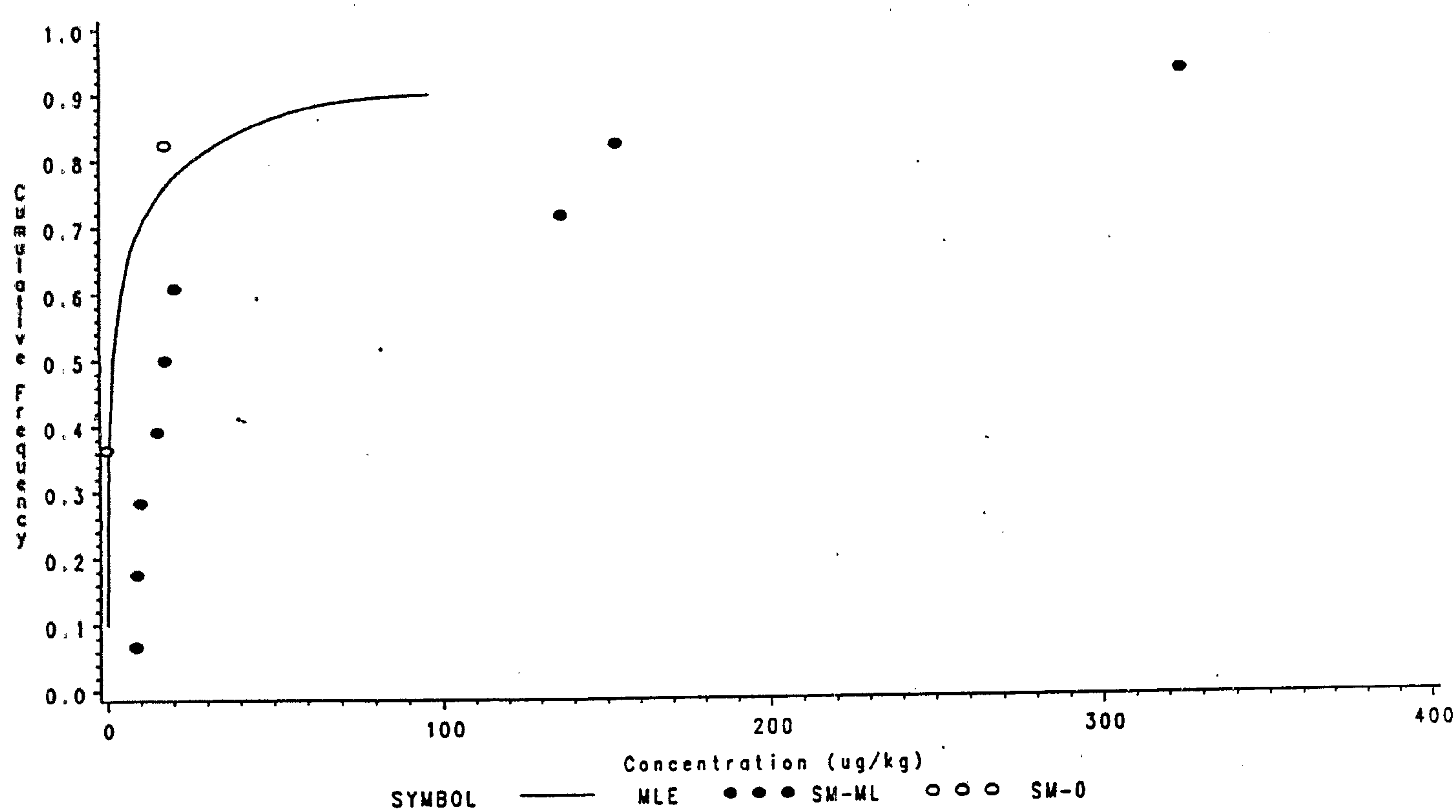
Appendix B

Graphics

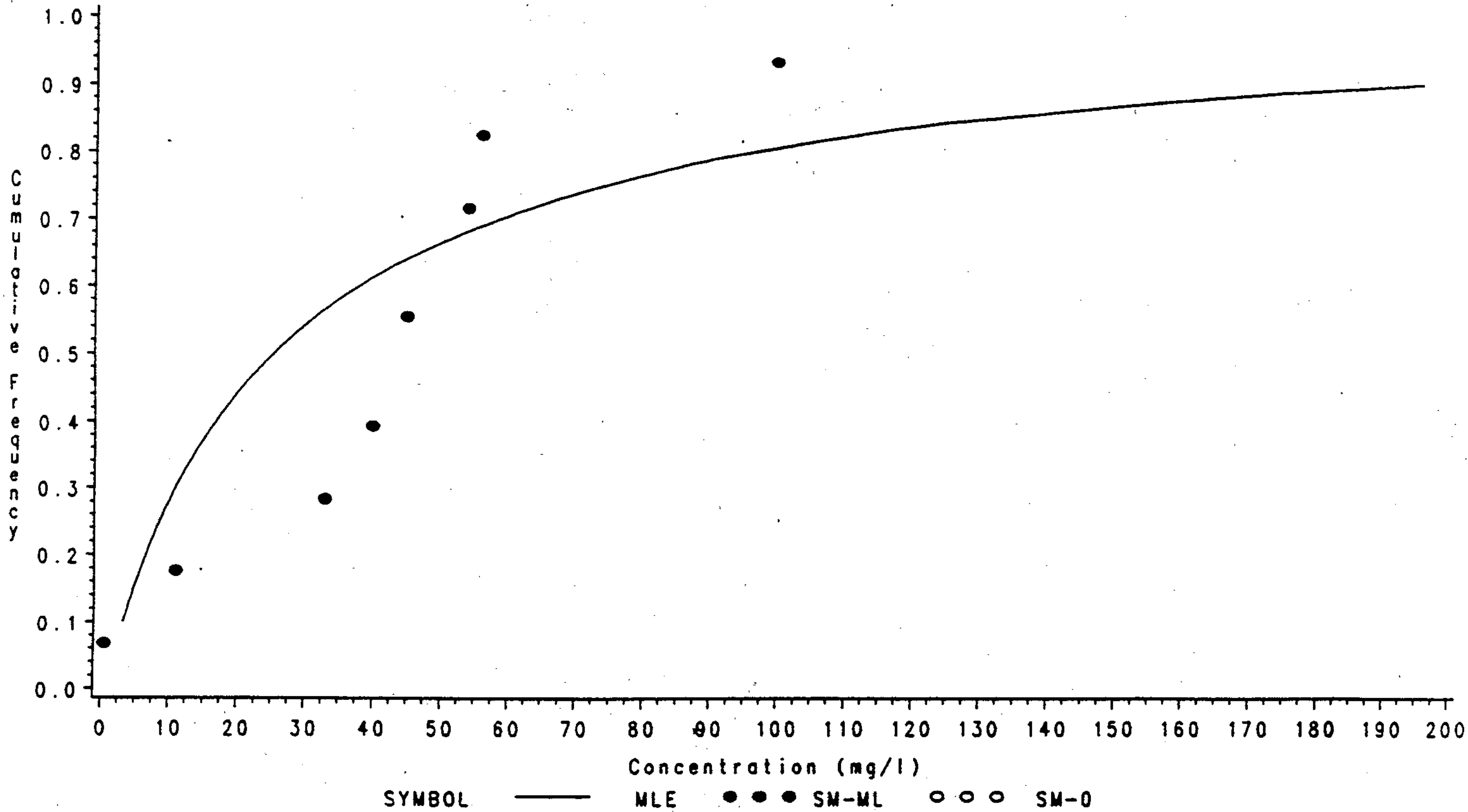
Cumulative Frequency for Total Aldrin/Dieldrin (ug/l)



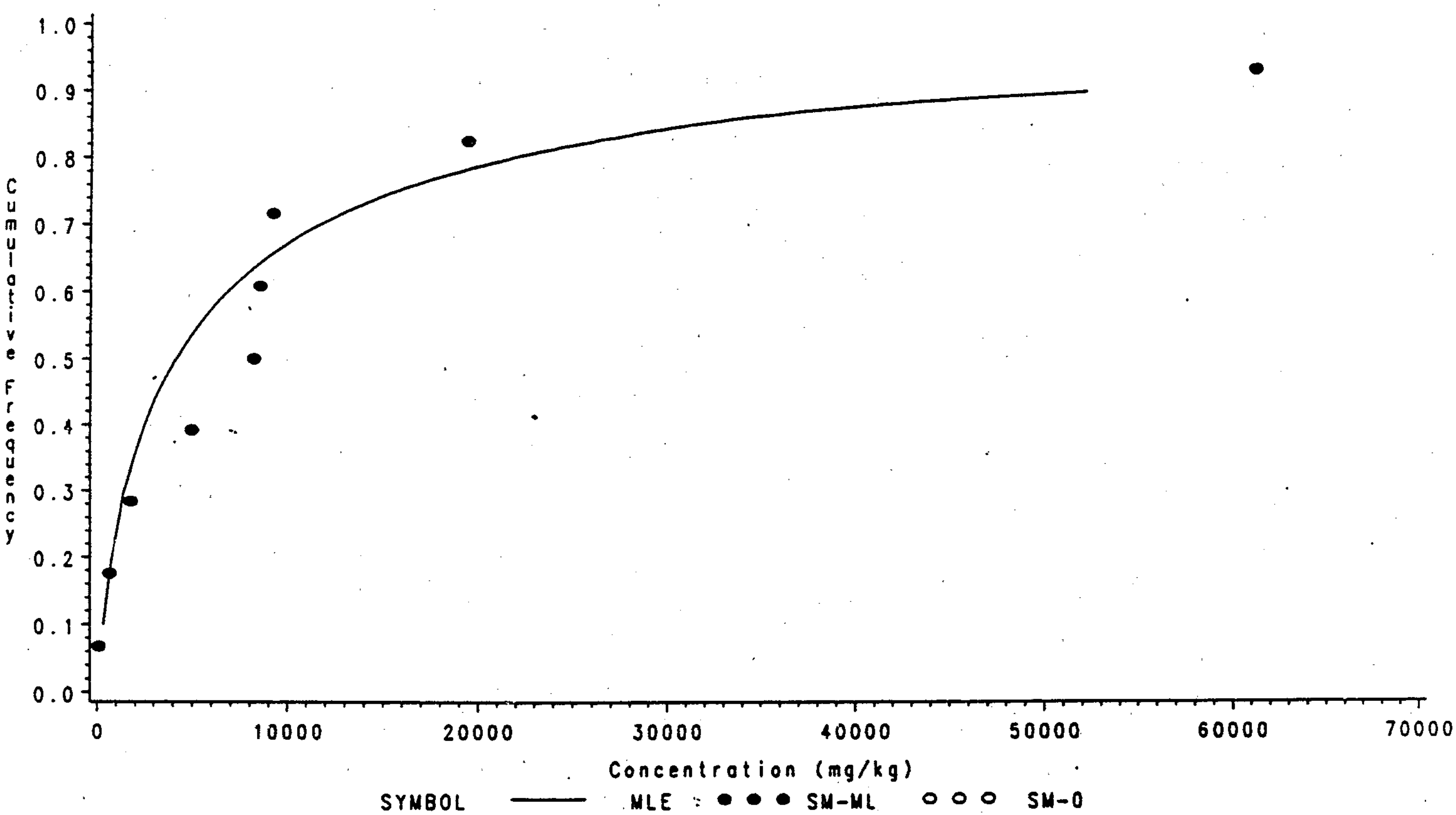
Cumulative Frequency for Total Aldrin/Dieldrin (ug/kg)



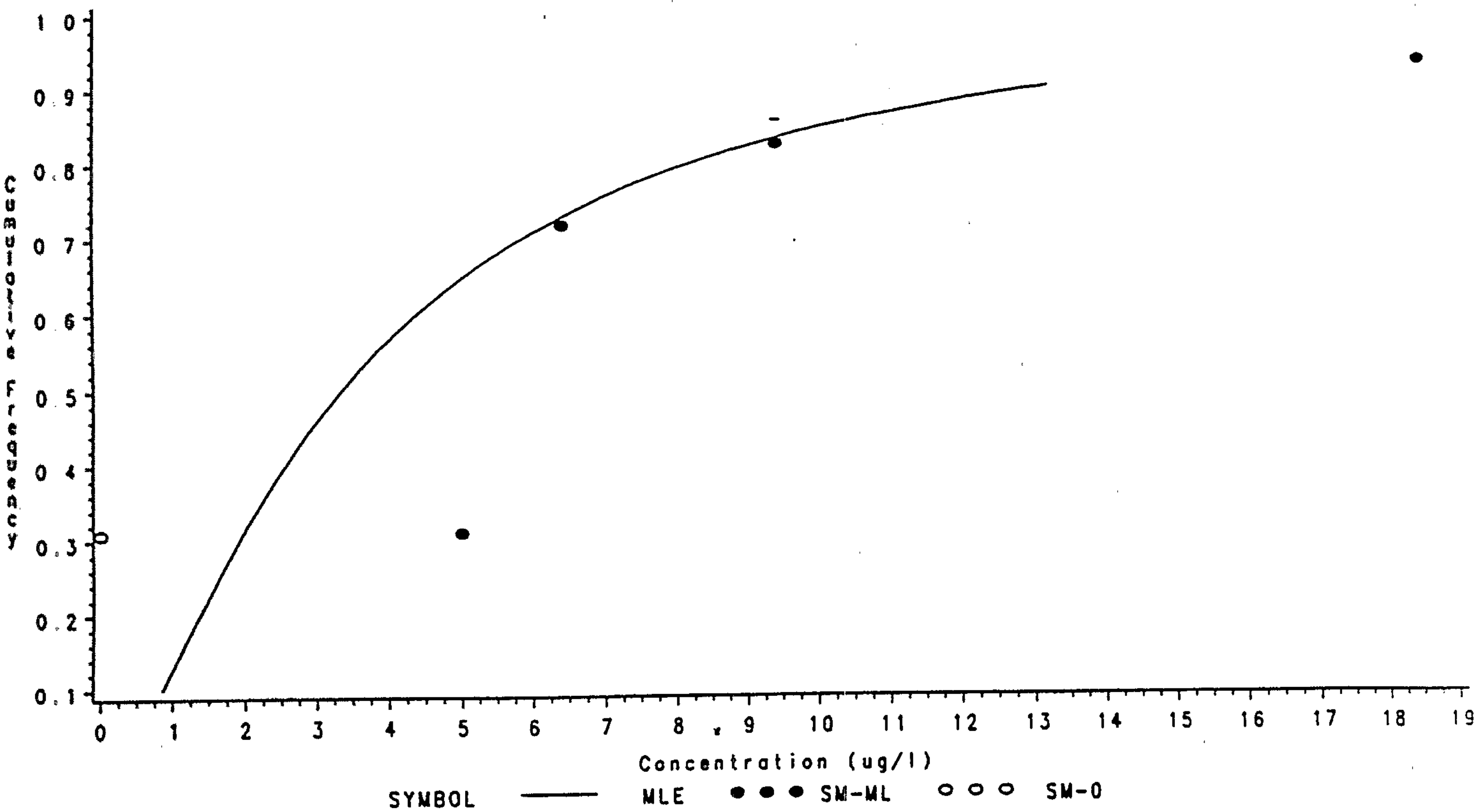
Cumulative Frequency for Ammonia (AS N) (mg/l)



