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ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 300

[FRL-3730-8]

RIN 2050 AB73

Hazard Ranking System

AGENCY: Environmental Protection Agency.

ACTION: Final rule.

SUMMARY: The Environmental Protection Agency (EPA) is adopting revisions to the Hazard Ranking System (HRS), the principal mechanism for placing sites on the National Priorities List (NPL). The revisions change the way EPA evaluates potential threats to human health and the environment from hazardous waste sites and make the HRS more accurate in assessing relative potential risk. These revisions comply with other statutory requirements in the Superfund Amendments and Reauthorization Act of 1986 (SARA).

DATES: Effective date March 14, 1991. As discussed in Section III H of this preamble, comments are invited on the addition of specific benchmarks in the air and soil exposure pathways until January 14, 1991.

ADDRESSES: Documents related to this rulemaking are available at and comments on the specific benchmarks in the air and soil exposure pathways may be mailed to the CERCLA Docket Office, OS-245, U.S. Environmental Protection Agency, Waterside Mall, 401 M Street, SW, Washington, DC 20460, phone 202-382-3046. Please send four copies of comments. The docket is available for viewing by appointment only from 9:00 am to 4:00 pm, Monday through Friday, excluding Federal holidays. The docket number is 105NCP-HRS.

FOR FURTHER INFORMATION CONTACT: Steve Caldwell or Agnes Ortiz, Hazardous Site Evaluation Division, Office of Emergency and Remedial Response, OS-230, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, or the Superfund Hotline at 800-424-9346 (in the Washington, DC area, 202-382-3000).

SUPPLEMENTARY INFORMATION:

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I. Background

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. 9601 *et seq.*), commonly called the Superfund, in response to the dangers posed by uncontrolled releases of hazardous substances, contaminants, and pollutants. To implement section 105(8)(A) of CERCLA and Executive Order 12316 (46 FR 42237, August 20, 1981), the U.S. Environmental Protection Agency (EPA) revised the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR part 300, on July 16, 1982 (47 FR 31180), with later revisions on September 16, 1985 (50 FR 37624), November 20, 1985 (50 FR 47912), and March 8, 1990 (55 FR 8666). The NCP sets forth guidelines and procedures for responding to releases or potential release of hazardous substances, pollutants, or contaminants.

Section 105(8)(A) of CERCLA (now section 105(a)(8)(A)) requires EPA to establish:

> Criteria for determining priorities among releases or threatened releases [of hazardous substances] throughout the United States for the purpose of taking remedial action and, to the extent practicable taking into account the potential urgency of such action, for the purpose of taking removal action. Criteria and priorities * * * shall be based upon the relative risk or danger to public health or welfare or the environment * * * taking into account to the extent possible the population at risk, the hazard potential of the hazardous substances at such facilities, the potential for contamination of drinking water supplies, the potential for direct human contact, [and] the potential for destruction of sensitive ecosystems * * *.

To meet this requirement and help set priorities, EPA adopted the Hazard Ranking System (HRS) as appendix A to the NCP (47 FR 31180, July 16, 1982). The HRS is a scoring system used to assess the relative threat associated with actual or potential releases of hazardous substances at sites. The HRS is the primary way of determining whether a site is to be included on the National Priorities List (NPL), the Agency's list of sites that are priorities for long-term evaluation and remedial response, and is a crucial part of the Agency's program to address the identification of actual and potential releases. (Each State can nominate one site to the NPL as a State top priority regardless of its HRS score; sites may also be added in response to a health advisory from the Agency for Toxic Substances and Disease Registry (see NCP, 40 CFR 300.425(c)(3)).) Under the original HRS, a score was determined for a site by evaluating three migration pathways—ground water, surface water, and air. Direct contact and fire and explosion threats were also evaluated to determine the need for emergency actions, but did not enter into the decision on whether to place a site on the NPL.

In 1986, Congress enacted the Superfund Amendments and Reauthorization Act of 1986 (SARA) (Pub. L. 99-499), which added section 105(c)(1) to CERCLA, requiring EPA to amend the HRS to assure "to the maximum extent feasible, that the hazard ranking system accurately assesses the relative degree of risk to human health and the environment posed by sites and facilities subject to review." Congress, in its Conference Report on SARA, stated the substantive standard against which HRS revisions could be assessed:

> This standard is to be applied within the context of the purpose for the National Priorities List; i.e., identifying for the States and the public those facilities and sites which appear to warrant remedial actions. * * * This standard does not, however, require the Hazard Ranking System to be equivalent to detailed risk assessments, quantitative or qualitative, such as might be performed as part of remedial actions. The standard requires the Hazard Ranking System to rank sites as accurately as the Agency believes is feasible using information from preliminary assessments and site inspections * * * Meeting this standard does not require long-term monitoring or an accurate determination of the full nature and extent of contamination at sites or the projected levels of exposure such as might be done during remedial investigations and feasibility studies. This provision is intended to ensure that the Hazard Ranking System performs with a degree of accuracy appropriate to its role in expeditiously identifying candidates for response actions. [H.R. Rep. No. 962, 99th Cong., 2nd Sess. at 199-200 (1986)]

Section 105(c)(2) further specifies that the HRS appropriately assess the human health risks associated with actual or potential contamination of surface waters used for recreation or drinking water and that this assessment should take into account the potential migration of any hazardous substance through surface water to downstream sources of drinking water.

SARA added two criteria for evaluating sites under section 105(a)(8)(A): Actual or potential contamination of the ambient air and threats through the human food chain. In addition, CERCLA section 118, added by SARA, requires EPA to give a high priority to facilities where the release of hazardous substances has resulted in the closing of drinking water wells or has contaminated a principal drinking water supply. Finally, CERCLA section 125, added by SARA, requires revisions to the HRS to address facilities that contain substantial volumes of wastes specified in section 3001(b)(3)(A)(i) of the Solid Waste Disposal Act, commonly referred to as the Resource Conservation and Recovery Act (RCRA). These wastes include fly ash wastes, bottom ash wastes, slag wastes, and flue gas emission control wastes generated primarily from the combustion of coal or other fossil fuels. Specifically, section 125 requires EPA to revise the HRS to assure the appropriate consideration of each of the following site-specific characteristics of such facilities:

- The quantity, toxicity, and concentrations of hazardous constituents that are present in such waste and a comparison with other wastes;
- The extent of, and potential for, release of such hazardous constituents into the environment; and
- The degree of risk to human health and the environment posed by such constituents.

EPA published an advance notice of proposed rulemaking (ANPRM) on April 9, 1987 (52 FR 11513), announcing its intention to revise the HRS and requesting comments on a number of issues. After a comprehensive review of the original HRS, including consideration of alternative models and Science Advisory Board review, EPA published a notice of proposed rulemaking (NPRM) for HRS revisions on December 23, 1988 (53 FR 51962). The NPRM contains a detailed preamble, which should be consulted for a more extensive discussion of CERCLA, SARA, the HRS, and the proposed changes to the HRS.

Today, EPA is publishing the revised HRS, which will supersede the HRS previously in effect as appendix A to the NCP. CERCLA section 105(c)(1) states that the revised HRS shall be applied to any site newly listed on the NPL after its effective date; as specified in section 105(c)(3), sites scored with the original HRS prior to that effective date need not be reevaluated.

The HRS is a scoring system based on factors grouped into three factor categories. The factor categories are multiplied and then normalized to 100 points to obtain a pathway score (e.g., the ground water migration pathway score). The final HRS score is obtained by combining the pathway scores using a root-mean-square method. The proposed HRS revised every factor to some extent. A few factors were replaced, and several new factors were added. The major proposed changes included:

(1) Consideration of potential as well as actual releases to air;

(2) Addition of mobility factors;

(3) Addition of dilution and distance weightings for the water migration pathways and modification of distance weighting in the air migration pathway;

(4) Revisions to the toxicity factor;

(5) Additions to the list of covered sensitive environments;

(6) Addition of human food chain and recreation threats to the surface water migration pathway;

(7) Revision of the hazardous waste quantity factor to allow a tiered approach;

(8) Addition of health-based benchmarks for evaluating population factors and ecological-based benchmarks for evaluating sensitive environments;

(9) Addition of factors for evaluating the maximally exposed individual; and

(10) Inclusion of a new onsite exposure pathway.

EPA conducted a field test of the proposed HRS to assess the feasibility of implementing the proposed HRS factors, to determine resources required for specific tasks, to assess the availability of information needed for evaluation of sites, and to identify difficulties with the use of the proposed revisions. To meet the objectives, site inspections were performed at 29 sites nationwide. The sites were selected either because work was already planned at the site or because the sites had specific features EPA wanted to test using the proposed revisions to the HRS. The major results of the field test were summarized on September 14, 1989 (54 FR 37949), when the field test report was made available for public review and comment.

II. Overview of the Final Rule

The rule being promulgated today incorporates substantial changes to revisions proposed in December 1988. EPA has changed the rule for three reasons: (1) To respond to the general comment submitted by many commenters that the factor categories and pathways need to be consistent with each other; (2) to respond to specific recommendations made by commenters; and (3) to respond to problems identified during the field test and discussed in the field test report. Major changes affecting multiple pathways include:

- Multiplication of hazardous waste quantity factor, toxicity, and other waste characteristics factors;
- Uncapping of population factors (i.e., no limit is placed on maximum value);
- Revised criteria for establishing an observed release;
- Capping of potential to release at a value less than observed release;
- Revision of the toxicity evaluation to select carcinogenic and non-cancer chronic values in preference to acute toxicity values;
- Elimination of Level III concentrations and extension of weighting based on levels of exposure to nearest individual (well/intake; formerly maximally exposed individual) factors;
- Modification of the weights assigned to Level I and Level II concentrations;
- Revisions to the benchmarks used and methods for determining exceedance of benchmarks;
- Use of ranges to assign values for potentially exposed populations;
- Inclusion of factors assessing exposures of the nearest individual in all pathways;
- Revisions to distance and dilution weights in all pathways except ground water migration;
- Replacement of the use factors with less heavily weighted resources factors;
- Evaluation of wetlands based on size or surface water frontage; and
- Specific instructions for the evaluation of radionuclides at radioactive waste sites and sites with radioactive and other hazardous substances wastes.