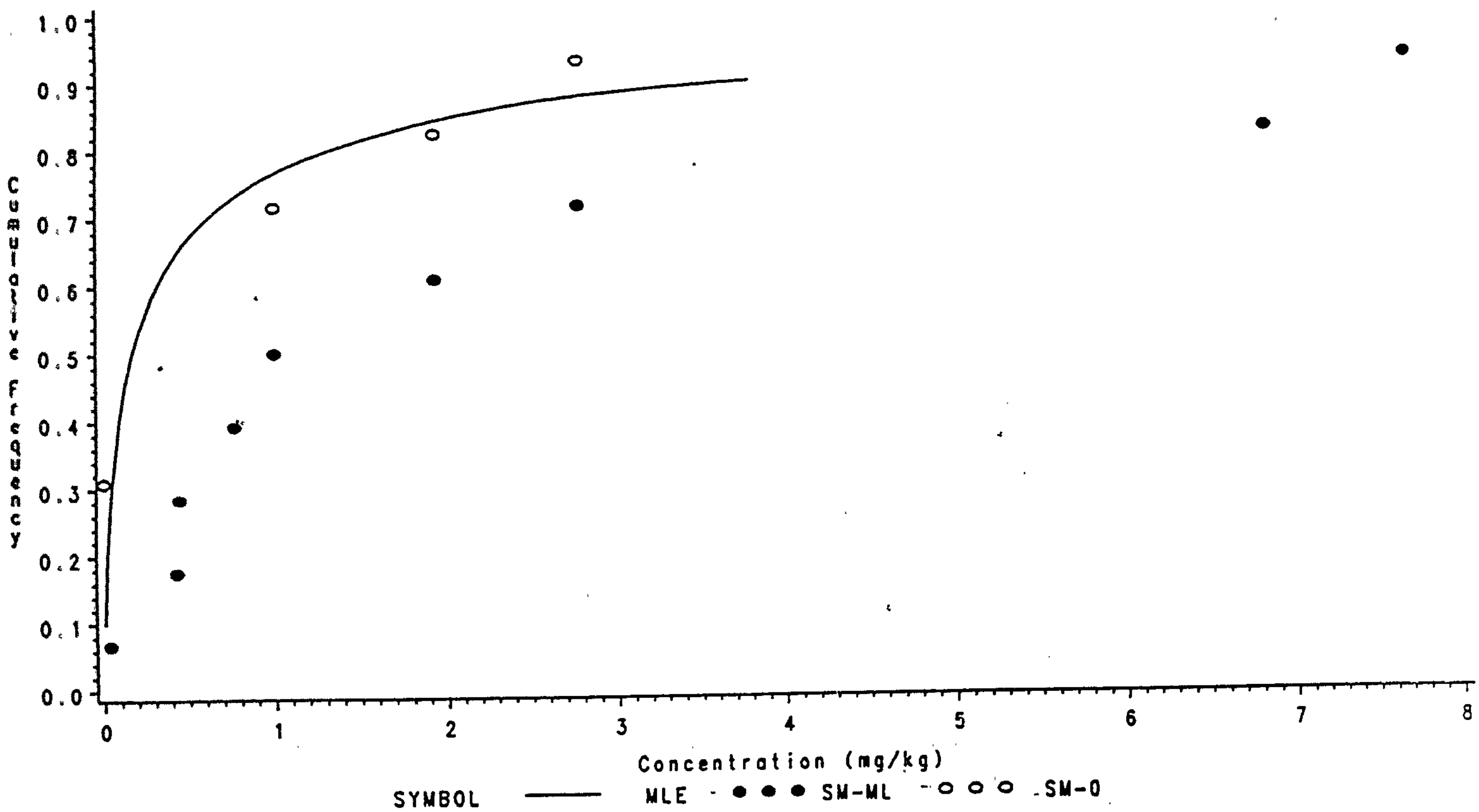
Cumulative Frequency for Ammonia (AS N) (mg/kg)



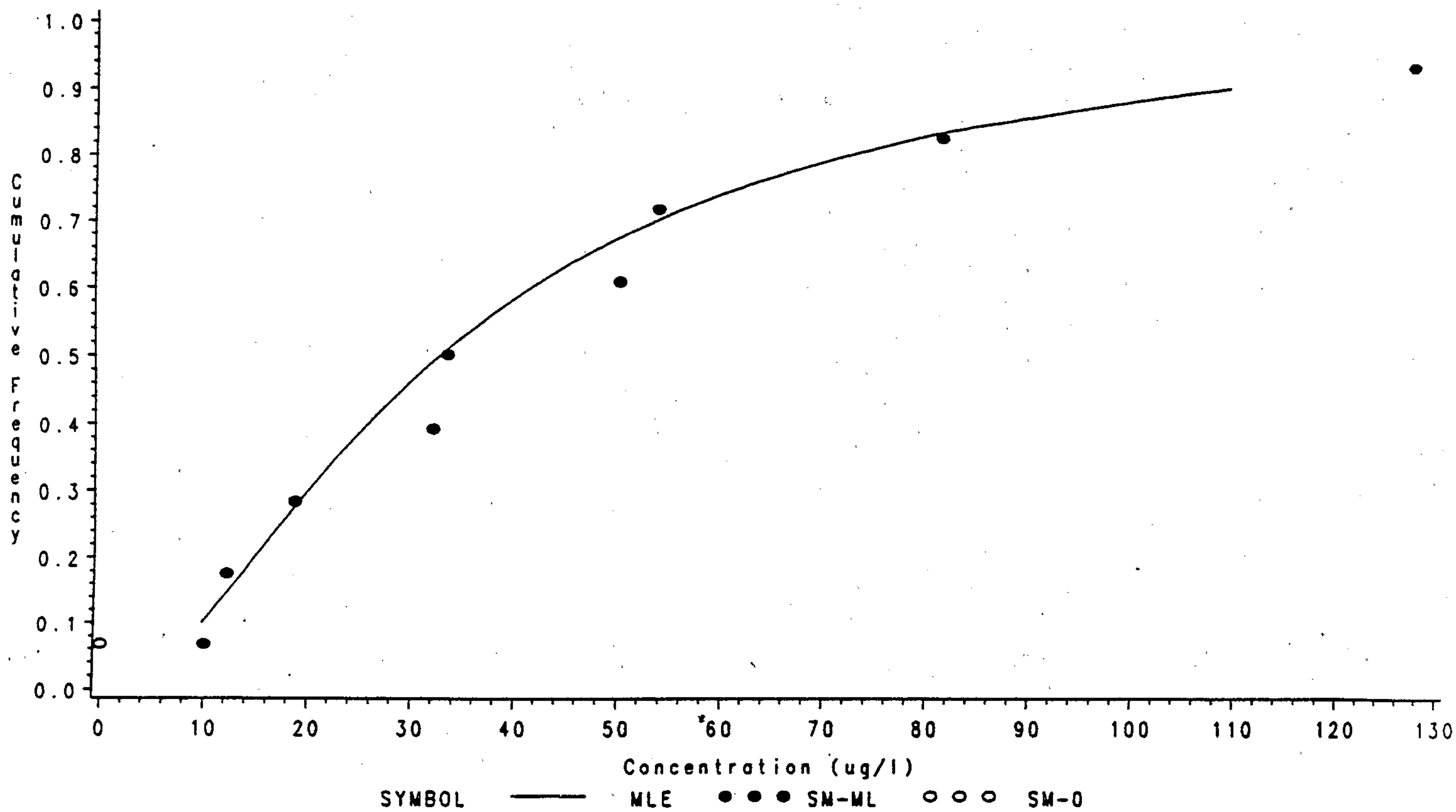
Cumulative Frequency for Cadmium (ug/l)



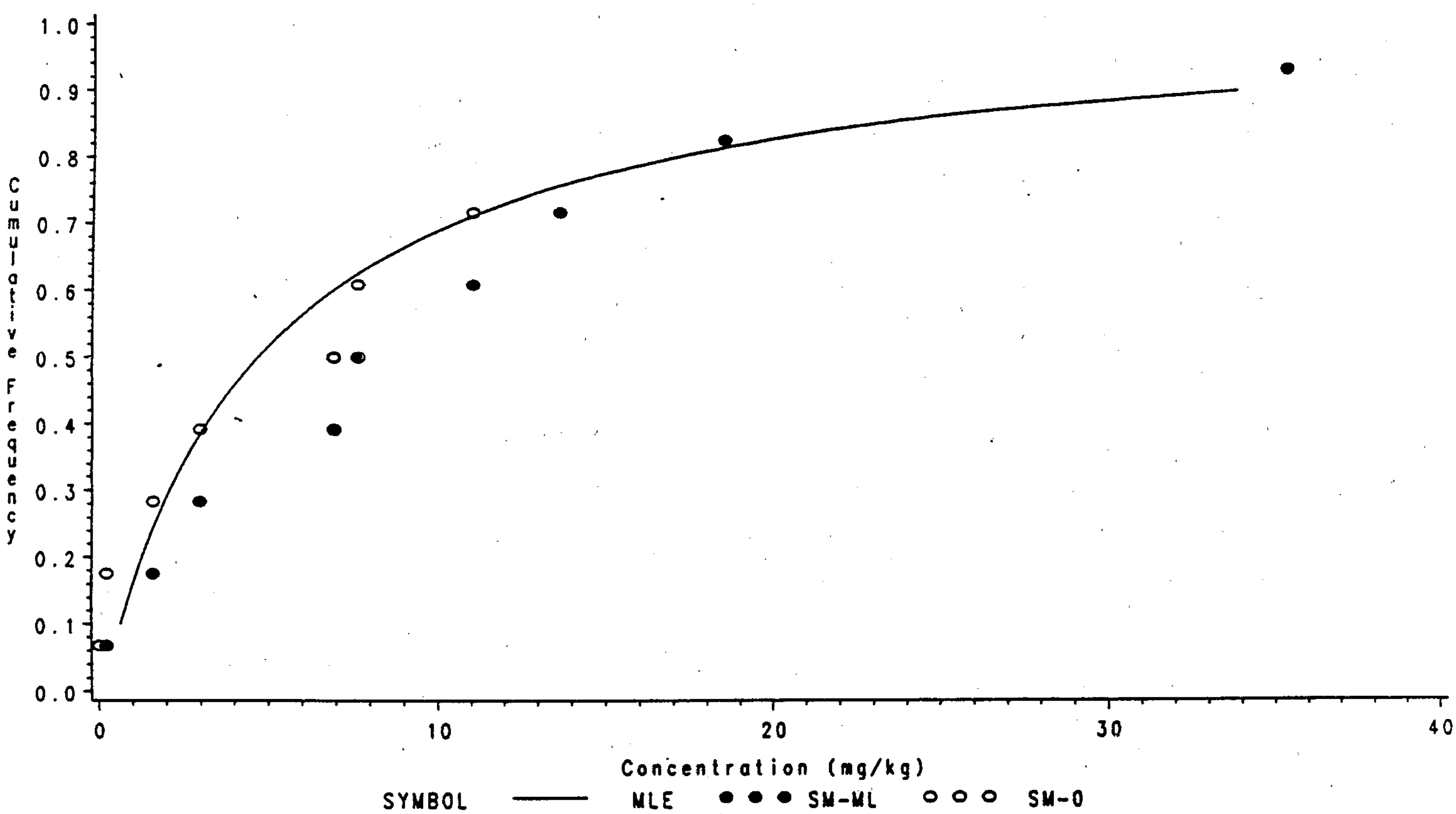
Cumulative Frequency for Cadmium (mg/kg)



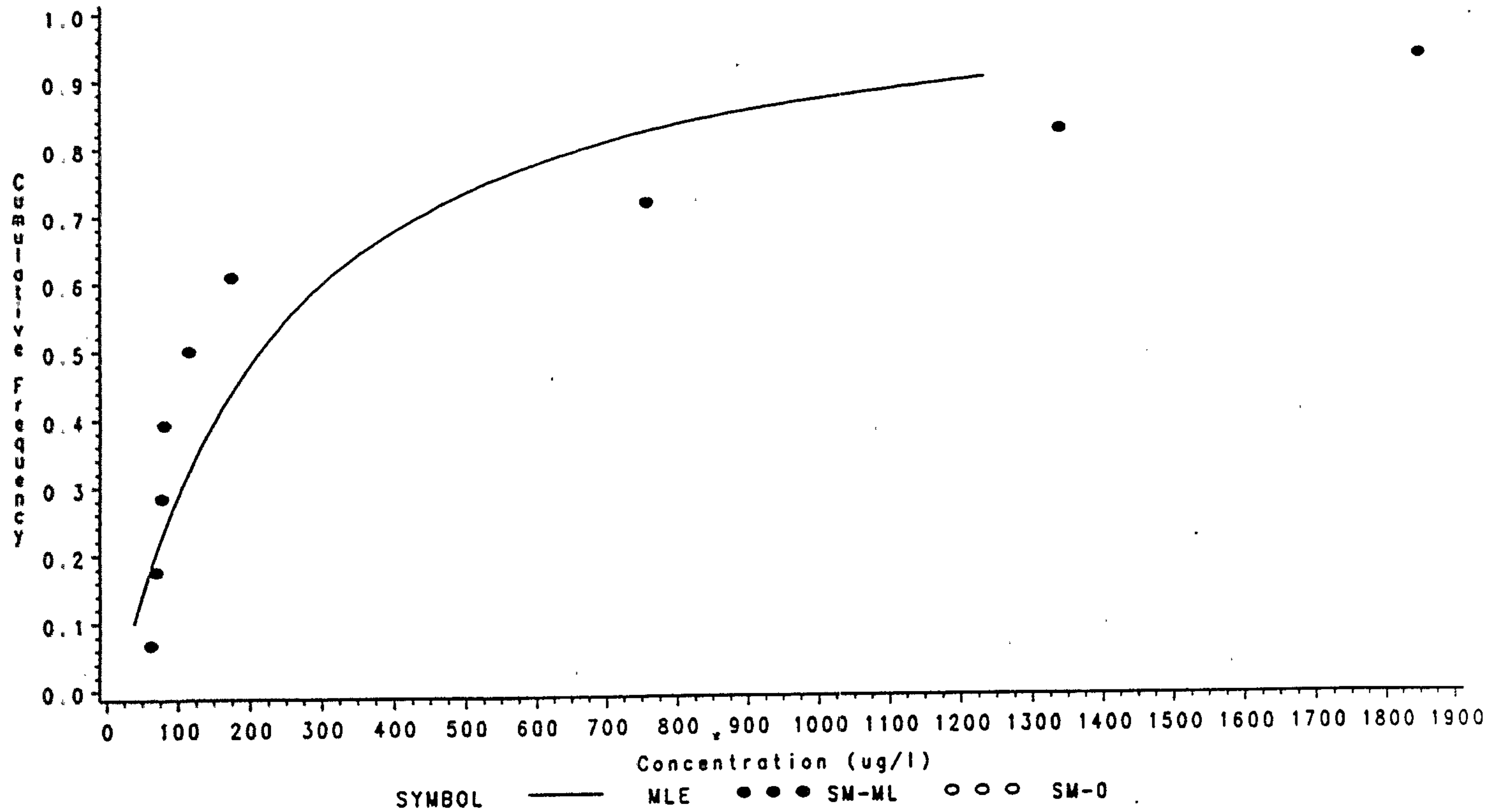
Cumulative Frequency for Chromium (ug/l)



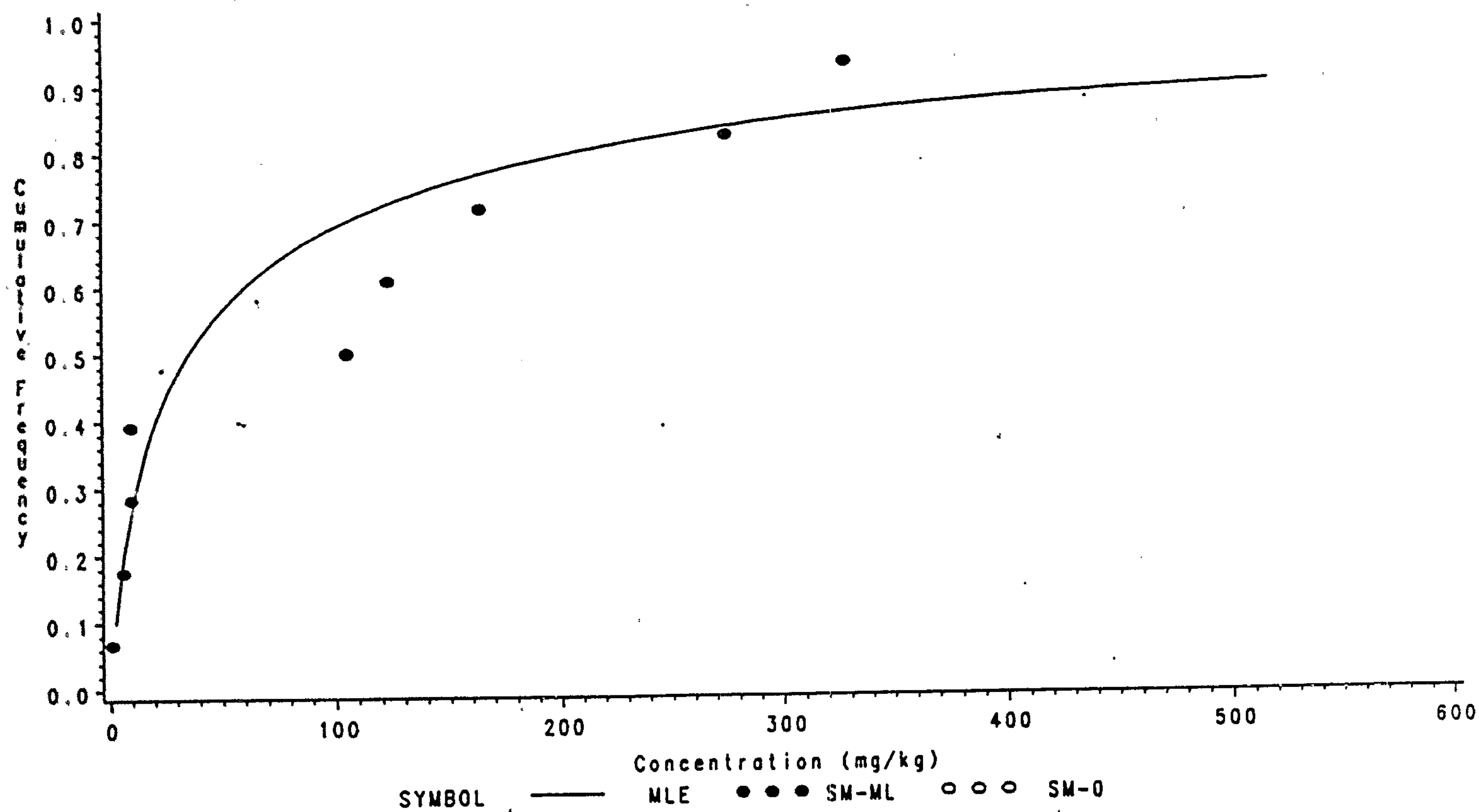
Cumulative Frequency for Chromium (mg/kg)