The major changes in the ground water migration pathway include:

- Replacement of depth to aquifer/hydraulic conductivity and sorptive capacity factors with travel time and depth to aquifer factors; and
- Revision of the mobility factor, including consideration of distribution coefficients.

In the surface water migration pathways, the major changes include:

- Elimination of the separate recreational use threat;
- Addition of a ground water to surface water component;

- Incorporation of bioaccumulation into the waste characteristics factor category rather than the targets factor category for the human food chain threat;
- Revision to allow use of additional tissue samples in establishing Level I concentrations for the human food chain threat; and
- Addition of ecosystem bioaccumulation potential factor for sensitive environments.

The major changes in the soil exposure pathway (formerly the onsite exposure pathway) include:

- Elimination of separate consideration of the high risk population;
- Inclusion of hazardous waste quantity in the waste characteristics factor category;
- Consideration of workers in the resident threat's targets factor category; and
- Revisions to scoring of terrestrial sensitive environments.

The major changes in the air migration pathway include:

- Separate evaluation of gas and particulate potential to release; and
- Consideration of actual contamination in evaluating sensitive environments.

Figures 1 to 4 show the differences between the pathways in the original HRS and in the final rule.

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Figure 1

Ground Water Migration Pathway

ORIGINAL HRS

Likelihood of Release	X	Waste Characteristics	X	Targets
Observed Release		Toxicity/Persistence		Ground Water Use
or		Hazardous Waste Quantity		Distance to Nearest Well/ Population Served
Route Characteristics				
Depth to Aquifer of Concern				
Net Precipitation				
Permeability of Unsaturated Zone				
Physical State				
Containment				

FINAL HRS

Likelihood of Release	X	Waste Characteristics	X	Targets
Observed Release		Toxicity/Mobility		Nearest Well
or		Hazardous Waste Quantity		Population
Potential to Release				Resources
Containment				Wellhead Protection Area
Net Precipitation				
Depth to Aquifer				
Travel Time				

Figure 2

Surface Water Migration Pathway

ORIGINAL HRS

Likelihood of Release	X	**Waste Characteristics**	X	**Targets**
Observed Release		Toxicity/Persistence		Surface Water Use
or		Hazardous Waste Quantity		Distance to Sensitive Environment
Route Characteristics				Population Served/Distance to Nearest Intake Downstream
Facility Slope/Intervening Terrain				
1-Year, 24-Hour Rainfall				
Distance to Nearest Surface Water				
Physical State				
Containment				

Figure 2

Surface Water Migration Pathway (continued)

FINAL HRS

Likelihood of Release:
Overland Flow/Flood Component

Observed Release
or
Potential to Release

- By Overland Flow
  - Containment
  - Runoff
  - Distance to Surface Water
- By Flood
  - Containment
  - Flood Frequency

or

Likelihood of Release:
Ground Water to Surface Water Component

Observed Release
or
Potential to Release

- Containment
- Net Precipitation
- Depth to Aquifer
- Travel Time

X

Drinking Water Threat

Waste Characteristics	**x**	**Targets**
Toxicity/Mobility[1]/Persistence Hazardous Waste Quantity		Nearest Intake Population Resources

+

Human Food Chain Threat

Waste Characteristics	**x**	**Targets**
Toxicity/Mobility[1]/ Persistence/Bioaccumulation Hazardous Waste Quantity		Food Chain Individual Population

+

Environmental Threat

Waste Characteristics	**x**	**Targets**
Ecosystem Toxicity/Mobility[1]/ Persistence/Bioaccumulation Hazardous Waste Quantity		Sensitive Environments

[1] Mobility is only applicable to the Ground Water to Surface Water Component.

Figure 3

Soil Exposure Pathway[1]

FINAL HRS

Resident Population Threat

Likelihood of Exposure	**X**	**Waste Characteristics**	**X**	**Targets**
Observed Contamination		Toxicity Hazardous Waste Quantity		Resident Individual Resident Population Workers Resources Terrestrial Sensitive Environments

\+

Nearby Population Threat

Likelihood of Exposure	**X**	**Waste Characteristics**	**X**	**Targets**
Attractiveness/Accessibility Area of Contamination		Toxicity Hazardous Waste Quantity		Population Within 1 Mile Nearby Individual

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[1] New pathway.

Figure 4

Air Migration Pathway

ORIGINAL HRS

Likelihood of Release	**X**	**Waste Characteristics**	**X**	**Targets**
Observed Release		Reactivity and Incompatibility Toxicity Hazardous Waste Quantity		Population Within 4-Mile Radius Distance to Sensitive Environment Land Use

FINAL HRS

Likelihood of Release	**X**	**Waste Characteristics**	**X**	**Targets**
Observed Release or Potential to Release Gas Gas Containment Gas Source Type Gas Migration Potential Particulate Particulate Containment Particulate Source Type Particulate Migration Potential		Toxicity/Mobility Hazardous Waste Quantity		Nearest Individual Population Resources Sensitive Environments

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Section III of this preamble summarizes and responds to major issues raised by commenters. These issues are organized so that issues that affect multiple pathways are covered first, followed by discussions of individual pathway issues. Section IV provides a section-by-section discussion of the final rule. All substantive changes not discussed in section III are identified in section IV. Because the rule has been substantially rewritten to clarify the requirements, editorial changes are not generally noted.

III. Discussion of Comments

About 100 groups and individuals submitted comments on the ANPRM and NPRM. Nineteen of these also submitted comments on the field test report; two other groups submitted comments only on the field test report. The commenters included more than 20 State agencies, several Federal agencies, companies, trade associations, Indian tribes, environmental groups, technical consultants, and individuals. This section summarizes and responds to the major issues raised by commenters. A description of the comments and EPA's response to each issue raised in the comments are available in *Responses to Comments on Revisions to the Hazard Ranking System (HRS)* in the EPA CERCLA docket (see **ADDRESSES** section above).

A. Simplification

In response to SARA, EPA proposed revisions to the HRS so that, to the maximum extent feasible, it accurately assesses the relative risks posed by hazardous waste sites to human health and the environment. Consequently, the proposed rule required more data than did the original HRS.

A number of commenters stated that the data collection requirements of the proposed rule were excessive given its purpose as a screening tool. These commenters expressed concern that the data requirements were too extensive for a screening process; specifically, that the data requirements would lengthen the time needed to score sites with the HRS, increase the cost of listing sites, and, therefore, limit the money available for remedial actions. Most commenters—even those who considered that the revisions increased the accuracy of the model—stated that the resources required to evaluate sites under the proposed HRS were excessive.

One commenter suggested the proposed HRS would be so expensive to implement that EPA would need to develop a new screening tool to determine whether a site should undergo an HRS evaluation. Another commenter suggested that because of the complexity of the proposed revisions, preliminary scoring of a site during the site assessment process would be impractical because sites would advance too far in the site assessment process before they were determined not to be NPL candidates. Several commenters stated that, with the additional requirements, the proposed HRS is more of a quantitative risk-assessment tool than the screening tool it is supposed to be. Another suggested that the increased accuracy of the proposed rule over the original HRS is of marginal value relative to the amount of time and money involved, and that the HRS is no longer a quick and inexpensive method of assessing relative risks associated with sites.

Several commenters expressed concern that the increased data requirements of the proposed HRS would affect the schedule of the entire site assessment process. They suggested that these requirements would create a backlog of sites to be evaluated, slow the process of listing sites, and delay cleanup. Some noted that this would be contrary to the goal of identifying and evaluating sites expeditiously.

In response, the Agency believes the requirements of the final rule are within the scope of the site assessment process and that a new screening tool to determine whether a site should undergo an HRS evaluation will not be needed. To assist in screening sites, the site assessment process is divided into two stages:

- A preliminary assessment (PA), which focuses on a visual inspection, collection of available local, State, and Federal permitting data, site-specific information (e.g., topography, population), and historical industrial activity; and
- A site inspection (SI), where PA data are augmented by additional data collection, including sampling of appropriate environmental media and wastes, to determine the likelihood of a site receiving a high enough HRS score to be considered for the NPL.

The field test identified a best-estimate of the average and range of costs incurred to support the data requirements of the proposed HRS. These cost estimates represented the entire site assessment process from PA to SI, and comprehensive evaluations for all pathways at most sites. As such, the Agency believes these cost estimates overstate the costs associated with site assessments occurring on the greater universe of CERCLA sites. The amount of data collected during an SI varies from site to site depending on the complexity of the site and the number of environmental media believed to be contaminated. Some SIs may be limited in scope if data are easy to obtain, while others require more substantial resource commitments. The most important factors in determining costliness of an SI are (1) the presence or absence of ground water monitoring wells in situations where ground water is affected, and (2) the number of affected media, which determines the number of samples taken and analyzed. The Agency believes the greater universe of CERCLA sites will not require the more substantial resource commitments.

Finally, EPA does not agree that the requirements of the final rule will delay the listing of sites. The site assessment process screens sites at each stage, thereby limiting the number of sites that require evaluation for scoring. The Agency believes that it will be possible to score sites expeditiously with the revised HRS.