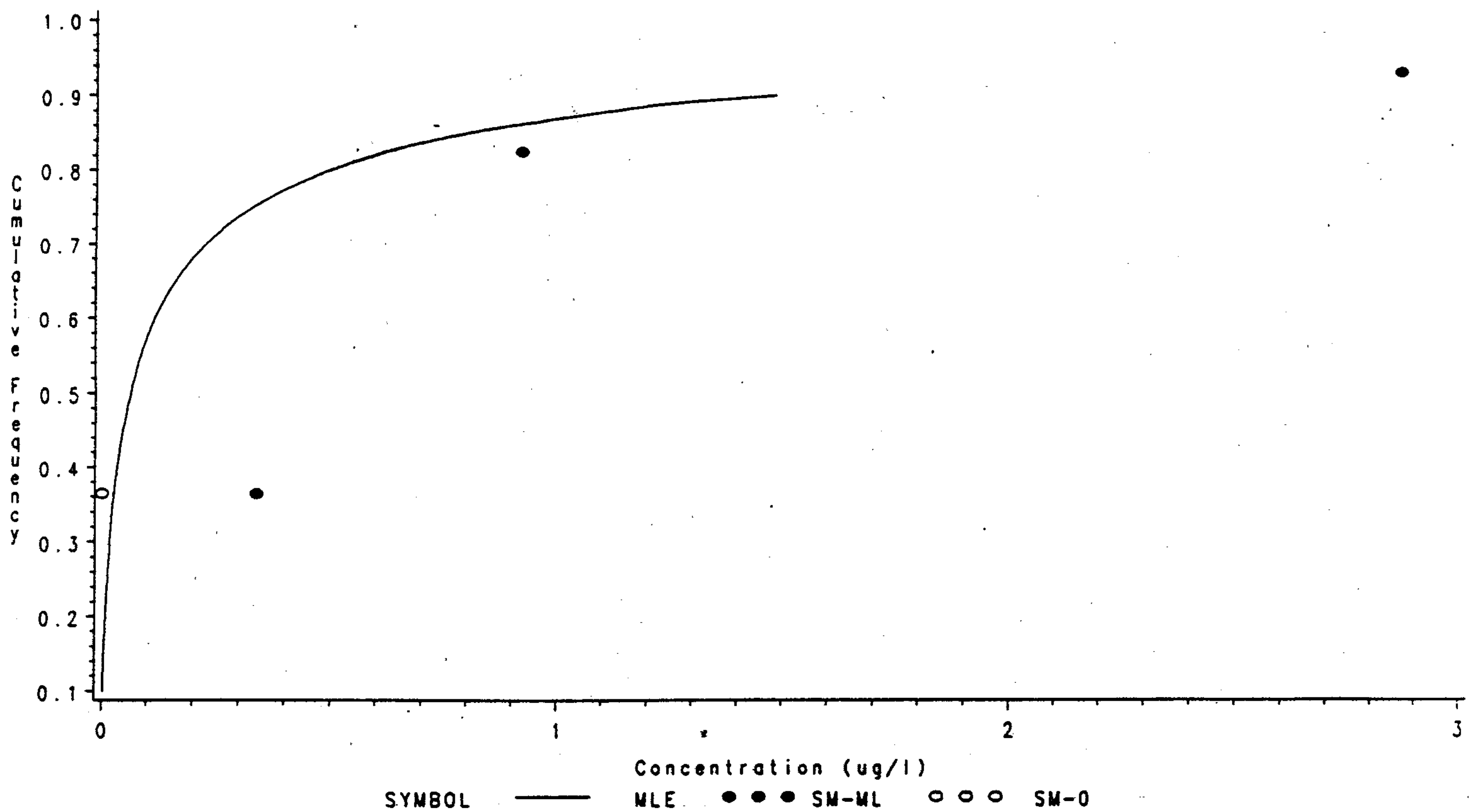
Cumulative Frequency for Copper (ug/l)



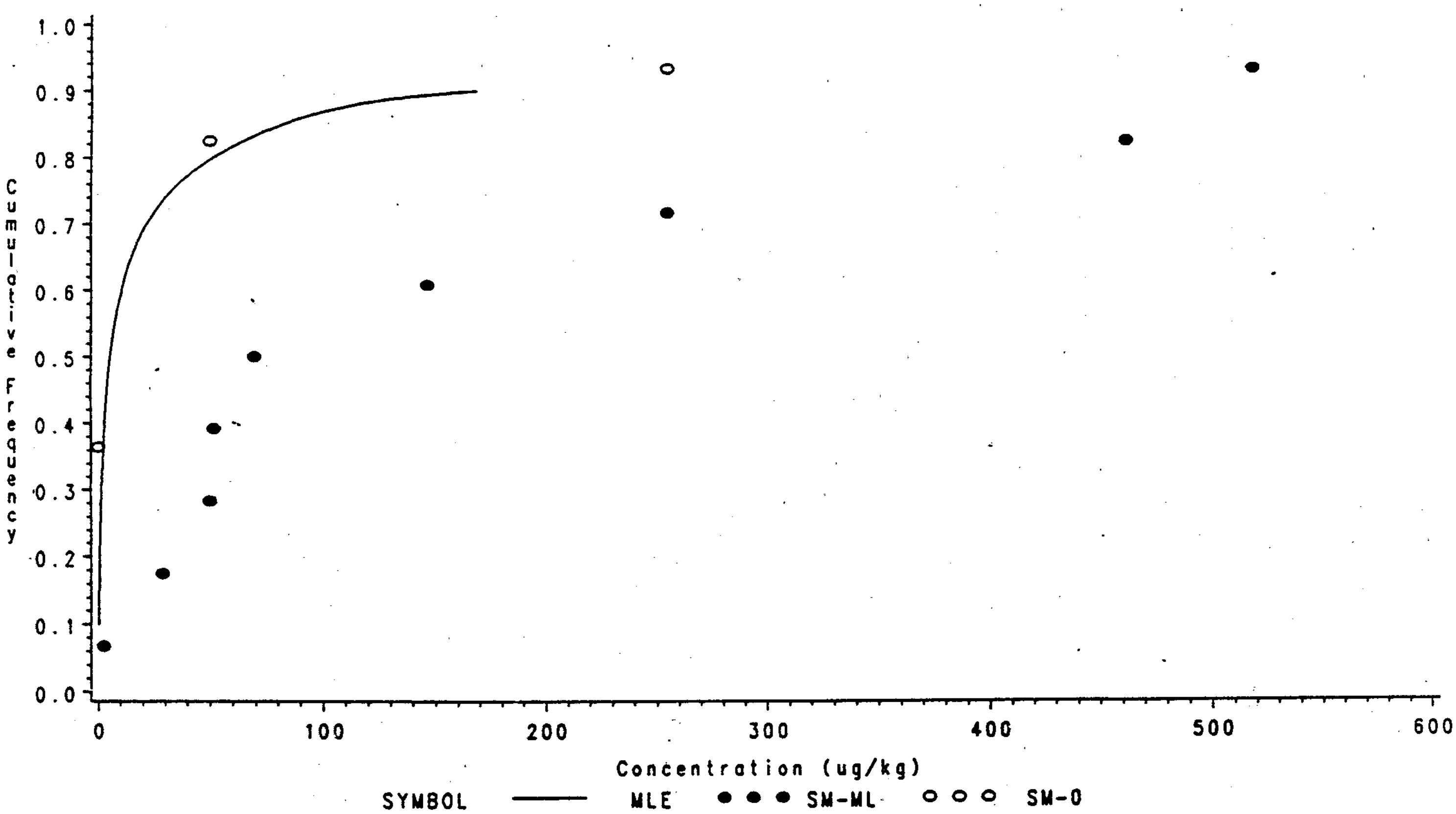
Cumulative Frequency for Copper (mg/kg)



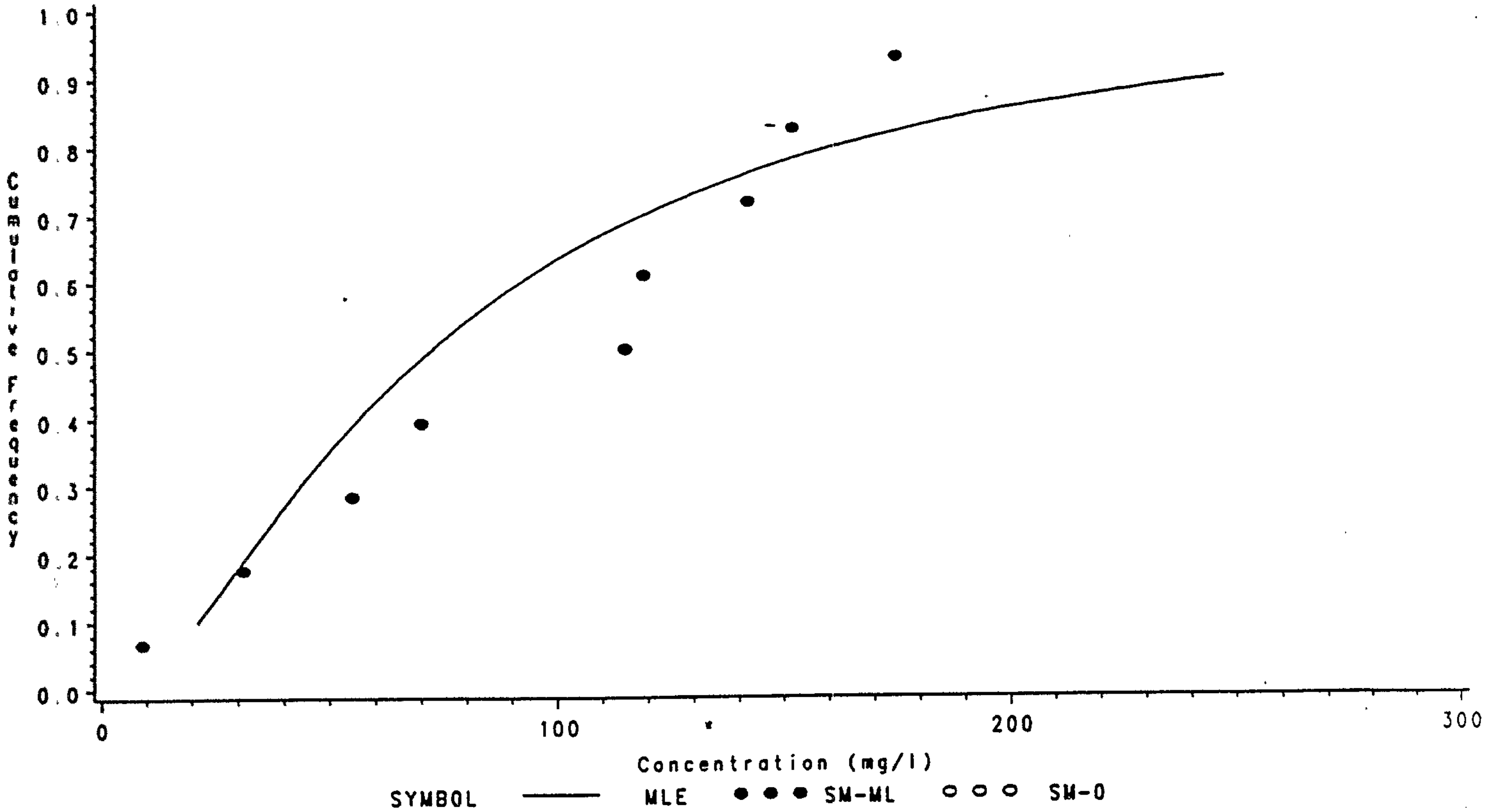
Cumulative Frequency for Total DDT, DDE, and DDD (ug/l)



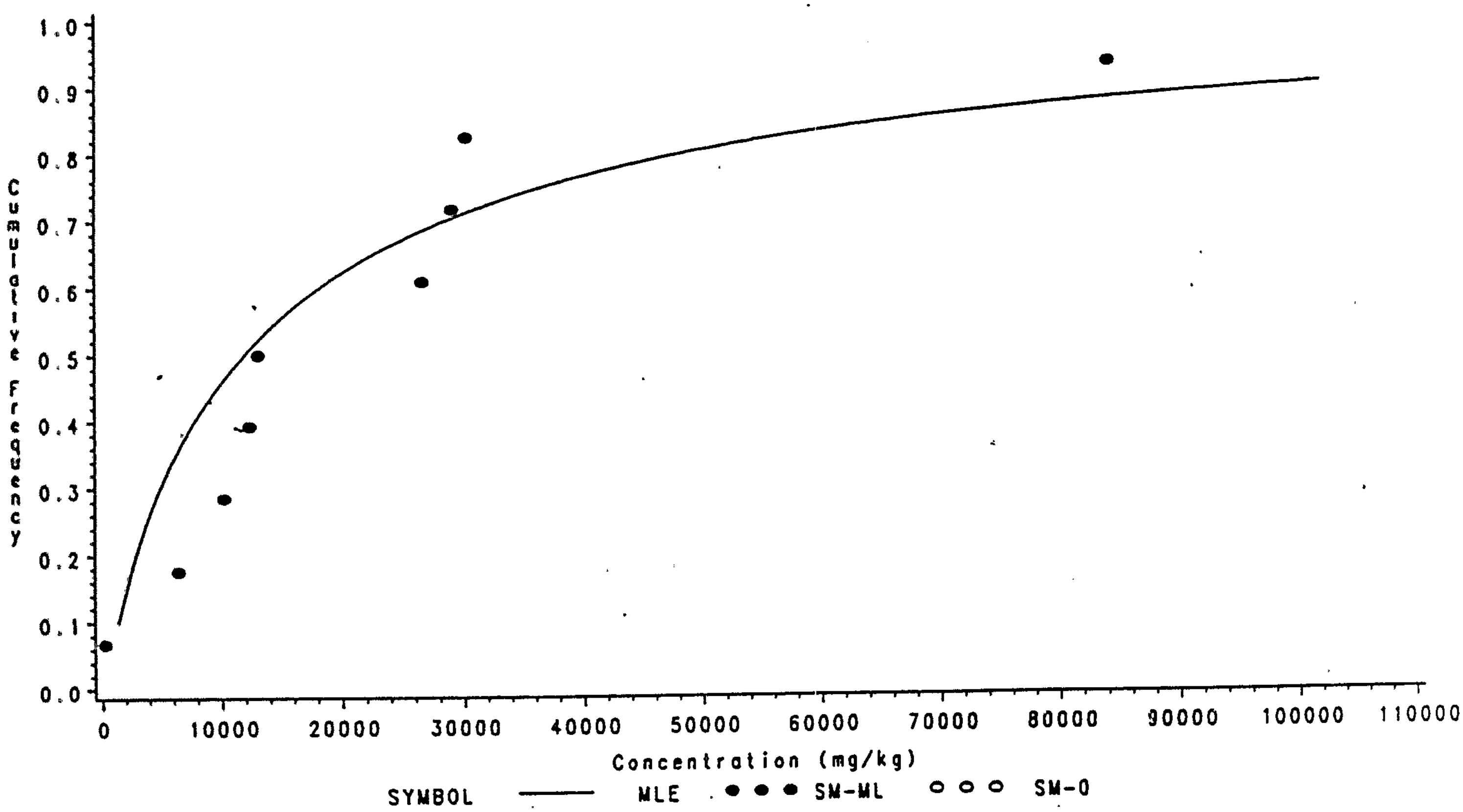
Cumulative Frequency for Total DDT, DDE, and DDD (ug/kg)

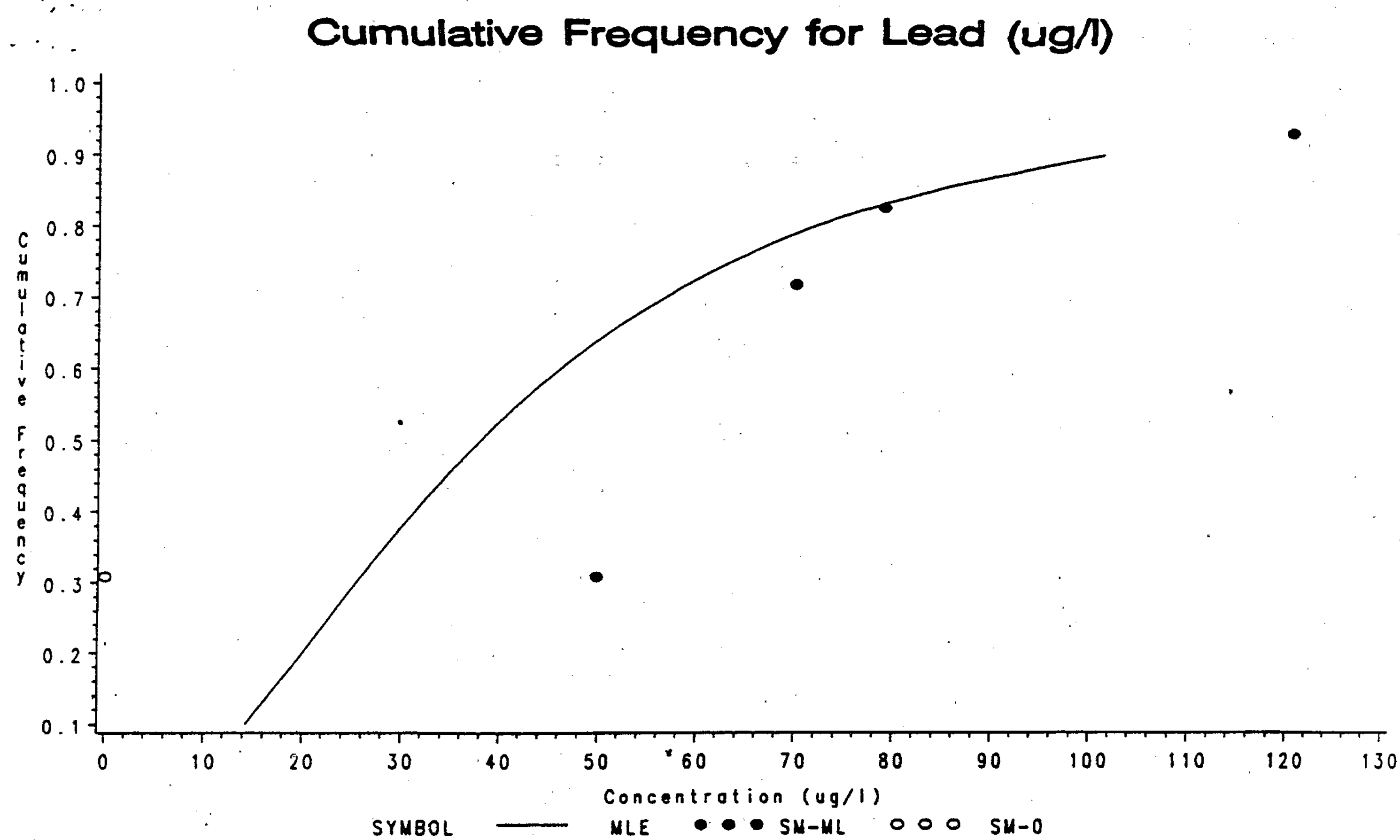


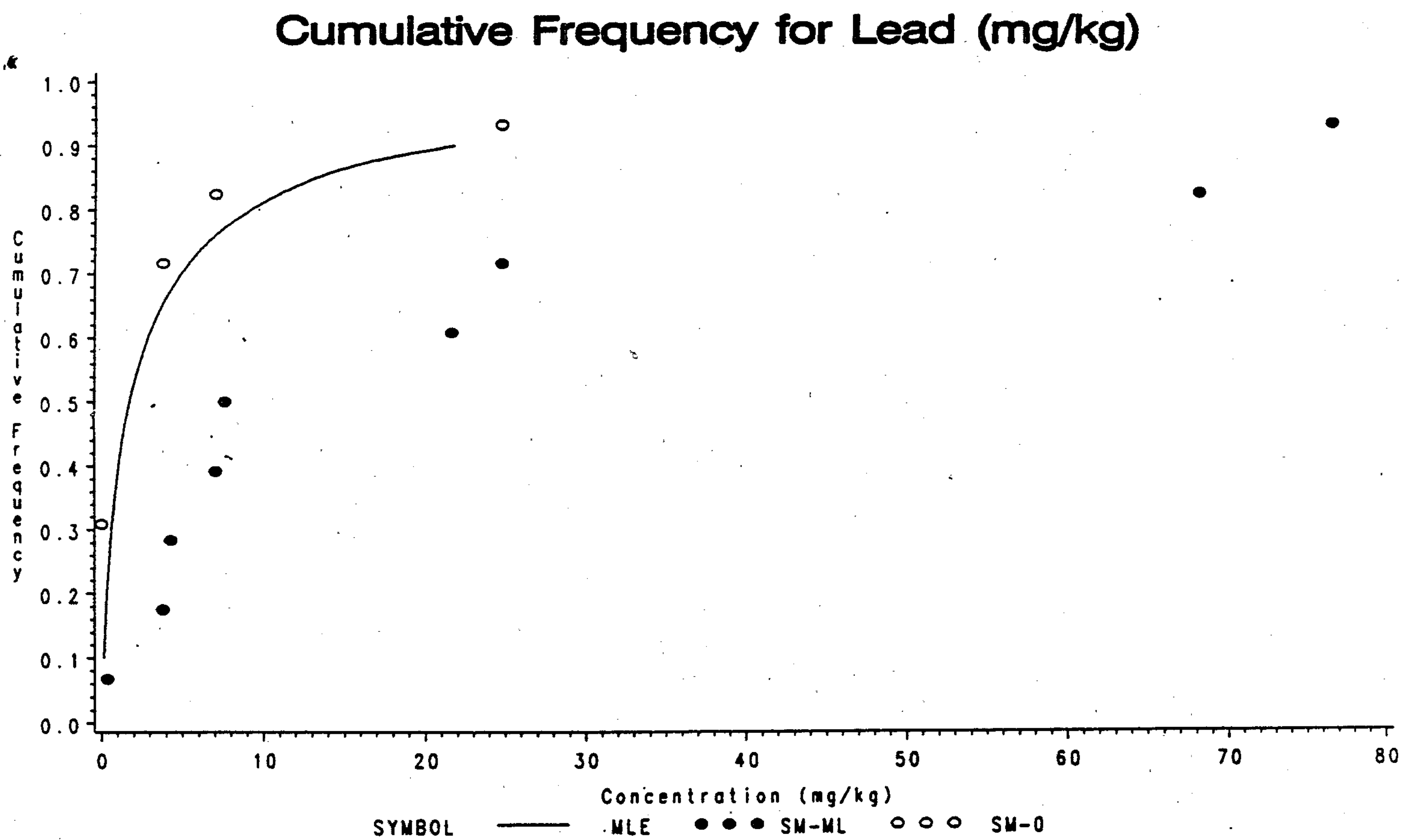
Cumulative Frequency for Total Kjeldahl Nitrogen (mg/l)



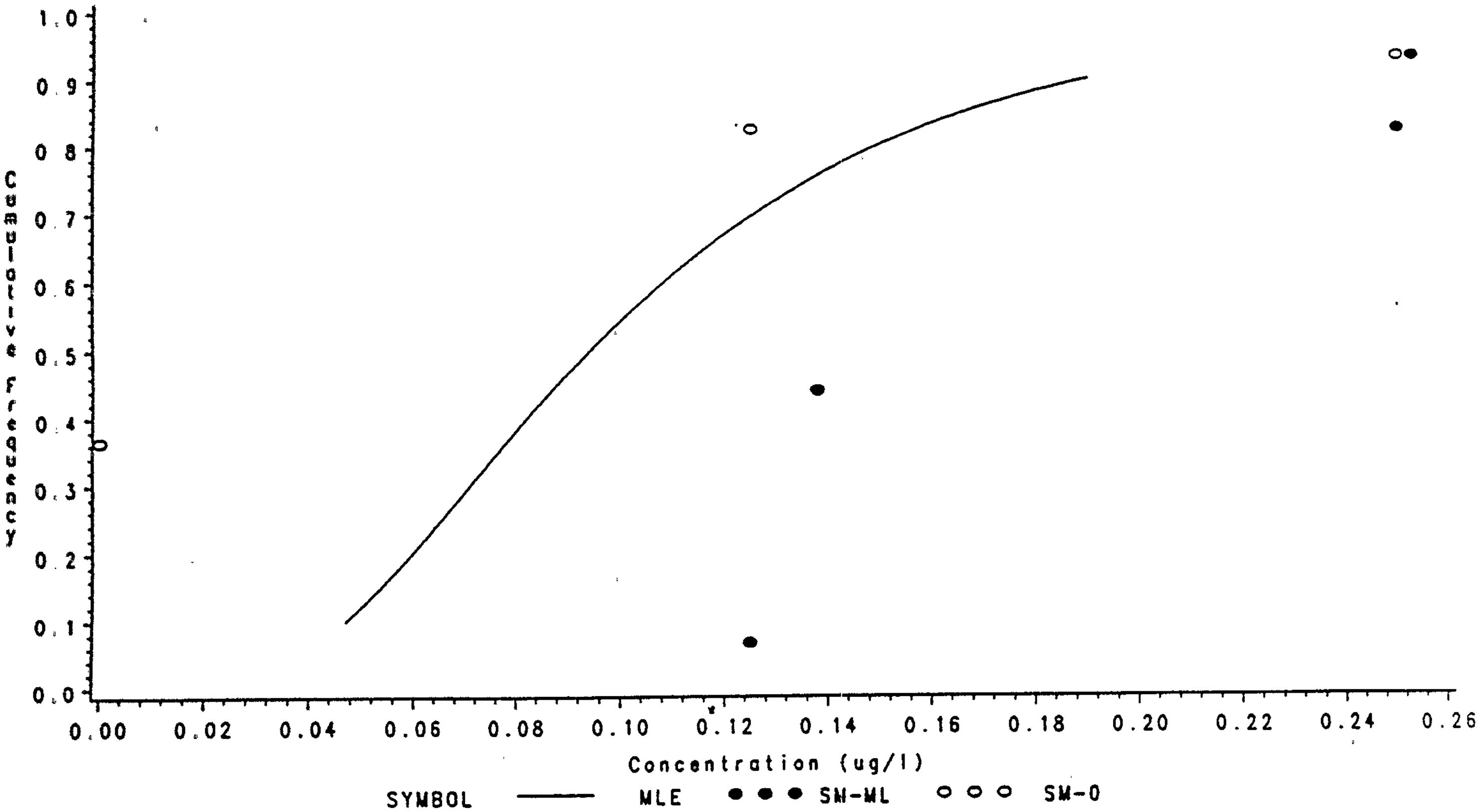
Cumulative Frequency for Total Kjeldahl Nitrogen (mg/kg)



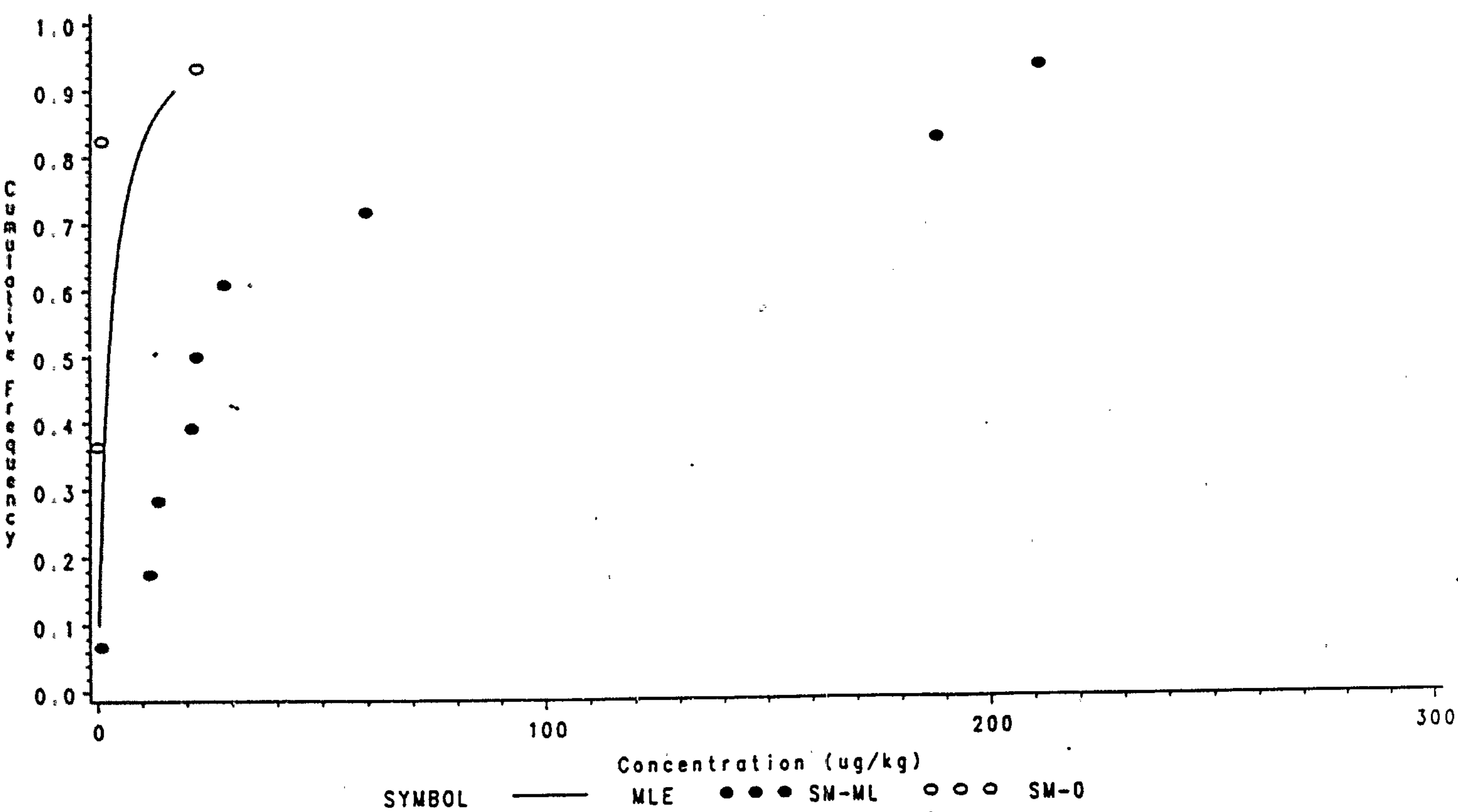

Cumulative Frequency for Lead (ug/l)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
10
20
30
40
50
60
70
80
90
100
110
120
130
Concentration (ug/l)
SYMBOL
MLE
SM-ML
SM-0


Cumulative Frequency for Lead (mg/kg)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
10
20
30
40
50
60
70
80
Concentration (mg/kg)
SYMBOL
MLE
SM-ML
SM-0