The Agency believes the additional data requirements of the final rule will make it more accurately reflect the relative risks posed by sites, but also that the HRS should be as simple as possible to make it easier to implement and to retain its usefulness as a screening device. This approach responds to the majority of commenters who recommended that EPA simplify the proposed HRS to make it easier and less expensive to implement. In response to these comments, the rule adopted today includes a number of changes from the proposed rule that simplify the HRS. These simplifying changes were based largely on EPA's field test of the proposed rule, sensitivity studies, and issue analyses undertaken by EPA in response to comments.

- In the surface water migration pathway, the proposed recreation threat has been eliminated as a separate threat. Instead of requiring a separate set of detailed calculations and data, the final rule accounts for recreational use exposures through resources factors, where points may be added for recreation use.
- In the ground water migration pathway, the proposed potential to release has been simplified by dropping "sorptive capacity," by revising "depth to aquifer" and making it a separate factor, and by eliminating the requirement to consider all geological layers between the hazardous substance and the aquifer in evaluating travel time to the aquifer. The "travel time" factor (the depth to aquifer/hydraulic conductivity factor in the proposed rule)

is now based on the layer(s) with the lowest hydraulic conductivity.

- In the three migration pathways (i.e., ground water, surface water, and air), the use factors in the proposed rule—"land use" in the air migration pathway, "drinking water use" and "other water use" in the ground water migration pathway, and "drinking water use" and "other water use" in the surface water migration pathway—have been replaced by "resources" factors. The "fishery use" factor has been dropped from the surface water migration pathway. A resources factor has been added to the soil exposure pathway.
- In the soil exposure pathway, the requirement that children under seven be counted as a separate population has been dropped. The "accessibility/frequency of use" factor has been replaced by a simpler "attractiveness/accessibility" factor.
- In the surface water migration pathway, the "runoff curve number," which required determining the predominant land use within the drainage area, has been replaced by a simpler factor, "soil group," which only requires classifying the predominant soil group in the drainage area into one of four categories.
- In the air migration pathway, the maps used to assign values of particulate migration potential (formerly particulate mobility under potential to release) have been simplified.
- In all pathways, potentially exposed populations are assigned values based on ranges rather than exact counts, reducing documentation requirements.
- In the surface water and ground water migration pathways, Level III benchmarks have been dropped.
- In all pathways, hazardous waste quantity values are based on ranges, which will reduce documentation requirements. The methodology and explanation for evaluating the hazardous waste quantity factor have been simplified.
- Containment tables have been simplified in the air, ground water, and surface water migration pathways.

A number of the simplifications, such as the changes to the travel time and hazardous waste quantity factors, better reflect the uncertainty of the underlying site data and, therefore, do not generally affect the accuracy of the HRS. In addition, EPA notes that some revisions that may appear to make the HRS more complex actually make it more flexible. For example, the hierarchy for determining hazardous waste quantity allows using data on the quantity of hazardous constituents if they are available or can be determined; additionally, data on the quantity of hazardous wastestreams, source volume, and source area can be used, depending on the completeness of data within the hierarchy. The hierarchy allows a site to be scored at the most precise level for which data are reasonably available, but does not require extensive data collection where available data are less precise.

In response to comments on the complexity of the rule language, the presentation of the HRS has been reorganized and clarified. Factors that are evaluated in more than one pathway are explained in a separate section of the final rule (§ 2) to eliminate the repetition of instructions. The proposed HRS included descriptive background material that, while useful, made the HRS difficult to read. Much of this descriptive material has been removed from the rule.

B. HRS Structure Issues

Although the proposed rule retained the basic structure of the original HRS, a number of commenters felt that the HRS should provide results consistent with the results of a quantitative risk assessment. Several commenters identified this issue explicitly, while others identified specific aspects of the proposed rule that they believed to be inconsistent with basic risk assessment principles. The commenters maintained that if the HRS is to reflect relative risks to the extent feasible, as required by the statute, its structure should be modified to better reflect the methods employed in quantitative risk assessments. Commenters stressed the need for EPA to follow the advice of the EPA Science Advisory Board (SAB) as expressed in the SAB review of the HRS:

> Revisions to the HRS should begin with the development of a chain of logic, without regard for the ease or difficulty of collecting data, that would lead to a risk assessment for each site. This framework, but not the underlying logic, would be simplified to account for the very real difficulties of data collection.
>
> This chain of logic * * * should lead to a situation in which an increased score reflects an increased risk presented by a site.

In response to the structural issues raised by commenters and to the statutory mandate to reflect relative risk to the extent feasible, EPA made a number of changes to the final rule. These structural changes affect how various factors are scored and how scores are combined, but do not involve changes in the types or amount of data required to score a site with the HRS. The Agency stresses that the limited data generated at the SI stage are designed to support site screening, and are not intended to provide support for a quantitative risk assessment.

General structural changes. While the final rule retains the basic structure of the proposed rule in that three factor categories (likelihood of release, waste characteristics, and targets) continue to be multiplied together to obtain pathway scores, the structure has been changed in certain respects to make the underlying logic of the HRS more consistent with risk assessment principles.

The key structural changes to the waste characteristics factor category were to make use of consistent scales and to multiply the hazardous waste quantity and toxicity (or, depending on the pathway and threat, toxicity/mobility, toxicity/persistence, or toxicity/persistence/bioaccumulation) factors. Within the waste characteristics factor category, factors have been modified so they are on linear scales. These modifications make the functional relationships between the HRS factors more consistent with the toxicity and exposure parameters evaluated in risk assessments.

Where possible, the final rule assigns similar maximum point values to factor categories across pathways. The likelihood of release (likelihood of exposure) factor category is assigned a maximum value of 550; the waste characteristics factor category is assigned a maximum value of 100 (except for the human food chain and environmental threats of the surface water migration pathway); the targets factor category is not assigned a maximum. EPA determined that in general targets should be a key determinant of site threat because the data on which the targets factors are based are relatively more reliable than most other data available at the SI stage.

Likelihood of release. Except in the air migration pathway, the proposed rule assigned the same maximum value to observed release and potential to release. In the final rule, an observed release is assigned a value of 550 points and potential to release has a maximum value of 500 in all pathways. This relative weighting of values reflects the greater confidence (the association of risks with targets) when reporting an observed release as opposed to a potential release. As a result of this change in point values at the factor category level, as well as the new maximums for most pathways, the values assigned to individual potential to release factors have been adjusted.

Waste characteristics. The proposed rule assigned a maximum point value to hazardous substance quantities of 1,000 pounds. Because some sites have hazardous substance quantities far in excess of that amount and because it is reasonable to assume that these sites present some additional risk, all else being equal, the final rule elevates the maximum value to quantities in excess of 1,000,000 pounds. Even when hazardous waste quantity is documented with precision, EPA concluded that there are diminishing returns in considering quantities above this amount.

Although the HRS does not employ the same type and quality of information that would be used to support a risk assessment (e.g., pounds of waste and mobility are combined in the ground water pathway as a surrogate for long-term magnitude of releases), as waste characteristics values rise, contamination resulting from conditions at the sites in general should be worse. As a result of using linear scales and incorporation of a multiplicative relationship between hazardous waste quantity, toxicity, and other waste characteristics factors, the influence of the waste characteristics factor category could be disproportionately large relative to the likelihood of release and targets factor categories in determining overall pathway scores. Therefore, EPA is limiting—through use of a scale transformation—the values assigned to the waste characteristics factor category, shown in Table 2–7 of the final HRS, to limit the effect of waste characteristics on the pathway scores.

While the waste characteristics factor values are limited to values of 0 to 100 in most cases, the waste characteristics factor category may reach values of up to 1,000 for both the human food chain and environmental threats in the surface water migration pathway. These exceptions have been made to accommodate the bioaccumulation factor (or ecosystem bioaccumulation factor), applied in these threats but not in other pathways or threats, which can add up to four orders of magnitude to the waste characteristics factor values before reduction to the scale values of 0 to 1,000.

Targets. The final rule includes two major structural changes to the targets factor category. Population factor values are not capped as they were in the proposed rule. This change allows a site with a large population but a low waste characteristics value to receive scores similar to a site with a smaller population but larger waste characteristics value (as would be done in a risk assessment). A second change in the targets factors involves the nearest individual (or intake or well) factors (i.e., the maximally exposed individual factors in the proposed rule). These factors are now assigned values based on exposure to Level I and Level II contamination (50 and 45 points, respectively). Potentially exposed nearest individuals are assigned a maximum of 20 points in all pathways. EPA changed the assigned values for these factors to give more relative weight to individuals that are exposed to documented contamination.

C. Hazardous Waste Quantity

In the NPRM, EPA proposed to change the hazardous waste quantity factor to allow the use of four levels of data depending on what data are available and how complete they are. Hazardous waste quantity for a source could be based on (a) hazardous constituent quantity, (b) the total quantity of hazardous wastes in the source, (c) the volume of the source, or (d) the area of the source. Each source at the site would be evaluated separately, based on data available for the source.

EPA received numerous comments relating to changes in the hazardous waste quantity factor. Several commenters agreed that allowing use of waste constituent data, when available, was an improvement over the original HRS. Several also supported the tiered approach to scoring hazardous waste quantity when constituent data were incomplete or unavailable.

Two commenters stated that the emphasis on hazardous constituent data will require more extensive and expensive site investigations. These commenters have misunderstood the revisions. The rule does not require the scorer to determine hazardous constituent quantities in all instances, but simply encourages use of those data when they are available. This approach allows a scorer the flexibility to use different types of available data for scoring hazardous waste quantity. At a minimum, the scorer need only determine the area of a source (or the area of observed contamination), which is routinely done in site inspections. Where better data are available, they may be used in scoring the factor. This approach is in keeping with the intent of Congress that the HRS should act as a screening tool for identifying sites warranting further investigation.