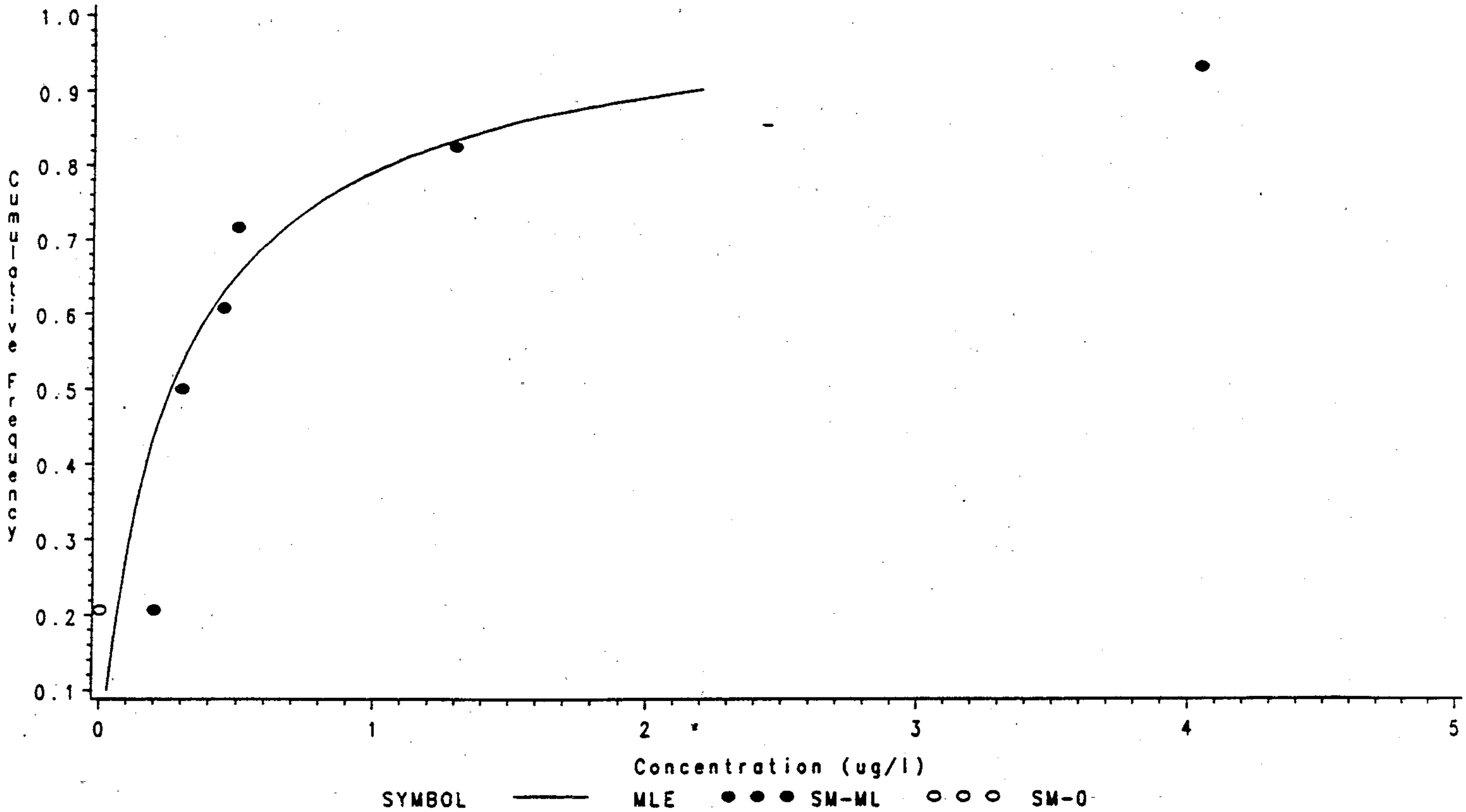
Cumulative Frequency for Lindane (Gamma-BHC) (ug/l)



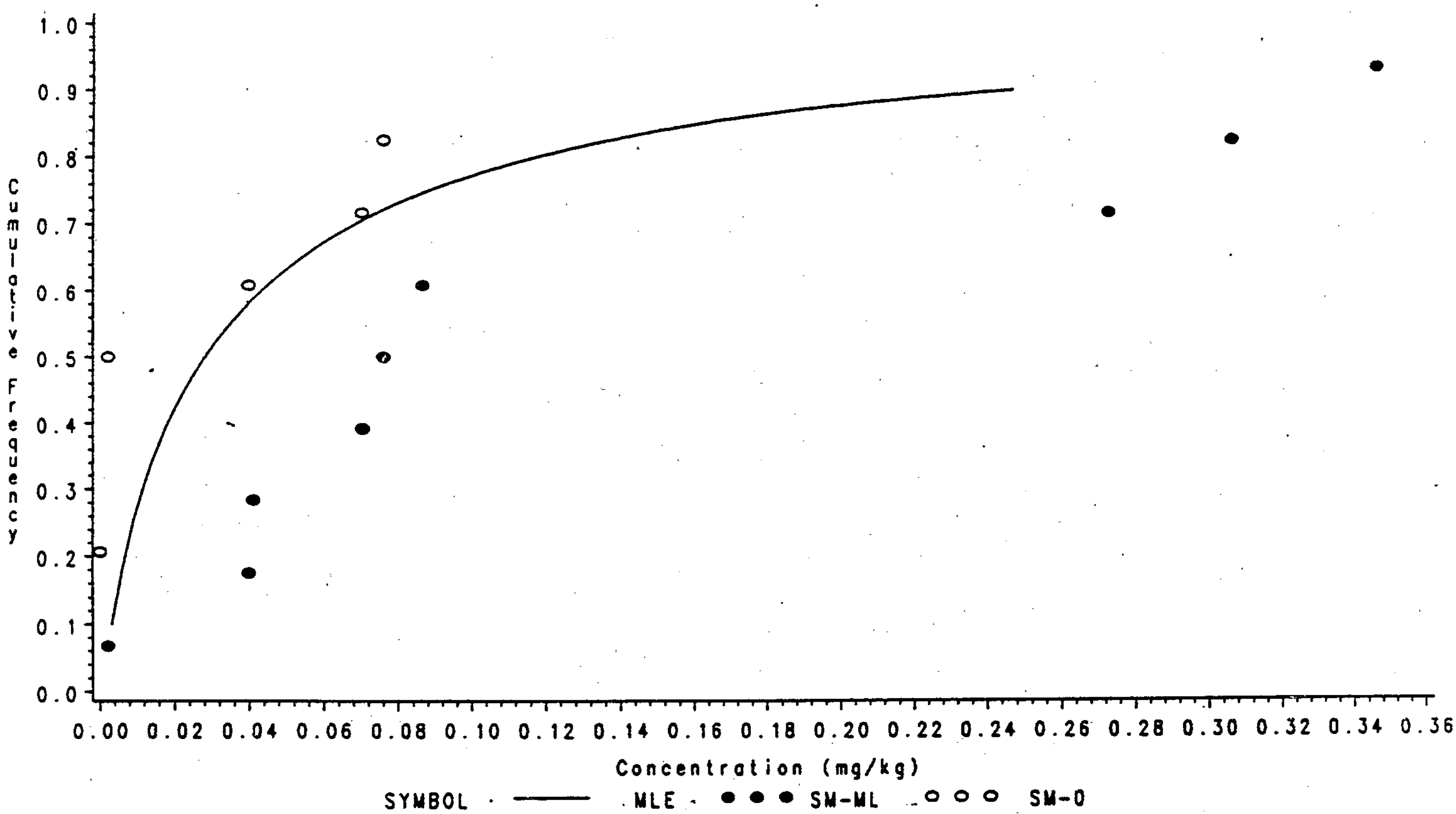
Cumulative Frequency for Lindane (Gamma-BHC) (ug/kg)



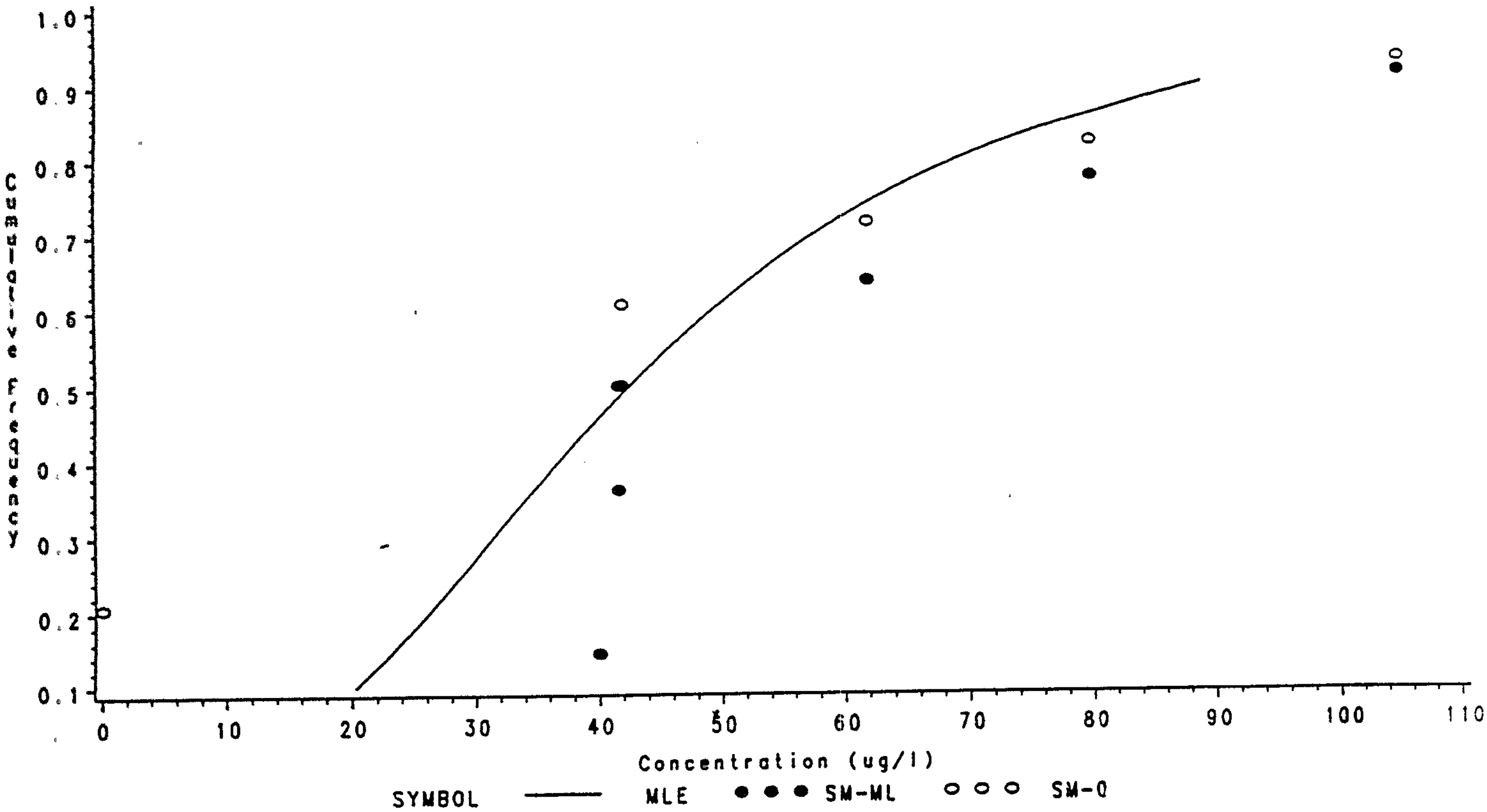
Cumulative Frequency for Mercury (ug/l)



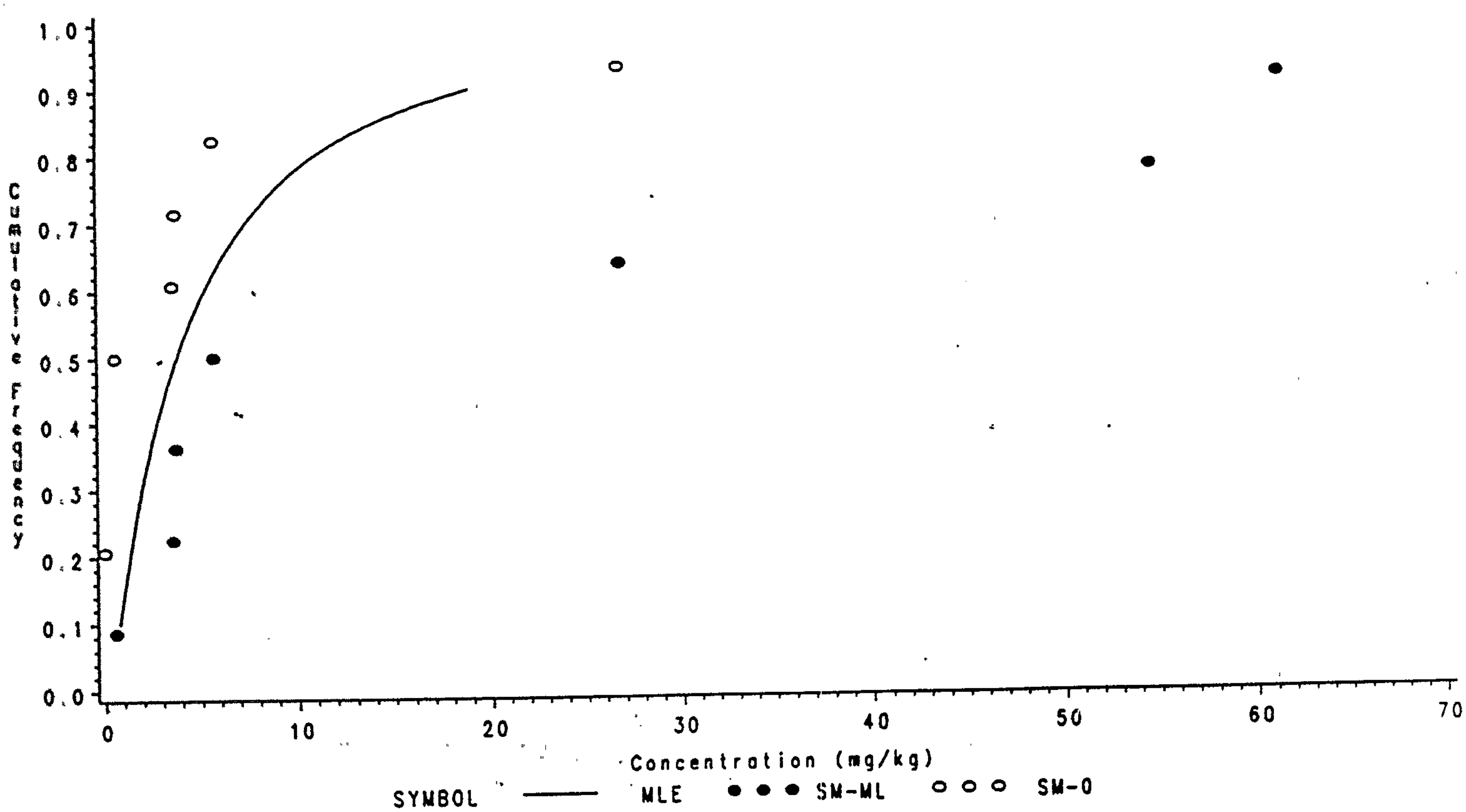
Cumulative Frequency for Mercury (mg/kg)

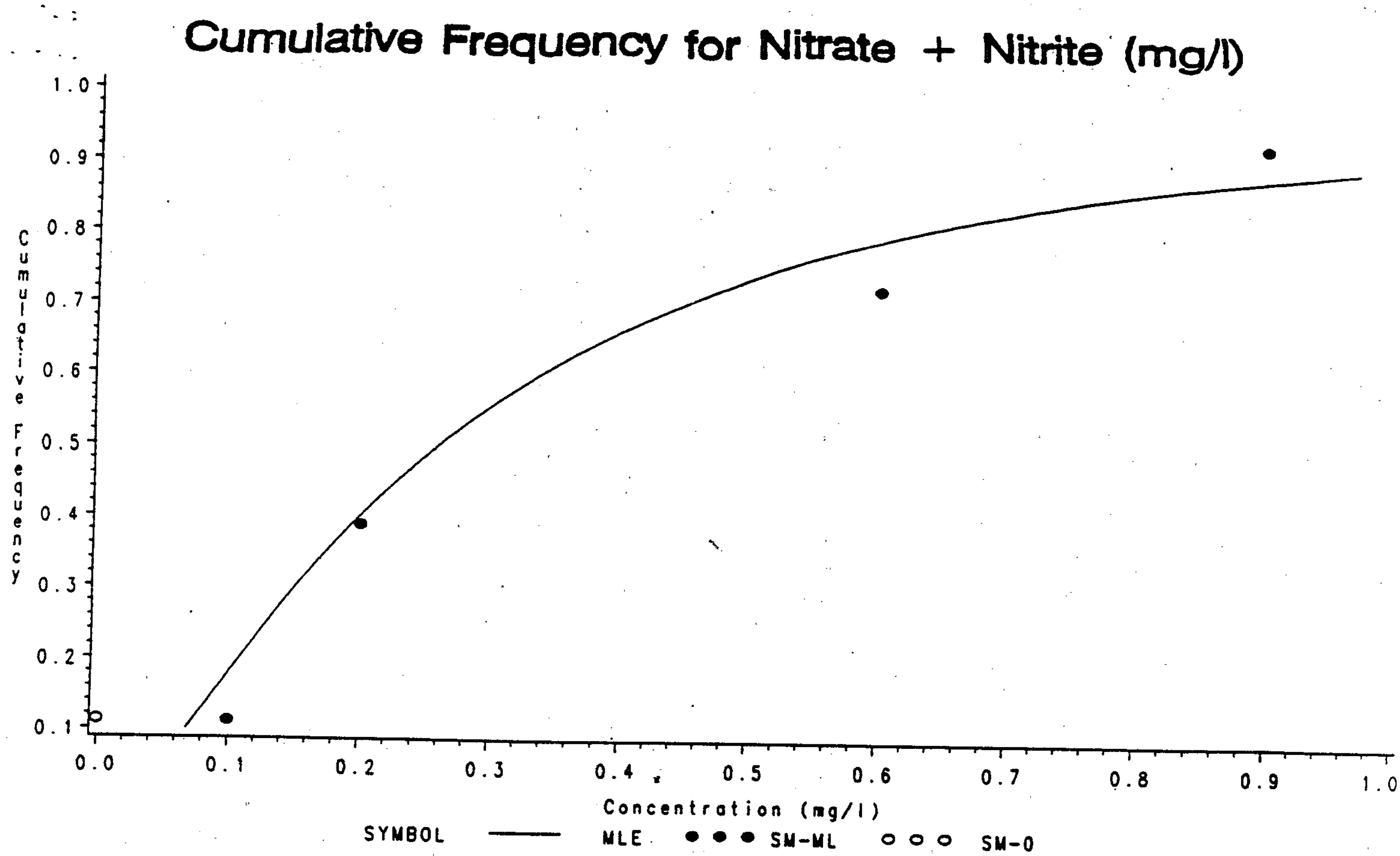


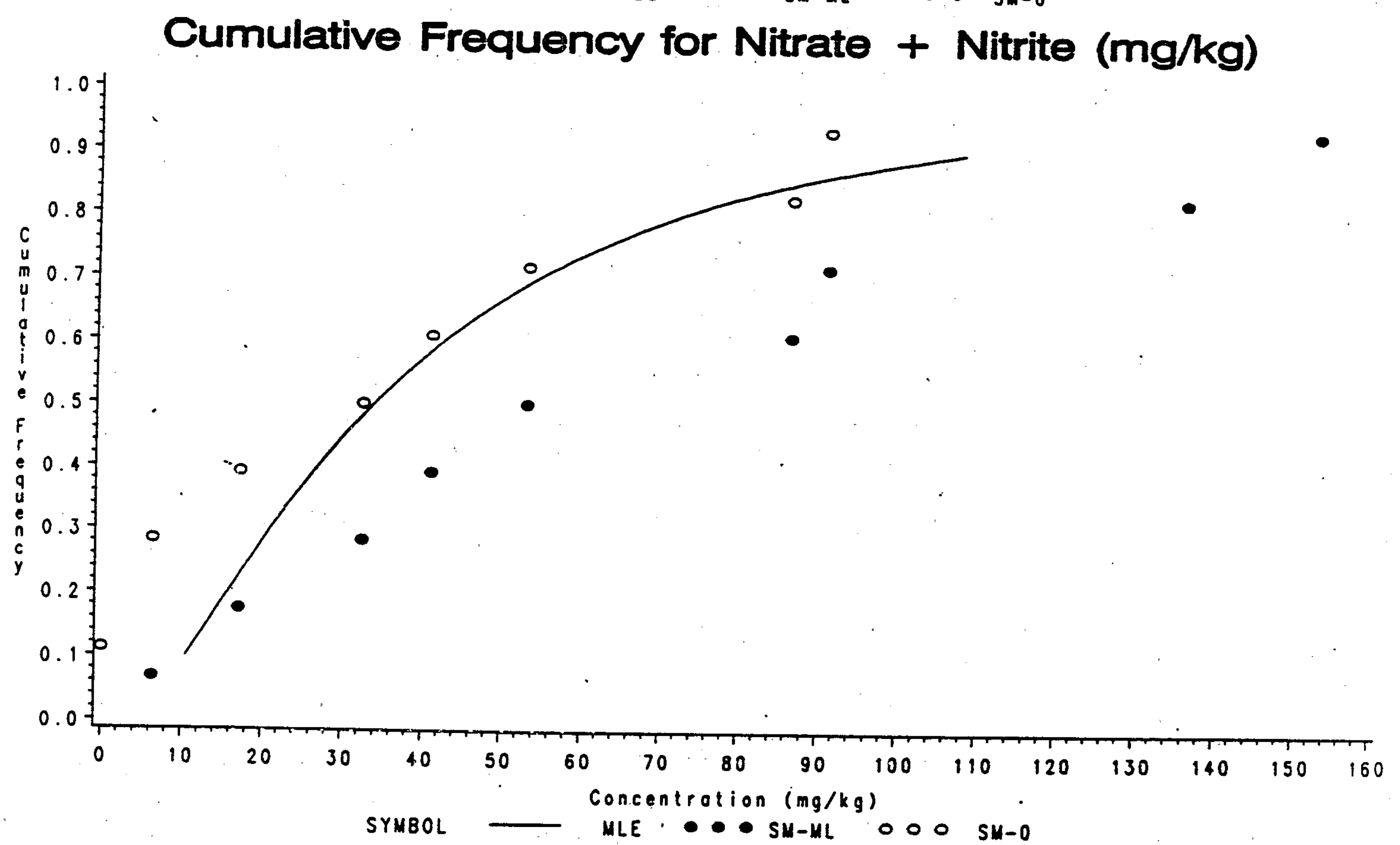
Cumulaltive Frequency for Nickel (ug/l)

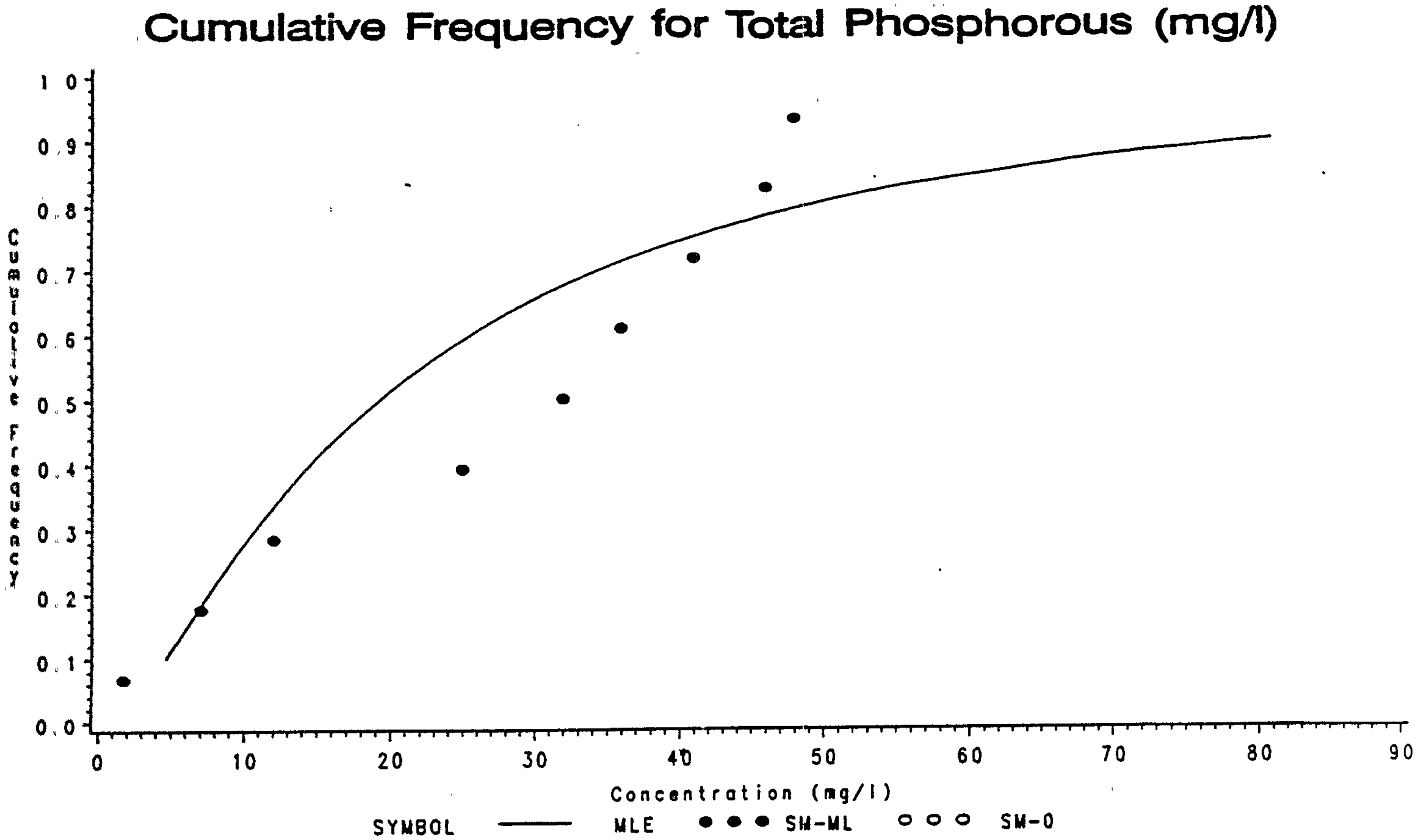


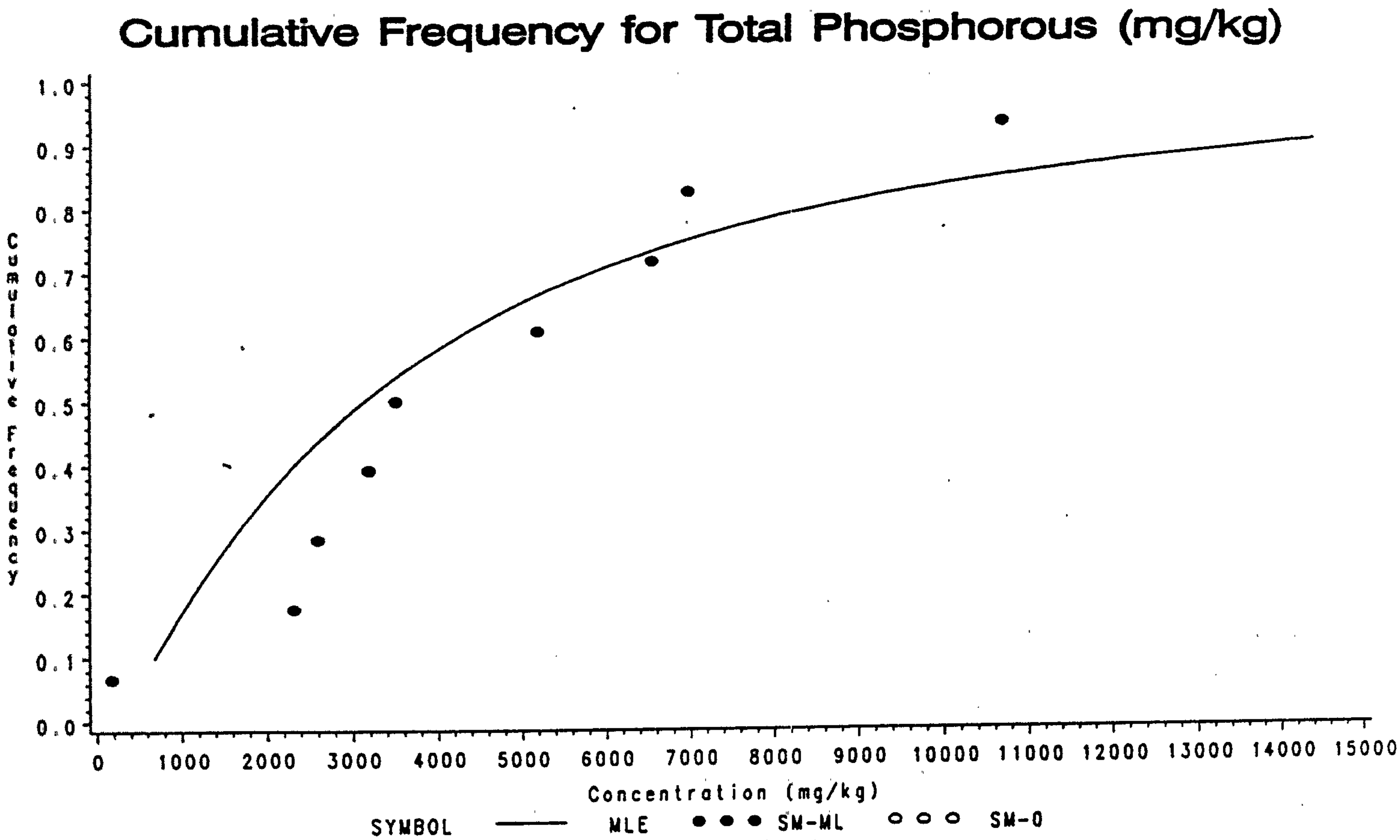
Cumulative Frequency for Nickel (mg/kg)

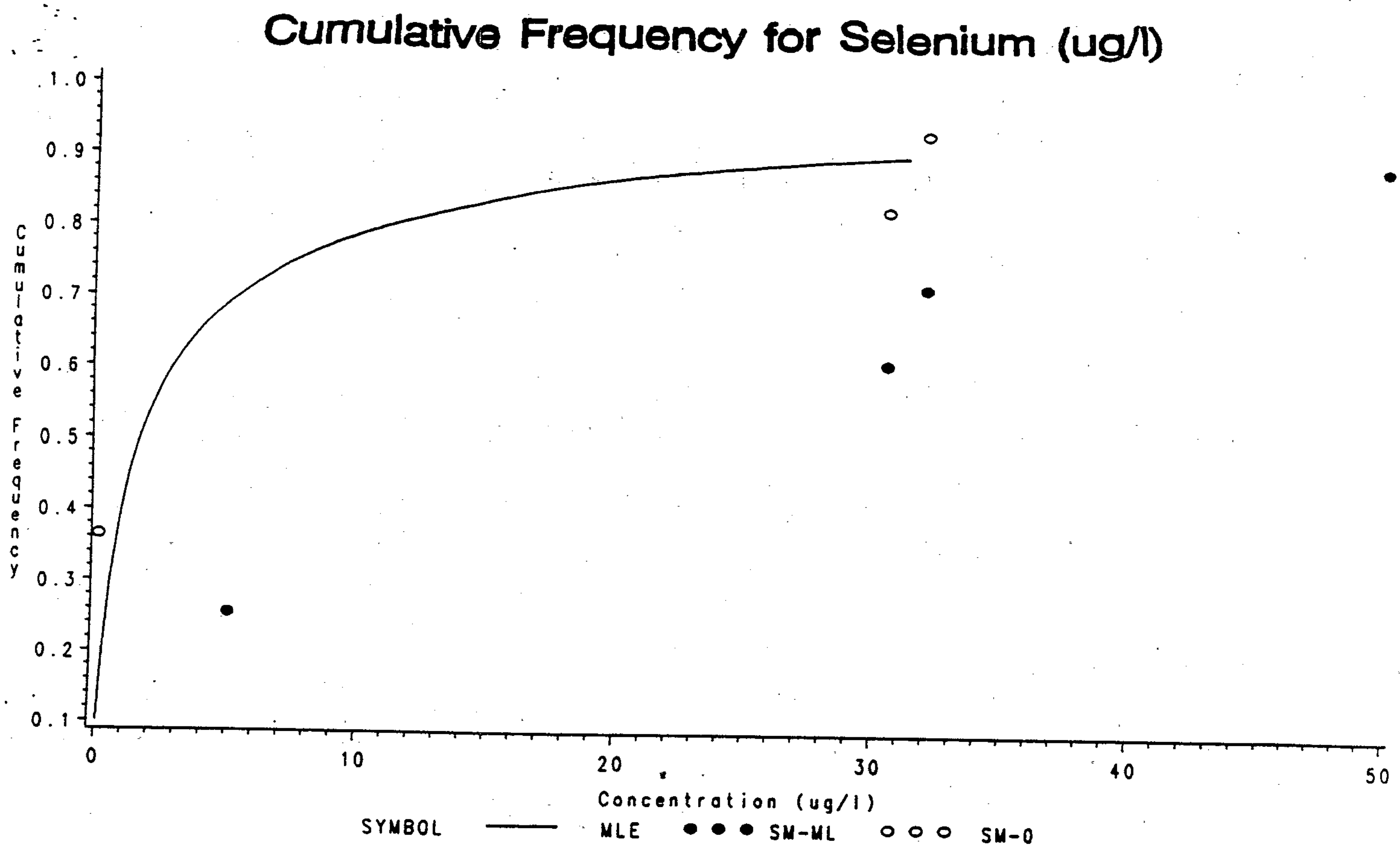



Cumulative Frequency for Nitrate + Nitrite (mg/l)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Concentration (mg/l)
SYMBOL
MLE
SM-ML
SM-0