Several commenters stated that the methodology for determining hazardous waste quantity was too complex and time consuming, and that its administrative costs outweighed its benefits. Others found the proposed rule instructions and tables confusing and hard to follow.

EPA strongly disagrees with the claim that the costs of the revised approach to scoring waste quantity outweigh its benefits. The amount of hazardous substances present at a site is an important indicator of the potential threat the site poses. At the same time, EPA recognizes that cost is an important consideration. In revising the hazardous waste quantity factor, however, the Agency believes it has established an appropriate balance between time and cost required for scoring this factor and the degree of accuracy needed to evaluate the relative risk of the site properly.

In response to comments, EPA has modified the hazardous waste quantity scoring methodology to make it easier to understand and to use. The changes include elimination of proposed rule Table 2–13, Hazardous Waste Quantity Factor Evaluation Methodology and Worksheet. In addition, the scale for the hazardous waste quantity factor has been divided into ranges that span two orders of magnitude (100x) to reflect the uncertainty inherent in estimates of hazardous waste quantities at typical sites. The practical effect of this scale change is to reduce the data collection and documentation requirements. See §§ 2.4.2–2.4.2.2. The final rule also clarifies the treatment of wastes classified as hazardous under RCRA. Under CERCLA, any RCRA hazardous waste stream is considered a hazardous substance. If this definition were strictly applied in evaluating hazardous waste quantity of RCRA hazardous wastestreams, hazardous constituent quantity and hazardous wastestream quantity would be the same because the entire wastestream would be considered a hazardous substance. The final rule makes clear that only the constituents in a RCRA wastestream that are CERCLA hazardous substances should be evaluated for determining hazardous constituent quantity; for the other three tiers, however, the entire RCRA wastestream is considered as is any other wastestream.

As discussed in section III Q, EPA will consider removal actions when calculating waste quantities. EPA believes consideration of removal actions is likely to increase incentives for rapid actions. If there has been a removal at a site, and the hazardous constituent quantity for all sources and associated releases is adequately determined, the hazardous waste quantity factor value will be based only on the amount remaining after the removal. This will result in lowering some hazardous waste quantity factor values.

Where an adequate determination of the hazardous constituent quantity remaining after the removal cannot be made, EPA has established minimum hazardous waste quantity factor values in order to ensure that the HRS score reflects any continuing risks at the sites. In this case, the assigned hazardous waste quantity factor value will be the current hazardous waste quantity factor value (as derived in Table 2-6), or the minimum value, whichever is greater.

The proposed rule assigned a minimum hazardous waste quantity factor value of 10 when data on hazardous constituent quantity was not complete. In the final rule, for migration pathways (i.e., not the soil exposure pathway), if the hazardous constituent quantity is not adequately determined, and if any target is subject to Level I or II contamination, the minimum hazardous waste quantity factor value will be 100.

If the hazardous constituent quantity for all sources is not adequately determined, and none of the targets are subject to Level I or II contamination, the minimum factor value assigned for hazardous waste quantity depends on whether there has been a removal action, and what the hazardous waste quantity factor value would have been without consideration of the removal action. If there has not been a removal action, the minimum hazardous waste quantity factor value will be 10. If there has been a removal action and if a factor value of 100 or greater would have been assigned without consideration of the removal action, a minimum hazardous waste quantity factor value of 100 will be assigned. If the hazardous waste quantity factor value was less than 100 prior to consideration of the removal action, a minimum hazardous waste quantity factor value of 10 will be assigned. This will ensure that the Agency provides an incentive for removal actions and that in no case will consideration of removal actions result in an increased hazardous waste quantity factor value score.

D. Toxicity

The proposed HRS substantially changed the basis for evaluating toxicity. The major change was that hazardous substance toxicity would be based on carcinogenicity, chronic non-cancer toxicity, and acute toxicity. For each migration pathway and each surface water threat except human food chain and recreation, toxicity was combined with mobility or persistence factors to select the hazardous substance with the highest combined value for toxicity and the applicable mobility or persistence factor. For the human food chain threat, only substances with the highest bioaccumulation values were evaluated for toxicity/persistence. For the recreation threat, only substances with the highest dose adjusting factor values were evaluated for toxicity/persistence. In addition, ecosystem toxicity rather than human toxicity was evaluated for the environmental threat of the surface water migration pathway.

Several commenters expressed concern about or opposition to using the single most hazardous substance at a site to score toxicity, stating that the approach seems overly conservative and unlikely to distinguish sites on the basis of hazard. Some commenters suggested that EPA allow flexibility in weighting the toxicity values of multiple substances either by concentration, waste quantity, or proportion information, whenever such information is available. One commenter suggested basing toxicity on a fixed percentage of the hazardous substances known to be present at a site.

The Agency agrees that, for purposes of accurately assessing the risk to human health and the environment posed by a site, it would be preferable to evaluate the overall toxicity by considering all hazardous substances present, based on some type of dose- (or concentration-) weighted toxicity approach. EPA believes, however, that this approach is not feasible because the data requirements would be excessive. Such an approach would be feasible only when relative exposure levels of multiple substances are known or can reasonably be estimated; however, these data can be obtained only by conducting a comprehensive risk assessment. Extensive concentration data would be required to be confident that comparable concentrations are being used for the various substances, and that the multi-substance toxicity of the contaminants is not, in fact, being underestimated. Use of inadequate data could result in underestimating or overestimating the toxicity of substances in a pathway.

EPA considered a number of alternatives to the use of a single hazardous substance to score toxicity (mobility/persistence) and tested some of these on several real and hypothetical sites. The analyses included comparisons between the single most toxic substance and the average toxicity value for all substances, the average toxicity value for the 10 most toxic substances, and the concentration-weighted average value of all substances. These alternatives were also tested using toxicity/mobility values. The results of these analyses showed that using a single substance approach usually resulted in an assigned value (either toxicity or toxicity/mobility) that was within one interval in the scale of values of the alternatives tested; for example, the single substance approach would assign a value of 1,000 for toxicity whereas averaging the toxicities would assign a value of 1,000 or 100, the next lower scale value. (The final rule uses linear scales to assign values for toxicity, mobility, and persistence. The scales for toxicity now range from 0 to 10,000 rather than 0 to 5; consequently, the default value for toxicity is now 100 rather than 3.) The Agency recognizes the uncertainty in the use of the single substance approach, but concludes that it is a reasonable approach for a screening model, especially given the general unavailability of information to support alternatives. In making this judgment, the Agency notes that the single substance approach to evaluating the toxicity factor was not identified in SARA as a portion of the HRS requiring further examination, even though it had been used in the original HRS and EPA had received criticism similar to the above comments prior to the enactment of SARA.

Several commenters suggested that additive, synergistic, or antagonistic effects among substances be considered in scoring toxicity when several substances are found at a site. In particular, one commenter suggested increasing the scores for sites with a large number of hazardous substances to account for additive or synergistic effects.

As noted in EPA's 1988 *Technical Support Document for the Proposed Revisions to the Hazard Ranking System*, quantitative consideration of synergistic/antagonistic effects between hazardous substances is generally not possible even in RI/FS risk assessments because appropriate data are lacking for most combinations of substances. Interactive effects have been documented for only a few substance mixtures, and the Agency's risk assessment guidelines for mixtures (51 FR 34014, September 24, 1986) emphasize that although additivity is a theoretically sound concept, it is best applied for assessing mixtures of similar acting components that do not interact. Thus, the Agency believes that consideration of interactive effects in evaluating toxicity in the HRS is not feasible, nor is it necessary to allow use of the HRS as a screening model. The Agency rejects the suggestion that scores should simply be raised for sites with numerous substances because this approach ignores the technical complexities related to interactions (i.e., the possibility of antagonistic effects.)

One commenter suggested that a waste's toxicity should be assessed in terms of its "degree of risk," and that this could be measured by comparing constituent concentrations at the point of exposure to appropriate toxicity reference levels. Two commenters stated that toxicity should be measured at a likely point of human exposure rather than at the waste site.

The toxicity of a substance, as used in the HRS, is an inherent property, often expressed quantitatively as a dose or exposure concentration associated with a specific response (i.e., a dose-response relationship). These toxicity values, in general, are independent of expected environmental exposure levels; many are based on laboratory tests on animals. Risk, on the other hand, is a function of toxicity, the concentration of a substance in environmental media to which humans may be exposed, and the likelihood of exposure to that medium (and the population likely to be exposed). The toxicity factor in the waste characteristics factor category of the HRS is intended to reflect only the inherent toxicity (i.e., the basic dose-response relationship) of substances found at the site. The HRS as a whole is intended to evaluate, to the extent feasible, relative risks posed by sites by including factors for likelihood of release, waste quantity, toxicity, and the proximity of potentially exposed populations. If actual contamination (for example, of drinking water) has been detected at a site, the measured environmental concentration of each substance is compared with its appropriate health-based or ecological-based concentration limit (i.e., its benchmark). If these environmental concentrations equal or exceed a benchmark, certain target factors are assigned higher values than if environmental concentrations are less than benchmarks.

Two commenters suggested using Cancer Potency Factors to score toxicity only for Class A and B1 carcinogens, and using reference doses (RfDs) for scoring Class B2 and C carcinogens (i.e., substances for which there is inadequate or no direct human evidence of carcinogenicity).

In response, EPA believes that because the HRS is a screening tool, it should maintain a conservative (i.e., protective) approach to evaluation of potential cancer risks. EPA's 1986 *Guidelines for Carcinogen Risk Assessment* (51 FR 34014, September 24, 1986) provide for substances in Class A and Class B (both B1 and B2) to be regarded as suitable for quantitative human risk assessment. In general, according to EPA's 1989 *Risk Assessment Guidance for Superfund: Human Health Evaluation Manual,* Class C substances are evaluated for cancer risks within the Superfund risk assessment process. Thus, the use of cancer risk information for Class B2 and C substances in the HRS is consistent with the objective of maintaining a conservative approach and with other Agency and Superfund program risk assessment guidelines.

In response to comments that the best available data should be used to score sites, that accepted Agency practices be relied on, and that consistency across pathways be encouraged, the Agency has modified slightly the way the toxicity value for a substance is selected. The final rule requires the use of carcinogenicity and chronic toxicity data, when available, over acute toxicity data. If both slope factors and RfDs are available, the higher of the values assigned for these types of toxicity parameters is used. If neither is available, but acute toxicity data are available, the acute toxicity data are used to assign toxicity factor values. EPA decided to give preference to slope factors and RfD values because these undergo more extensive Agency review and are based on long-term exposure studies.

E. Radionuclides

The proposed HRS assigned radionuclides a maximum toxicity value, but included no other procedures specific to radionuclides.

One commenter, the U.S. Department of Energy (DOE), asserted that the proposed HRS "* * * contains an inequitable bias regarding radionuclides * * *" DOE specifically criticized assigning maximum toxicity factor values to radionuclides, "* * * where, in fact, the health impact associated with radionuclides is associated with the type of decay, the level of decay energy, the half-life, the mobility, the concentration of the radionuclide, internal biological factors, and external pathway factors." DOE proposed using concepts for evaluating radionuclides that were included in its Modified Hazard Ranking System (mHRS). In its subsequent comments on the HRS field test report, DOE stated that it considered the "* * * method of handling radionuclides in the proposed revised HRS to be a serious flaw in the evaluation system."

In the final rule, EPA has clarified and significantly changed how radionuclides are evaluated. Instead of using or adapting the mHRS directly, however, EPA modified the proposed HRS to account more fully for radionuclides based on EPA's own methods for evaluating them, which are similar to and generally consistent with the radiation analysis concepts underlying the mHRS.

The final rule evaluates radionuclides within the same basic structure as other hazardous substances, and the evaluation of many individual HRS factors is the same whether radionuclides are present or not. Table 7–1 of the final rule lists HRS factors and indicates which are evaluated differently for radionuclides. Essentially, radionuclides are simply treated as additional hazardous substances with certain special characteristics that are accounted for by separate scoring rules for some HRS factors. For sites containing only radionuclides, the scoring process is very similar to the process at other hazardous substance sites, except that different scoring rules are applied to a number of substance-specific factors and a few other factors. For sites containing both radionuclides and other hazardous substances, both types of substances are scored for all HRS factors that are substance-specific, with overall factor values based either on combined values or the higher of the values, as appropriate.

EPA notes that, although some radioactive substances are statutorily excluded from the definition of "hazardous waste" in both CERCLA and RCRA (specifically, source, special nuclear, and byproduct material as defined in the Atomic Energy Act of 1954), such substances may be, and generally are, "hazardous substances" as defined in section 101(14) of CERCLA and therefore may be addressed under CERCLA. Radioactive substances should be included in HRS scoring and section 7 of the final rule is intended to facilitate that analysis. It also should be noted that two narrow categories of releases (either from "nuclear incidents" or from sites designated under the Uranium Mill Tailings Radiation Control Act of 1978) are excluded from CERCLA's definition of the term "release" (CERCLA section 101(22)), and such releases should not be scored using the HRS.

The major changes to the HRS in the evaluation of radionuclides apply to establishing observed releases, to factors in the waste characteristics category, and to determining the level of actual contamination in the targets factor category. The HRS components that have been modified are briefly described below.

The criteria for establishing an observed release through analysis of samples for radionuclides differ considerably from the criteria used for other hazardous substances. These criteria are divided into three groups: radionuclides that occur naturally or are ubiquitous in the environment; manmade radionuclides that are not ubiquitous in the environment; and gamma radiation (soil exposure pathway only). (See § 7.1.1.)

The hazardous waste quantity factor for sources (and areas of observed contamination) containing radionuclides has been modified to reflect the different units used to measure the amount of radiation (curies, a measure of activity) versus the units used for other hazardous substances (pounds, a measure of mass). EPA believes it is preferable to use activity units rather than mass units because activity is the standard measure of radiation quantity and is a better indicator of energy released and potential to cause human health damage than is mass. In addition, the hierarchy for evaluating the waste quantity factor for sources (and areas of observed contamination) containing radionuclides is limited to Tiers A and B. Tiers C and D, based on source volume and source area, respectively, are not used because adequate data to derive their quantitative relationship to Tier A were unavailable. Thus, the waste quantity factor is based either on radionuclide constituent quantity (Tier A) or radionuclide wastestream quantity (Tier B).

For sites containing only radionuclides, hazardous waste quantity is calculated based on the activity content of the radionuclides or radionuclide wastestreams associated with each source. For sites with both radionuclides and other hazardous substances, hazardous waste quantity is evaluated separately for the two types of hazardous substance for each source, and the values are then summed in determining the hazardous waste quantity value. The scale for scoring radionuclide waste quantity was derived based on concepts of risk equivalence between radionuclides and other hazardous substances.

In the proposed rule, all radionuclides were automatically assigned a maximum default value for the toxicity factor. The final rule evaluates radionuclides individually on the basis of human toxicity, across a range of factor values based on the potential to cause cancer (i.e., cancer slope factors). Non-cancer effects are not considered for radionuclides because cancer is generally the most significant toxic effect. Incorporated in the development of cancer slope factors are the type of radioactive decay; energy emitted during decay; biological uptake, distribution, and retention; and radiation dose-response relationship. Thus, across the set of scoring ranges used, radionuclides that are more potent carcinogens per unit activity now receive higher toxicity factor values than those that are less potent. The new toxicity scoring scale for radionuclides was derived in a manner consistent with the derivation of the existing carcinogenicity scale for other hazardous substances. Taken together, the new toxicity and hazardous waste quantity scales for radionuclides result in a risk equivalence between radionuclides and other hazardous substances.

Mobility of radionuclides in both the air and ground water migration pathways is evaluated in the same way as mobility for other hazardous substances; that is, on the basis of the chemical and physical characteristics of the radionuclide. Similarly, the bioaccumulation (and ecosystem bioaccumulation) potential factor is evaluated in the same way for radionuclides as for other hazardous substances. The final rule clarifies that radionuclides should be scored for these factors in all relevant pathways.

The persistence factor in the surface water migration pathway has been modified so that radionuclides are evaluated solely on the basis of half-life, which for HRS purposes is based on both radioactive half-life and volatilization half-life. Sorption to sediments is not considered, nor are hydrolysis, photolysis, or biodegradation. Other than this change in the processes considered to estimate surface water half-life, the scoring of the persistence factor is the same for radionuclides as for other hazardous substances.

The final rule extends to radionuclides the benchmark concept used throughout the HRS for weighting certain targets factor values. Measured levels of specific radionuclides at potential exposure points are compared to benchmark levels, and additional weight is given to targets subject to actual contamination (Levels I and II). This approach for weighting target factors using benchmarks is similar for radionuclides and for other hazardous substances, although both the specific benchmark values used for radionuclides and the methods for deriving the values are different. Benchmarks for evaluating radionuclide contamination parallel those used for other hazardous substances in that available Federal standards and screening concentrations are used when applicable. At sites with both radionuclides and other hazardous substances, each radionuclide and other substance is evaluated separately. If no individual substance equals or exceeds its benchmark, the ratios of the measured concentrations to the screening concentrations for cancer for radionuclides and other hazardous substances are added. Radionuclides are not evaluated using screening concentrations for non-cancer effects.

Specific benchmark values for radionuclides are in activity units instead of mass units, however, to reflect the appropriate measurement units for the level of radionuclide contamination. Radionuclide benchmarks include drinking water maximum contaminant levels (MCLs) for both the ground water and the surface water/drinking water threat pathways; Uranium Mill Tailings Radiation Control Act (UMTRCA) standards for the soil exposure pathway; and screening levels corresponding to 10^{-6} individual cancer risk for inhalation or oral exposures, as derived from cancer slope factors, for all pathways and threats incorporating human health benchmarks. The radionuclide benchmarks are consistent with EPA's radionuclide risk assessment methods in that they incorporate standard data or assumptions about contact/consumption rates for various environmental media and radiation dose-response, as well as the specific radionuclide's type of decay, decay energy, biological absorption, and biological half-life. Furthermore, radionuclide benchmarks for the soil exposure pathway account for external exposure (i.e., exposure to radiation originating outside the human body) from gamma-emitting radioactive materials in surficial material as well as from ingestion, which is the sole basis for non-radioactive hazardous substance benchmarks for the soil exposure pathway, because external exposure from gamma-emitting radionuclides can be an extremely important exposure route.

F. Mobility/Persistence

The proposed rule added mobility factors to both the ground water and air migration pathways and modified the persistence factor in the surface water migration pathway to consider a greater number of potential degradation mechanisms.

The Agency received a large number of comments critical of several aspects of the ground water mobility factor. The most common issues included:

- Concern about the use of coefficients of aqueous migration to establish mobility values for inorganic cations and anions;
- Suggestions that solubility values, distribution coefficients, and other measures be used to establish mobility values for anions and cations; and
- Requests that the same measures of mobility be used for organics and inorganics.

Criticism of the use of the coefficients of aqueous migration focused on its obscurity; except for geochemists, few scientists are familiar with the measure. In response to these comments and because coefficients of aqueous migration are not available for all hazardous substances and radionuclides, the Agency decided to replace coefficients of aqueous migration.