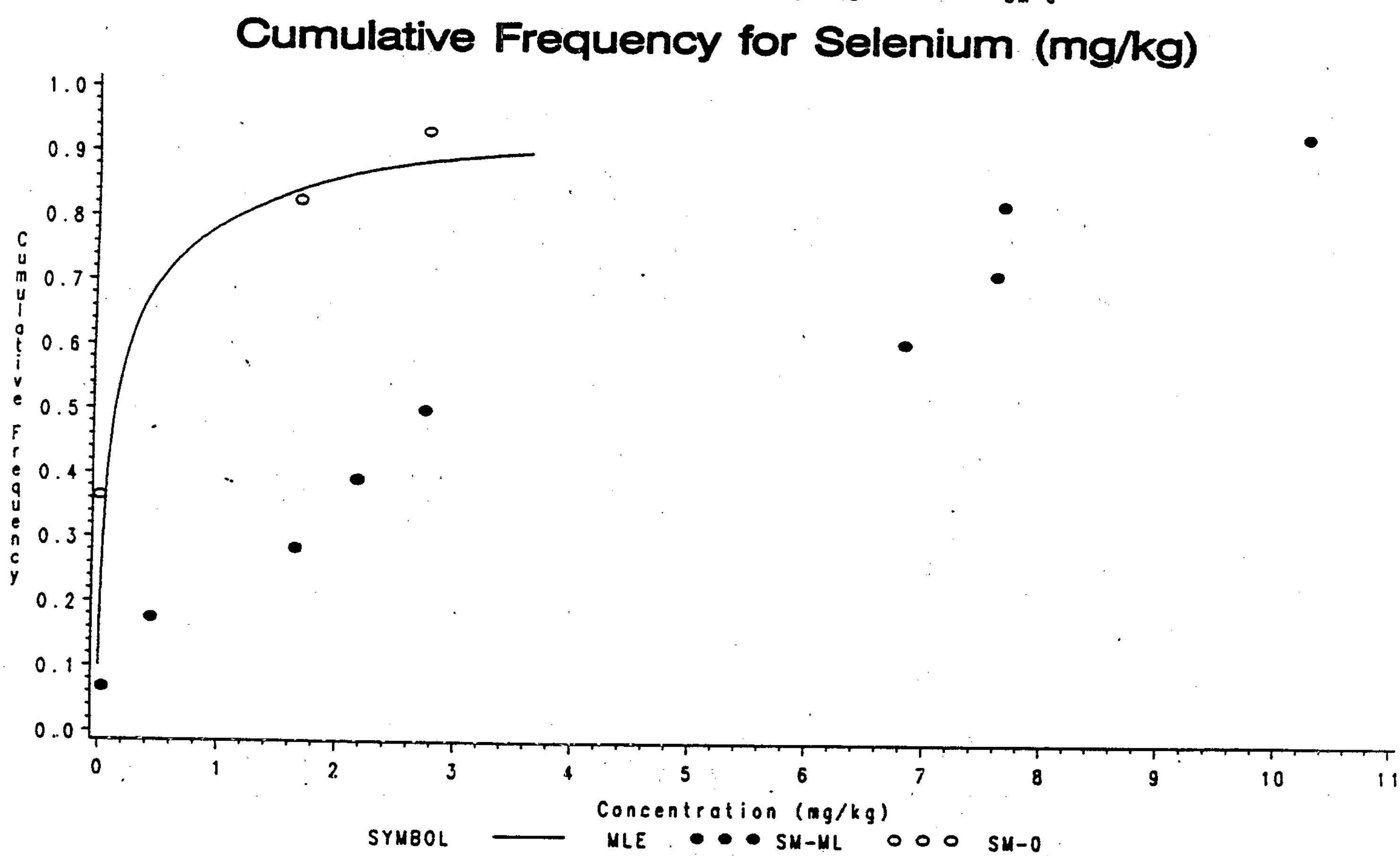

Cumulative Frequency for Nitrate + Nitrite (mg/kg)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
Concentration (mg/kg)
SYMBOL
MLE
SM-ML
SM-0


Cumulative Frequency for Total Phosphorous (mg/l)
Cumulative Frequency
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
0
10
20
30
40
50
60
70
80
90
Concentration (mg/l)
SYMBOL MLE SM-ML SM-0


Cumulative Frequency for Total Phosphorous (mg/kg)
Cumulative Frequency
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
15000
Concentration (mg/kg)
SYMBOL MLE SM-ML SM-0

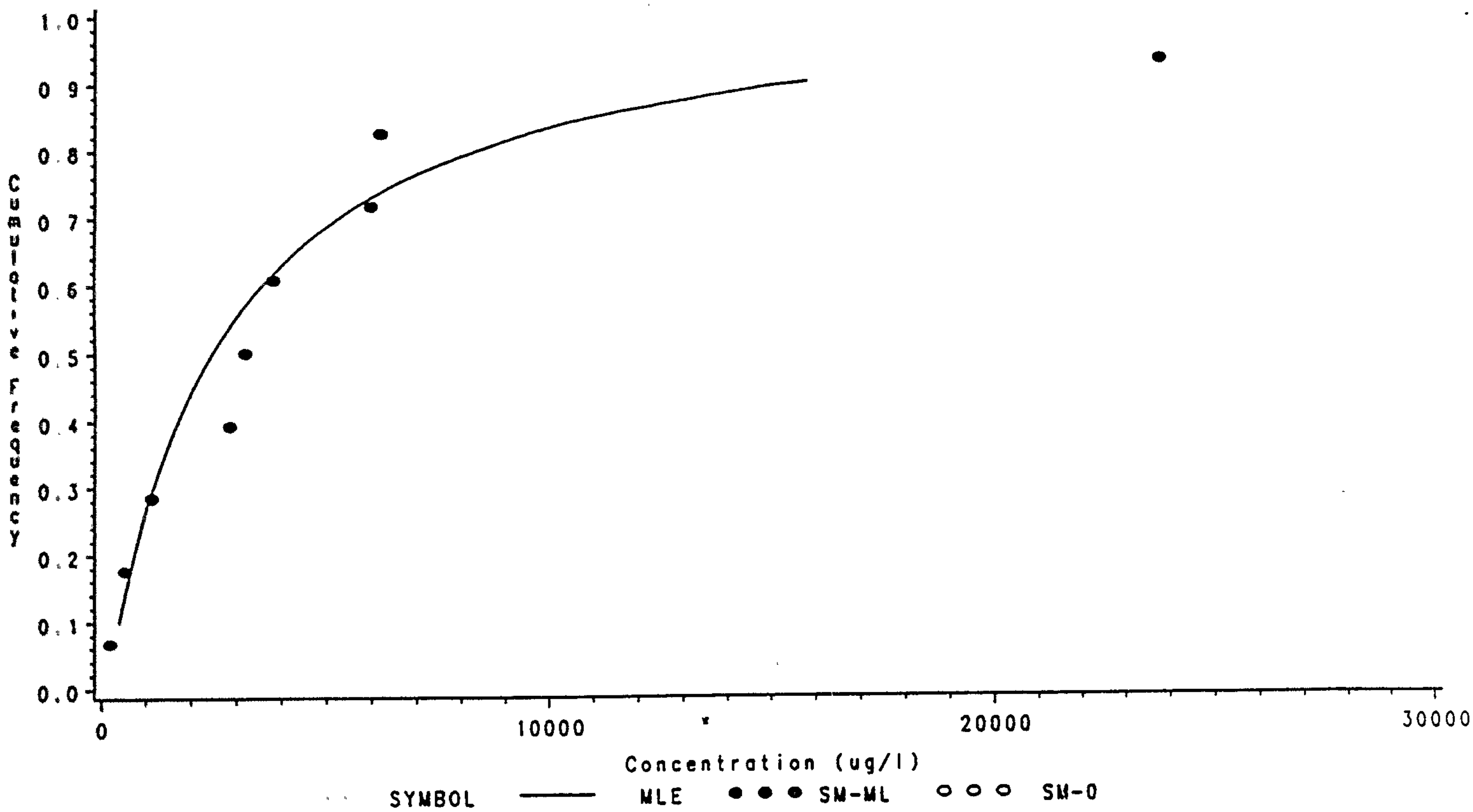


Cumulative Frequency for Selenium (ug/l)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
10
20
30
40
50
Concentration (ug/l)
SYMBOL
MLE
SM-ML
SM-0

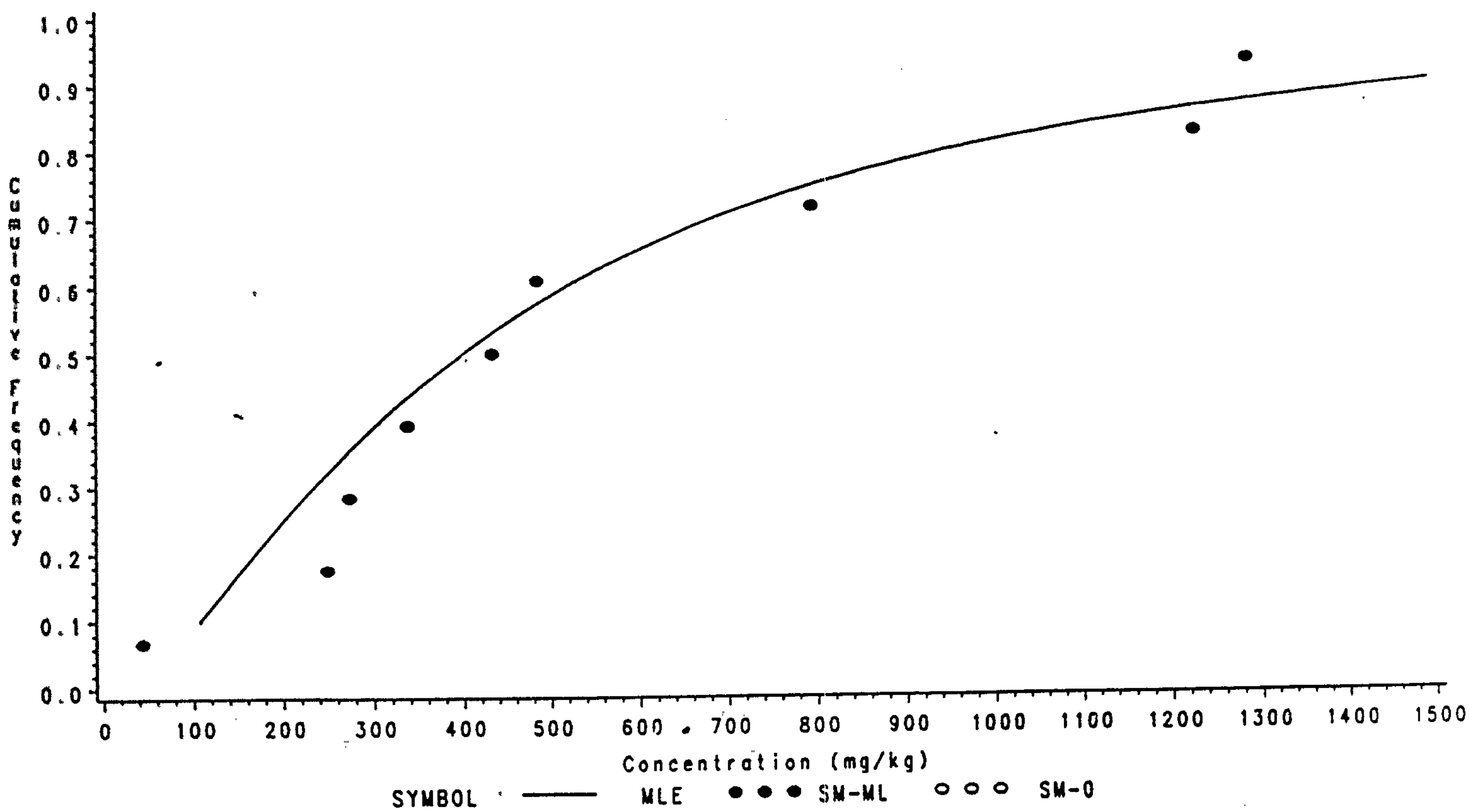


Cumulative Frequency for Selenium (mg/kg)
Cumulative Frequency
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
1
2
3
4
5
6
7
8
9
10
11
Concentration (mg/kg)
SYMBOL
MLE
SM-ML
SM-0

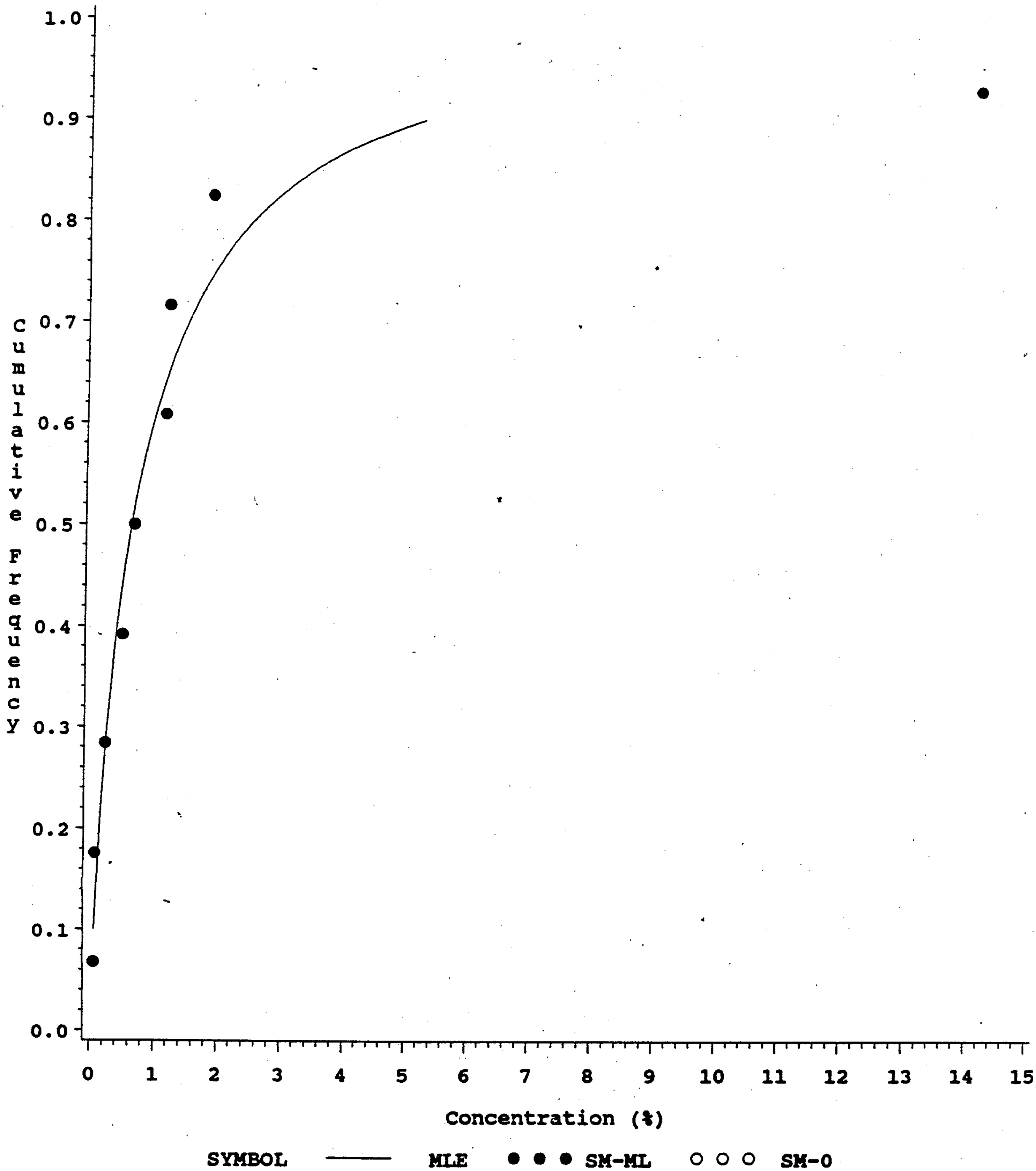
Cumulative Frequency for Zinc (ug/l)