The majority of commenters stated a preference for using parameters related either to hazardous substance release (solubility) or to transport (distribution coefficients) as measures of mobility. The ground water mobility factor is intended to reflect the fraction of a hazardous substance expected to be released from sources, migrate through porous media, and contaminate aquifers and the drinking water wells that draw from them. Because mobility is concerned with both release and transport, the Agency concluded that mobility for all hazardous substances in ground water will be evaluated using both solubility and distribution coefficient values. A default value is assigned when none of the hazardous substances eligible to be evaluated can be assigned a mobility factor value based on available data.

A number of commenters raised questions about the persistence factor in the surface water migration pathway. In general, the commenters were divided between those who wanted more degradation mechanisms considered and those who believed the equation in the proposed rule for calculating half-lives was too complex. Several commenters suggested including sorption of substances by sediments.

In response to these comments, EPA has made several changes to the persistence factor. The free-radical oxidation half-life has been dropped from the equation used to calculate half-life because the data on which its half-life values are based are typically derived from ideal, laboratory conditions that differ greatly from conditions found in nature; few field validation studies have been conducted to provide a basis for extrapolating these laboratory values to natural environments. Thus, EPA concluded that including free-radical oxidation in the persistence equation resulted in an overemphasis of the influence of free-radical oxidation as a degradation mechanism. For hazardous substances that sorb readily to particulates found in natural water bodies, the persistence equation as proposed overemphasized the importance of degradation mechanisms that occur in the liquid phase. Log K_{ow}, the logarithm of the n-octanol-water partition coefficient, has been added to account for sorption to sediments.

The Agency received several comments concerning the mobility factors in the air migration pathway. The most significant of the issues raised by commenters were:

- Whether consideration of mobility in both the likelihood of release factor category and the waste characteristics factor category counts mobility twice;
- Whether the approach used in the proposed rule properly reflected the dynamics of releases of gases from sources into the atmosphere; and
- Whether the Thornthwaite P-E Index was sufficient as the sole measure of particulate mobility and whether particle size should be included.

In response to these and other related structural and air migration pathway comments, the Agency thoroughly re-assessed the adequacy of the mobility factors in the likelihood of release and waste characteristics factor categories. Based on this review, EPA has made several changes to the mobility factors in the final rule. In response to the "double counting" issue, the Agency believes there are differences between mobility in the context of likelihood of release and mobility in the context of waste characteristics. The potential to release mobility factor is a measure of the likelihood that a source at a site will release a substance to the air; the waste characteristics mobility factor, together with the hazardous waste quantity factor, is a measure of the magnitude of release. To highlight these differences, the names of the likelihood of release mobility factors have been changed to gas (or particulate) migration potential.

In response to comments on air migration pathway mobility and structure, EPA reviewed gas and particulate release rate models to develop revised mobility factors that improve evaluations of release magnitude and duration. The gas and particulate mobility factors in the final rule are a result of that review. The gas mobility factor is based on a simplified release model and is determined by the vapor pressure of the most toxic/mobile hazardous substance available for migration to the atmosphere at the site. The particulate mobility factor is based on a simplified fine-particle wind-erosion model and reflects the combined effects of differing wind speeds and soil moisture. Analyses indicated that soil moisture was dominant over both wind speed and particle size, which are essentially equal in effect. Because of the comparative difficulty of determining particle sizes in an SI, a single particle size was assumed to apply to all sites. This constant particle size value was factored into the simplified model yielding the factor in the final rule.

G. Observed Release

The proposed HRS described how to determine whether an observed release was significantly above background levels based on multiples of detection limits and background concentrations.

Some commenters stated that the proposed revisions treated observed release in an overly complex manner. A number of commenters, primarily from the mining industries, were concerned about the consideration of background concentration in determining an observed release. (See Section III P below for a summary of their concerns and EPA's response.)

As in the proposed rule, observed releases may be established based on either direct observation or chemical analysis of samples. In the case of direct observation, material (e.g., particulate matter) containing hazardous substances must be seen entering the medium directly or must have been deposited in the medium.

EPA has replaced the proposed rule criteria for establishing an observed release by chemical analysis with simpler criteria. In the final HRS, an observed release is established when a sample measurement equals or exceeds the sample quantitation limit (SQL) and is at least three times above the background level, and available information attributes some portion of the release of the hazardous substance to the site. (The SQL is the quantity of a hazardous substance that can be reasonably quantified, given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (e.g., dilution, concentration).) When a background concentration is not detected (i.e., below detection limits), an observed release is established when the sample measurement equals or exceeds the SQL. Any time the sample measurement is less than the SQL, no observed release is established. Table 2-3 of the final rule provides the criteria for determining when analytic sampling information is sufficient for establishing an observed release (or observed contamination in the soil exposure pathway). The final rule also provides procedures to be followed when the SQL is unavailable and defines various types of detection and quantitation limits in the context of the HRS. (See § 2.3 of the final rule.)

H. Benchmarks

SARA requires that EPA give high priority to sites that have led to closing of drinking water wells or contamination of principal drinking water supplies. To respond to this mandate, the proposed rule added health-based benchmarks to the ground water and surface water migration pathways; in addition, ecological-based benchmarks were added to evaluate sensitive environments targets in surface water. In the proposed rule, population factors were evaluated at Level I if a health-based benchmark had been exceeded. If actual contamination was present, but the benchmark was not exceeded, populations were evaluated based on two levels of contamination (i.e., Level II and Level III). Sensitive environments in the surface water migration pathway were evaluated based on two levels of actual contamination (exceeding benchmark or not exceeding benchmark). Where several hazardous substances were present below benchmarks, the percentages of their concentrations relative to their benchmarks were added to determine which level was used to assign values.

Of the commenters on this issue, most supported EPA's proposal to give extra weighting to sites where measured exposure-point concentrations exceed benchmarks. One commenter who dissented suggested giving extra weighting to sites where actual contamination is documented; documentation of an observed release (or observed contamination) would be the only criterion for assigning higher values to target factors, and the relationship of the concentration of hazardous substances to benchmarks would not be used. The other dissenting commenter suggested that EPA re-evaluate the role of health-based benchmarks in the HRS because common sense, and other laws, will discourage people from drinking water contaminated above benchmark levels, and because evaluating this factor will entail large resource expenditures for marginal gains in discrimination.

The final rule weights most targets based on actual and potential exposure to contamination across all pathways and threats, including those for which benchmarks were not originally proposed, because EPA believes that this approach both improves the ability of the HRS to identify sites that pose the greatest threat to human health and the environment and increases the internal consistency of the HRS. (See §§ 2.5, 2.5.1, 2.5.2, 3.3.1, 3.3.2, 4.1.2.3.1, 4.1.2.3.2, 4.1.3.3.1, 4.1.3.3.2, 4.1.4.3.1, 4.2.2.3.1, 4.2.2.3.2, 4.2.3.3.1, 4.2.3.3.2, 4.2.4.3.1, 5.1.3.1, 5.1.3.2, 6.3.1, 6.3.2, 6.3.4, 7.3.1, 7.3.2.) In the final rule, both the population factors and the factors reflecting the hazard to the nearest individual (or well or intake) are evaluated in relation to health-based benchmarks in all pathways. The sensitive environment factor in the surface water environmental threat is weighted in relation to ecological-based benchmarks; however, in the soil exposure and air migration pathways, the sensitive environment factor is weighted simply on the basis of exposure to actual contamination, and no benchmarks are used.

The Agency chose to use benchmarks in all pathways in response to comments that specifically suggested such a change; it is also responding to comments that the HRS should better reflect relative risks and that the approaches in all pathways should be consistent. The Agency has concluded that the concerns expressed by commenters outweigh the concerns about uncertainties in the evaluation of samples collected in air and soil and about the lack of regulatory standards and criteria on which to base soil or air benchmarks that led the Agency not to include benchmarks for those pathways in the proposed rule. In short, EPA carefully considered this point and concluded that the consistent application of benchmarks across all pathways provides for the most reasonable use of data given the purpose of the HRS as a screening tool.

EPA generally selected specific criteria based on applicable or relevant and appropriate requirements (ARARs), excluding State standards, that have been selected for the protection of public health and the environment as outlined in the NCP (55 FR 8666, March 8, 1990). In the HRS NPRM, EPA proposed to use MCLs, maximum contaminant level goals (MCLGs), and screening concentrations (SCs) based on cancer slope factors as drinking water benchmarks, and Food and Drug Administration (FDA) Action Levels as benchmarks for the human food chain threat. EPA also proposed to use Ambient Water Quality Criteria (AWQC) as ecological-based benchmarks for the environmental threat. EPA received 21 comments from 12 commenters on which benchmarks the HRS should use and whether additional information should be considered in establishing benchmarks. Opinion was divided on the use of specific types of benchmarks: three commenters supported the use of MCLs; three did not. Two commenters supported the use of MCLGs, two opposed such use, and one suggested that EPA consider the economic impact of using the value of 0 (i.e., the MCLG for a carcinogen) as a health-based benchmark. Two commenters suggested including relevant State drinking water standards, and one suggested including concentrations based on RfDs. One commenter expressed concern that the current lack of water quality standards for many substances might make the benchmark system ineffective in identifying sites that pose a significant threat to human health. Two commenters suggested that carcinogen weight of evidence should be used in establishing SCs (e.g., the individual risk level should be lower for a Class A carcinogen than for a Class B2 carcinogen). Two commenters suggested considering other important routes of exposure (e.g., inhalation of hazardous substances volatilized from water, or dermal contact with contaminated water) in establishing drinking water benchmarks.