Cumulative Frequency for Zinc (mg/kg)



Cumulative Frequency for Percent Solids (%)



Appendix C

Data Listing

Wet Weight Concentrations of Pollutants in Septage

--------------- Pollutant=ALDRIN/DIELDRIN(TOTAL) ---------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.100	UG/L
19975	.	0.100	UG/L
19976	.	0.100	UG/L
19977	2.50	.	UG/L
19978	0.75	.	UG/L
19979	.	0.184	UG/L
19980	.	0.100	UG/L
19981	.	0.100	UG/L
19982	.	0.100	UG/L

------------------ Pollutant=ALPHA-CHLORDANE ------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.100	UG/L
19975	.	0.100	UG/L
19976	.	0.100	UG/L
19977	.	0.100	UG/L
19978	.	0.100	UG/L
19979	.	0.184	UG/L
19980	.	0.100	UG/L
19981	.	0.100	UG/L
19982	.	0.100	UG/L

------------------ Pollutant=AMMONIA (AS N) ------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	45.00	.	MG/L
19975	0.48	.	MG/L
19976	40.00	.	MG/L
19977	11.00	.	MG/L
19978	45.00	.	MG/L
19979	33.00	.	MG/L
19980	56.00	.	MG/L
19981	54.00	.	MG/L
19982	100.00	.	MG/L

Wet Weight Concentrations of Pollutants in Septage

Pollutant=ARSENIC

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	20.000	UG/L
19975	.	20.000	UG/L
19976	.	20.000	UG/L
19977	.	20.000	UG/L
19978	.	20.000	UG/L
19979	.	20.000	UG/L
19980	.	20.000	UG/L
19981	.	20.000	UG/L
19982	.	20.000	UG/L

Pollutant=BENZENE

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

Pollutant=BENZO(A)PYRENE

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19975	.	10.000	UG/L
19976	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

Wet Weight Concentrations of Pollutants in Septage

--------------------- Pollutant=BERYLLIUM ---------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	5.000	UG/L
19975	.	5.000	UG/L
19976	.	5.000	UG/L
19977	.	5.000	UG/L
19978	.	5.000	UG/L
19979	.	5.000	UG/L
19980	.	5.000	UG/L
19981	.	5.000	UG/L
19982	.	5.000	UG/L

------------ Pollutant=BIS(2-ETHYLHEXYL) PHTHALATE ------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19975	.	10.000	UG/L
19976	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

--------------------- Pollutant=CADMIUM ---------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	9.40	.	UG/L
19975	.	5.000	UG/L
19976	.	5.000	UG/L
19977	.	5.000	UG/L
19978	6.40	.	UG/L
19979	18.40	.	UG/L
19980	.	5.000	UG/L
19981	.	5.000	UG/L
19982	.	5.000	UG/L

Wet Weight Concentrations of Pollutants in Septage

Pollutant=CHROMIUM

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	53.90	.	UG/L
19975	.	10.000	UG/L
19976	12.10	.	UG/L
19977	32.10	.	UG/L
19978	81.60	.	UG/L
19979	128.00	.	UG/L
19980	33.50	.	UG/L
19981	50.20	.	UG/L
19982	18.70	.	UG/L

Pollutant=COPPER

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	1340.00	.	UG/L
19975	77.10	.	UG/L
19976	80.30	.	UG/L
19977	115.00	.	UG/L
19978	758.00	.	UG/L
19979	174.00	.	UG/L
19980	1850.00	.	UG/L
19981	62.00	.	UG/L
19982	69.60	.	UG/L

Pollutant=DDT,DDE,DDD(TOTAL)

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.338	UG/L
19975	.	0.338	UG/L
19976	.	0.338	UG/L
19977	.	0.338	UG/L
19978	.	0.338	UG/L
19979	0.92	.	UG/L
19980	2.88	.	UG/L
19981	.	0.338	UG/L
19982	.	0.338	UG/L

Wet Weight Concentrations of Pollutants in Septage

Pollutant=GAMMA-CHLORDANE

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.113	UG/L
19975	.	0.113	UG/L
19976	.	0.113	UG/L
19977	.	0.113	UG/L
19978	.	0.113	UG/L
19979	.	0.207	UG/L
19980	.	0.113	UG/L
19981	.	0.113	UG/L
19982	.	0.113	UG/L

Pollutant=HEPTACHLOR

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	0.25	.	UG/L
19975	.	0.063	UG/L
19976	.	0.063	UG/L
19977	.	0.063	UG/L
19978	.	0.063	UG/L
19979	.	0.115	UG/L
19980	.	0.063	UG/L
19981	.	0.063	UG/L
19982	.	0.063	UG/L

Pollutant=HEXACHLOROBENZENE

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19975	.	10.000	UG/L
19976	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

Wet Weight Concentrations of Pollutants in Septage

----------------- Pollutant=HEXACHLOROBUTADIENE -----------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19975	.	10.000	UG/L
19976	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

----------------------- Pollutant=LEAD -----------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	121.00	.	UG/L
19975	.	50.000	UG/L
19976	.	50.000	UG/L
19977	.	50.000	UG/L
19978	.	50.000	UG/L
19979	70.30	.	UG/L
19980	79.30	.	UG/L
19981	.	50.000	UG/L
19982	.	50.000	UG/L

----------------- Pollutant=LINDANE(GAMMA-BHC) -----------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.138	UG/L
19975	.	0.138	UG/L
19976	.	0.138	UG/L
19977	0.13	.	UG/L
19978	.	0.138	UG/L
19979	.	0.253	UG/L
19980	0.25	.	UG/L
19981	.	0.138	UG/L
19982	.	0.138	UG/L

Wet Weight Concentrations of Pollutants in Septage

Pollutant=MERCURY

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	0.200	UG/L
19975	.	0.200	UG/L
19976	.	0.200	UG/L
19977	0.30	.	UG/L
19978	.	0.200	UG/L
19979	1.30	.	UG/L
19980	0.45	.	UG/L
19981	0.50	.	UG/L
19982	4.05	.	UG/L

Pollutant=MOLYBDENUM

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	14.40	.	UG/L
19975	.	10.000	UG/L
19976	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	10.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

Pollutant=N-NITROSODIMETHYLAMINE

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	50.000	UG/L
19975	.	50.000	UG/L
19976	.	50.000	UG/L
19977	.	50.000	UG/L
19978	.	50.000	UG/L
19979	.	100.000	UG/L
19980	.	50.000	UG/L
19981	.	50.000	UG/L
19982	.	50.000	UG/L

Wet Weight Concentrations of Pollutants in Septage

---------------------- Pollutant=NICKEL ----------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	40.000	UG/L
19975	.	40.000	UG/L
19976	.	40.000	UG/L
19977	79.80	.	UG/L
19978	61.80	.	UG/L
19979	105.00	.	UG/L
19980	41.90	.	UG/L
19981	.	40.000	UG/L
19982	41.60	.	UG/L

--------------- Pollutant=NITRATE+NITRITE (AS N) ---------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	0.20	.	MG/L
19975	.	0.100	MG/L
19976	.	0.100	MG/L
19977	0.90	.	MG/L
19978	0.20	.	MG/L
19979	0.60	.	MG/L
19980	0.60	.	MG/L
19981	0.60	.	MG/L
19982	0.20	.	MG/L

-------------------- Pollutant=PCB(TOTAL) --------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	1.750	UG/L
19975	.	1.750	UG/L
19976	.	1.750	UG/L
19977	.	1.750	UG/L
19978	.	1.750	UG/L
19979	.	3.218	UG/L
19980	.	1.750	UG/L
19981	.	1.750	UG/L
19982	.	1.750	UG/L

Wet Weight Concentrations of Pollutants in Septage

Pollutant=SELENIUM

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	50.000	UG/L
19975	.	5.000	UG/L
19976	.	5.000	UG/L
19977	.	5.000	UG/L
19978	.	5.000	UG/L
19979	30.50	.	UG/L
19980	.	5.000	UG/L
19981	.	50.000	UG/L
19982	32.00	.	UG/L

Pollutant=TOTAL KJELDAHL NITROGEN

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	142.00	.	MG/L
19975	9.00	.	MG/L
19976	55.00	.	MG/L
19977	31.00	.	MG/L
19978	70.00	.	MG/L
19979	119.00	.	MG/L
19980	115.00	.	MG/L
19981	175.00	.	MG/L
19982	152.00	.	MG/L

Pollutant=TOTAL PHOSPHOROUS

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	32.00	.	MG/L
19975	1.70	.	MG/L
19976	7.00	.	MG/L
19977	25.00	.	MG/L
19978	12.00	.	MG/L
19979	48.00	.	MG/L
19980	36.00	.	MG/L
19981	46.00	.	MG/L
19982	41.00	.	MG/L

Wet Weight Concentrations of Pollutants in Septage

-------------------- Pollutant=TOTAL SOLIDS --------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	4880.00	.	MG/L
19975	733.00	.	MG/L
19976	653.00	.	MG/L
19977	142000.00	.	MG/L
19978	2310.00	.	MG/L
19979	18500.00	.	MG/L
19980	11300.00	.	MG/L
19981	6580.00	.	MG/L
19982	11700.00	.	MG/L

--------------------- Pollutant=TOXAPHENE ---------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	11.375	UG/L
19975	.	11.375	UG/L
19976	.	0.910	UG/L
19977	.	11.375	UG/L
19978	.	11.375	UG/L
19979	.	20.920	UG/L
19980	.	11.375	UG/L
19981	.	11.735	UG/L
19982	.	11.375	UG/L

------------------- Pollutant=TRICHLOROETHENE -------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	.	10.000	UG/L
19977	.	10.000	UG/L
19978	.	10.000	UG/L
19979	.	20.000	UG/L
19980	.	10.000	UG/L
19981	.	10.000	UG/L
19982	.	10.000	UG/L

Wet Weight Concentrations of Pollutants in Septage

------------------------ Pollutant=ZINC ------------------------

EPA Sample Number	Quantified Amount	Minimum Level	Units
19974	5990.00	.	UG/L
19975	182.00	.	UG/L
19976	519.00	.	UG/L
19977	6210.00	.	UG/L
19978	1120.00	.	UG/L
19979	23800.00	.	UG/L
19980	3810.00	.	UG/L
19981	2850.00	.	UG/L
19982	3190.00	.	UG/L

APPENDIX L

Calculation of the Amount of Sewage Sludge Used or Disposed for the Part 503 Frequency of Monitoring Requirements

CALCULATION OF THE AMOUNT OF SEWAGE SLUDGE USED OR DISPOSED FOR THE PART 503 FREQUENCY OF MONITORING REQUIREMENTS

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November 23, 1992

CALCULATION OF THE AMOUNT OF SEWAGE SLUDGE USED OR DISPOSED FOR THE PART 503 FREQUENCY OF MONITORING REQUIREMENTS

INTRODUCTION

The Standards for the Use or Disposal of Sewage Sludge in 40 CFR Part 503 contain frequency of monitoring requirements for land application of sewage sludge, placement of sewage sludge on a surface disposal site, and firing of sewage sludge in a sewage sludge incinerator. These requirements indicate how often sewage sludge has to be monitored for pollutant concentrations, pathogen densities, and vector attraction reduction. They are based on the amount of sewage sludge used or disposed during a 365 day period.

For land application, the frequency of monitoring requirements are based either on the amount of bulk sewage sludge applied to the land or the amount of sewage sludge received by a person who prepares the sewage sludge for sale or give away in a bag or similar enclosure for application to the land. As those amounts increase, the frequency of monitoring increases.

For surface disposal and firing of sewage sludge in a sewage sludge incinerator, the frequency of monitoring requirements are based on the amount of sewage sludge placed on a surface disposal site and the amount of sewage sludge fired in a sewage sludge incinerator, respectively. For these two practices, the frequency of monitoring also increases as the amount of sewage sludge used or disposed increases.

This document discusses calculation of the amounts of sewage sludge used or disposed for the Part 503 frequency of monitoring requirements. The assumptions on which those requirements are based and the calculations for the amounts used or disposed are presented below. Also presented below are the Part 503 frequency of monitoring requirements.

ASSUMPTIONS

- Wastewater is treated in "typical" secondary wastewater treatment plant (i.e., primary settling followed by biological treatment followed by secondary settling).
- Sewage sludge is stabilized in an anaerobic digester prior to use or disposal.
- Influent wastewater BOD5 concentration = 200 mg/l.
- Effluent wastewater BOD5 concentration = 30 mg/l.
- Influent wastewater TSS concentration = 200 mg/l.
- Effluent wastewater TSS concentration = 30 mg/l.

- TSS percent removal in primary treatment process = 60.
- Percent volatile solids in the influent to digester = 60.
- Percent volatile solids reduction in digester = 38.
- Percent fixed solids in the influent to digester = 40
- Solids concentration factor during secondary settling = 0.9

<u>CALCULATIONS FOR TREATMENT WORKS WITH A FLOW RATE OF ONE MGD</u>

- TSS removal in primary treatment process:

Influent TSS x Flow rate x Conversion factor x Percent removal

200 mg/l x 1 MGD x 8.34 x 0.6 = <u>1,000 pounds per day</u>.

- BOD5 removal through secondary settling process:

Influent BOD5 - Effluent BOD5 = 200 - 30 = 170 mg/l

Concentration removed x Flow rate x Conv. fact. x Conc. fact.

170 mg/l x 1 MGD x 8.34 x 0.9 = <u>1,276 pounds per day</u>.

- Sewage sludge to the digester:

Primary settling sludge + secondary settling sludge = total

1,000 + 1,276 = <u>2,276 pounds per day.</u>

- Amount of sewage sludge used or disposed:

Fixed solids = total amount x percent of total solids.

Fixed solids = 2,276 x 0.4 = <u>910 pounds per day</u>.

Volatile solids = total amount x percent of total solids x percent remaining after digestion.

Volatile solids = 2,276 x 0.6 x (1.0 - 0.38) = <u>847 pounds/day</u>

Total amount used or disposed = Fixed solids + volatile solids

910 + 847 = <u>1,757 pounds per day</u>

$$\text{Total amount} = 1{,}757\ \frac{\text{pounds}}{\text{days}} \times 365\ \frac{\text{days}}{\text{year}} \times 1\ \frac{\text{metric ton}}{2{,}200\ \text{pounds}}$$

Total amount for 1 MGD = <u>292 metric tons per year</u>.

Report amount in two significant figures:

Use 290 metric tons per year for 1 MGD treatment works (dry weight basis)

CALCULATION FOR A TREATMENT WORKS WITH A FLOW RATE OF FIVE MGD

Total amount = Amount for 1 MGD treatment works times 5

Total amount = 290 x 5 = 1,450 metric tons per year

Report amount in two significant figures:

Use 1,500 metric tons per year for five MGD treatment works (dry weight basis)

CALCULATION FOR A TREATMENT WORKS WITH A FLOW RATE OF 50 MGD

Total amount = Amount for 1 MGD treatment works x 50

Total amount = 290 x 50 = 14,500 metric tons per year

Report amount in two significant figures:

Use 15,000 metric tons per year for 50 MGD treatment works (dry weight basis)

PART 503 FREQUENCY OF MONITORING REQUIREMENTS

Results of the above calculations were used as the basis for the frequency of monitoring requirements in Part 503. Those frequencies are presented below.

FREQUENCY OF MONITORING

Amount of sewage sludge used or disposed (metric tons per 365 day period-dry weight)	Frequency
Greater than zero but less than 290	once per year
Equal to or greater than 290 but less than 1,500	once per quarter (four times per year)
Equal to or greater than 1,500 but less than 15,000	once per 60 days (six time per year)
Equal to or greater than 15,000	once per month (12 times per year)