EPA conducted a number of analyses on specific benchmarks and on the modification of factors to consider in establishing HRS benchmarks. As a result of public comments and these analyses, EPA has concluded that the HRS is improved by including concentrations based on nationally uniform standards, criteria, or toxicity values as health-based or ecological-based benchmarks in all pathways and threats. EPA's conclusion is based on several considerations. First, the addition of benchmarks across all pathways and the use of ARARs for those benchmarks improves linkages with the RI/FS process. That is, the HRS benchmarks will be those used most frequently during RI/FSs, and the additional points provided by equalling or exceeding a benchmark will aid in identifying areas requiring follow-up in the RI/FS. Second, the internal consistency of the HRS is improved by using benchmarks because concentrations measured at or above benchmark levels are treated in a parallel manner across all pathways, allowing more consistent and fuller use of the relatively costly sampling data collected during the SI. Third, the number of hazardous substances for which at least one health-based or ecological-based benchmark is available is increased, allowing for more uniform assessment of sites nationwide.

The benchmark criteria that the Agency has concluded are most appropriate for each pathway and threat are listed below. As discussed above, EPA agrees with comments suggesting that benchmarks also be used in the soil exposure and air migration pathways and has selected criteria for these pathways based upon the kinds of factors discussed above. While EPA believes the criteria for the soil exposure and air migration pathways in the final rule are appropriate, it is open to any comments that members of the public may wish to submit regarding these criteria and specifically solicits such comments at this time. EPA asks that any such comments be submitted on or before (30 days after the date of publication in the **Federal Register**).

For the final rule; EPA has selected the following types of benchmarks in each pathway and threat, subject to any revisions in the criteria for air and soil exposure that may be made in response to comments. (Benchmarks for radionuclides are discussed in Section III E of this preamble.)

- Benchmarks in the ground water migration pathway and the surface water drinking water threat include MCLs, non-zero MCLGs, screening concentrations (SCs) for non-cancer effects based on RfDs for oral exposures, and SCs for cancer based on slope factors for oral exposures and 10^{-6} individual cancer risk (see Table 3–10). Because SCs based on RfDs and slope factors are used as drinking water benchmarks, MCLGs with a value of 0 have been dropped as HRS benchmarks.
- Benchmarks in the surface water human food chain threat include FDA Action Levels for fish or shellfish, SCs for non-cancer effects based on RfDs for oral exposures, and SCs for cancer based on slope factors for oral exposures and 10^{-6} individual cancer risk (see Table 4–17).
- Benchmarks in the surface water environmental threat include AWQC and Ambient Aquatic Life Advisory Concentrations (AALACs); AALACs will be considered as they become available (see Table 4–22).
- Benchmarks in the soil exposure pathway include SCs for non-cancer effects based on RfDs for oral exposures, and SCs for cancer based on slope factors for oral exposures and 10^{-6} individual cancer risk (see Table 5–3).
- Benchmarks in the air migration pathway include National Ambient Air Quality Standards, National Emission Standards for Hazardous Air Pollutants (NESHAPs) that are expressed in ambient concentration units, SCs for non-cancer effects based on RfDs for inhalation exposures, and SCs for cancer based on slope factors for inhalation exposures and 10^{-6} individual cancer risk (see Table 6–14).

Several commenters suggested technical refinements for deriving health-based benchmarks. Although qualifying information is useful and important and is, in fact, used extensively in the RI/FS process, the benefits of including such information in the HRS must be balanced against its limited scope and purpose as well as the limited data available to determine concentration at the point of exposure. Consequently, in the final rule:

- All health-based benchmarks are set in reference to the major exposure concern for each pathway or threat (e.g., benchmarks in the air migration pathway are set in reference to inhalation only; benchmarks in drinking water, the human food chain threat, and the soil exposure pathway are set in reference to ingestion), except for radionuclides for which external exposure is also considered in the soil exposure pathway;
- All benchmarks are set in reference to uniform exposure assumptions that are consistent with RI/FS procedures (e.g., water consumption is assumed to be two liters per day; body weight is assumed to be 70 kg);
- State water quality standards and other State or local regulations are not included as benchmarks because they would introduce regional variation in the HRS;
- A hierarchy has been developed to provide a single benchmark concentration for each hazardous substance by pathway and threat; and
- Qualitative weight-of-evidence is not used in deriving SCs for carcinogens.

In the NPRM, EPA requested comments on how many tiers (levels) of actual contamination to consider when weighting populations relative to benchmarks (i.e., which of three alternative methods presented should be adopted). EPA received two comments on this issue and three related comments regarding the weighting factors for each level. One commenter supported Alternative 2 (i.e., use of two levels of observed contamination and one level of potential contamination). Another commenter suggested that Level II and Level III concentrations be combined to include the range of contaminant levels above background, but below health-based benchmarks. A third commenter suggested that the weighting factors for each level be reconsidered. A fourth commenter suggested that 1/1000 of a benchmark factor is inappropriate because it is excessively conservative and difficult to detect. The fifth commenter suggested that because Level III represents concentrations with cancer risks below 10^{-7}, populations exposed to Level III concentrations should not be considered in the population category of drinking water threats.

EPA conducted a number of analyses on the subject of benchmark tiers and has dropped Level III contamination. In the final rule, Level I contamination is defined as concentration levels for targets which meet the criteria for actual contamination (see § 2.5 of the final rule) and are at or above media-specific benchmark levels; Level II contamination is defined as concentration levels for targets which either meet the criteria for actual contamination but are less than media-specific benchmarks, or meet the criteria for actual contamination based on direct observation; and potential contamination is defined as targets that are potentially subject to releases (i.e., targets that are not associated with actual contamination for that pathway or threat). These three tiers are used to assign values to both the nearest individual (or well or intake) and the population factors. As a result of EPA's analyses of benchmark issues, the weighting assigned to Level I and Level II contamination has been changed and made consistent across pathways. For example, Level I populations are now multiplied by a factor of 10 in all pathways. As in the proposed rule, potentially contaminated populations and nearest individuals (or wells or intakes) are distance or dilution weighted.

The proposed rule summed the ratios of all hazardous substances to their individual benchmarks as a means of defining the level of actual contamination, and EPA requested comments on the appropriateness of this approach to scoring multiple substances detected in drinking water. Of the 10 comments in response to this proposal, nine strongly opposed the proposed approach, particularly when applied to drinking water standards (i.e., MCLs), MCLGs, and noncarcinogens. One commenter supported the proposed approach.

EPA has decided to retain the summing of ratios of hazardous substances to their individual benchmarks, but in a modified form. The final rule sums measures of carcinogenic and noncarcinogenic effects separately;

concentrations specified in regulatory limits (e.g., NAAQS, MCLs, or FDA Action Levels) are not included in the summing algorithm. EPA recognizes that a more precise estimate of relative risk would be obtained by summing the ratios of hazardous substances to their individual RfD-based concentrations by segregating substances according to major effect, target organ, and mechanism of action. In fact, such a segregation is recommended during the RI/FS. However, health-based benchmarks are used in the HRS to provide a higher weight to populations exposed to hazardous substances at levels that might result in adverse health effects. As a consequence, EPA believes that use of the summed ratios of hazardous substances within pathways and threats to their individual RfD-based benchmark levels is appropriate for the screening purpose of the HRS.

EPA proposed and solicited comments on a range of 10^{-4} to 10^{-7} for individual cancer risk levels of concern in establishing levels of actual contamination with respect to health-based benchmarks. EPA received eight comments concerning this risk range. Four commenters suggested restricting the range to 10^{-4} to 10^{-6}, primarily because this range would be consistent with risk levels identified in the NCP and used by other EPA regulatory programs. Three commenters said the SCs for carcinogens should be the 10^{-6} individual cancer risk level. One commenter stated that 10^{-4} to 10^{-7} generally is the risk range considered for Superfund response. The final rule defines only two levels of actual contamination: significantly above background and equal to or above benchmark, and significantly above background but less than benchmark. When an applicable or relevant and appropriate requirement does not exist for a carcinogen, EPA selects remedies resulting in cumulative risks that fall within a range of 10^{-4} to 10^{-6} incremental individual lifetime cancer risk based on the use of reliable cancer potency information. EPA has selected the 10^{-6} screening risk level in defining the HRS benchmark level for cancer risk because it is the lower end of the cancer risk range (i.e., 10^{-4} to 10^{-6}) identified in the NCP and used by other EPA regulatory programs.

Two commenters objected to assigning releases of substances with no benchmarks to Level II as a default value. One suggested assigning unknowns to Level III because substances that are frequently released or are known or suspected to cause health problems are studied before those that are not. The other objected because "the absence of data is not data."

Because EPA has decided to adopt a benchmark system incorporating only two levels of actual contamination, the default level is Level II. If none of the hazardous substances eligible to be evaluated at a sampling location has an applicable benchmark, but actual contamination has been established, the actual contamination at the location is assigned to Level II.

I. Use Factors

The proposed HRS included factors to assign values to uses of potentially affected resources in the three migration pathways: ground water use (drinking water and other) in the ground water migration pathway, drinking water and other use and fishery use in the surface water migration pathway, and land use in the air migration pathway.

EPA received a number of comments on each of these factors. The commenters raised specific objections to distinctions drawn among various potential uses and to the weights assigned to those uses. For example, for the ground water use factor, some commenters asserted that the HRS should not delineate between private and public water supply contamination. For the surface water use factors, a commenter recommended a range of assigned values for irrigation of commercial food or forage crops because of variations in rates of uptake of hazardous substances. For the land use factor, two commenters urged giving greater consideration to institutional land use because of the sensitive populations that would be exposed.

Partly in response to these comments, and in an effort to simplify the HRS, EPA has substantially revised the method of incorporating resource use information in targets factor categories. The field test indicated that collecting data on each of the use factors involved considerable effort at many sites. In addition, because of weighting factors applied to potentially contaminated populations, at sites with no actual contamination, use factors were contributing more to the targets value than were large populations. As some commenters pointed out, the use factors mixed concerns about human health with concerns about the value of the resource and, therefore, were partially redundant with population factors. To avoid redundancy with human health concerns as evaluated through the population factor, EPA has made major changes in how resource uses are evaluated and scored in the final rule.

In each migration pathway, the use factors have been replaced by a resources factor that assigns values to resources appropriate for the pathway. In addition, a resources factor has been added to the soil exposure pathway. The resources factor for a pathway is assigned a maximum of five points if any of the resource uses for that pathway exists within the target distance limit in the ground water or surface water migration pathway, within one-half mile of a source in the air migration pathway, or within an area of observed contamination in the soil exposure pathway. If none of the uses exists, the factor is assigned a value of 0.

The resources factor in the ground water migration pathway assigns a value of 5 for wells supplying water for irrigation of commercial food or commercial forage crops (five-acre minimum), watering of commercial livestock, as an ingredient in commercial food preparation, or as a supply for commercial aquaculture or for a major or designated water recreation area (excluding drinking water use)—for example, water parks (see § 3.3.3). A value of 5 is also assigned if the water in the aquifer is usable for drinking water, but not used.

The resources factor in the drinking water threat of the surface water migration pathway assigns a value of 5 if the surface water is designated by a State for drinking water use but not used, or is usable but not used for drinking water. In addition, points may be assigned for intakes supplying water for irrigation of commercial food or commercial forage crops (five-acre minimum), watering of commercial livestock, as an ingredient in commercial food preparation, or if the water body is used as a major or designated water recreation area (see § 4.1.2.3.3). The fishery use factor has been deleted to avoid double-counting of fisheries.

In the air migration pathway, the resources factor is assigned a value of 5 if there is commercial agriculture or commercial silviculture, or a major or designated recreation area within a half mile of a source (see § 6.3.3). The distance of one-half mile for the agricultural, silvicultural, and recreational areas was determined by the distance weighting factors for the air migration pathway, which reflect the rapid diminishing of air contaminant concentrations beyond one-half mile from a source. Therefore, resources beyond this distance are not considered in this pathway.

A resources factor has also been added to the resident population threat of the soil exposure pathway. The factor is assigned a value of 5 if there is commercial agriculture, commercial silviculture, or commercial livestock production or grazing on an area of observed contamination at the site.

J. Sensitive Environments

The proposed rule expanded the list of sensitive environments considerably and, for the surface water and air pathways, counted all sensitive environments within the target distance limit, rather than just the one with the highest assigned value; for the soil exposure pathway, only the sensitive environment assigned the highest value was counted. Potentially contaminated sensitive environments were distance/dilution weighted; in the surface water environmental threat, actual contamination of sensitive environments was evaluated on the basis of ecological-based benchmarks.

EPA received relatively few comments on issues related to sensitive environments. However, participants in the field test requested clarification of three categories of sensitive environments involving spawning areas, migratory pathways, and feeding areas critical for the maintenance of a fish species within a river system, coastal embayment, or estuary. In particular, critical migratory pathways and feeding areas were difficult to identify and seemed to provide little discrimination among surface waters in some areas of the country.

EPA has redefined critical spawning areas to include shellfish beds, and has limited the areas to those used for intense or concentrated spawning by a given species. Critical migratory pathways and feeding areas have been combined into a single category and limited to anadromous fish (i.e., fish that ascend from the ocean to spawn), which face special problems in migrating substantial distances between the ocean and their spawning areas. These feeding areas are further restricted to only those areas in which the fish spend extended periods of time. Examples include areas where juveniles of anadromous species feed for prolonged periods (e.g., weeks) as they prepare to migrate from fresh water to the ocean, and holding areas along the adult migratory pathways.

Terrestrial areas used for breeding by large or dense aggregations of vertebrates (e.g., heron rookery, sea lion breeding beach) have been added to the list of sensitive environments to parallel the spawning areas listed for fish species. Water segments designated by a State as not attaining toxic water quality standards have been removed because these environments are already degraded and thus are not analogous to the other sensitive environments listed. Also, the assigned value for State designated areas for protection or maintenance of aquatic life has been changed from 50 points to 5 points (see Table 4–23 in final rule) to be consistent with the points assigned under the resources factor for State designated areas for drinking water use.

In response to public comment, National Monuments have been added to the 100-point category on the list of terrestrial sensitive environments considered under the soil exposure pathway. "State designated natural areas" and "particular areas, relatively small in size, important to the maintenance of unique biotic communities" were also added to the list of terrestrial sensitive environments in response to public comment. These latter two categories were already considered in the air and surface water pathway evaluation of sensitive environments. (See Table 5–5.)

The method for evaluating wetlands has been revised, partially because participants in the field test had difficulty identifying discrete wetlands. Some wetlands were patchy and could be classified as one large or many small wetlands. Other wetlands were divided by rivers or roads, or changed from one type of wetland to another, making it unclear whether more than one wetland should be counted. To eliminate these difficulties, wetlands are now evaluated on the basis of size and level of contamination. In the air migration pathway, wetlands are evaluated based on acreage and level of contamination (see § 6.3.4); in the surface water migration pathway, wetlands are evaluated by linear frontage along the surface water hazardous substance migration path and level of contamination (see § 4.1.4.3.1). Distinguishing among wetlands on the basis of size and level of contamination should improve the discriminating ability of the sensitive environments factor. In the drier portions of the country, where even small wetlands (e.g., prairie potholes) are very important, small wetlands may also qualify as "particular areas, relatively small in size, important to the maintenance of unique biotic communities."

Sensitive environments other than wetlands are not evaluated on the basis of size for several reasons. Most other HRS sensitive environments tend to be less common and less widely distributed nationally than wetlands (e.g., see EPA's 1989 *Field Test of the Proposed Revised HRS*) and, therefore, their numbers and boundaries tend to be easier to identify. In addition, the value of many sensitive environments is independent of size; for example, the size of a critical habitat of an endangered species may vary solely due to the type of species present. Furthermore, potential or actual contamination of even a small portion of many sensitive environments—for example, a wildlife refuge—tends to be viewed as unacceptable.

An *ecosystem bioaccumulation* potential factor has been added to the waste characteristics factor category of the surface water environmental threat in response to comments that hazardous substances that demonstrate an ability to bind to sediments and/or to bioaccumulate (e.g., PCBs, mercury) tend to pose the greatest long-term threats to aquatic organisms. The accumulation of hazardous substances in the aquatic food chain can result in adverse effects in aquatic species and in other animals that ingest aquatic species (e.g., waterfowl). The ecosystem bioaccumulation potential factor differs slightly from the bioaccumulation potential factor in the human food chain threat, primarily in that all BCF data are considered in deriving it and not just BCF data for human food chain organisms.

The EPA ambient aquatic life advisory concentrations (AALACs) have been added to the data hierarchy used to assign the ecosystem toxicity value (see § 4.1.4.2.1.1). The Natural Heritage Program alternative sensitive environment rating factors have been removed from the rule because of problems that arose during the field tests; field test participants found that the availability of information varied substantially among States. However, a Natural Heritage Program Data Center can assist in identifying many of the sensitive environment types listed in Tables 4–23 and 5–5.

K. Use of Available Data

A number of commenters stated that all available data should be used when scoring a site. Several cited the tiered approach to hazardous waste quantity as a model that could be applied to other factors. Under this method, where data are available, they would be used; where data are not available, defaults or more generalized approaches would be applied. Several commenters specifically suggested using this approach for ground water flow direction and for scoring mining sites. These commenters argued that it would be less expensive and time-consuming to use available data when scoring a site than to wait until the remedial investigation to consider the additional information.

EPA considered modifying the HRS to allow the use of additional data, but determined that further expanding the HRS to account for varying levels of data availability is inconsistent with the HRS's role as an initial screening tool. Adding tiers to various factors to accommodate the use of all available data would make the HRS considerably more difficult to apply and could lead to substantial inconsistencies in how sites are investigated and evaluated. EPA Regions and States would have to determine, for each set of data presented, whether the data quality was good enough for the data to be considered. Debates over decisions on data quality could delay scoring and, ultimately, delay cleanup at sites. Therefore, the Agency believes that the limited use of tiers in the final HRS represents a reasonable tradeoff between the need to limit the complexity of the system and the desire to accommodate risk-related information that is generally outside the scope of a site inspection.

L. Ground Water Migration Pathway

The proposed rule included a number of significant changes in the ground water migration pathway: new hydrogeologic factors were added; populations were distance weighted unless exposed to actual contamination; a maximally exposed individual (MEI) factor was added; the target distance limit was extended; a mobility factor was added and combined with toxicity; and a wellhead protection area factor was added. Figure 5 shows the proposed ground water migration pathway and the final rule pathway.

Ground water flow direction. Neither the original HRS nor the proposed HRS directly considered ground water flow direction in evaluating targets. The proposed HRS indirectly considered ground water flow direction by weighting populations based on actual and potential contamination of drinking water wells.

EPA received 50 letters from 40 commenters on this issue; 27 letters responded to the ANPRM, 21 to the NPRM, and two to the field test report. Commenters included eight States, three Federal agencies, the mining, petroleum, chemical, and cement industries, utilities, and professional engineers. The commenters supported the consideration of ground water flow direction data, at least in some circumstances. Numerous commenters urged the use of ground water flow direction data when they are either available or easily obtained. They suggested several methods to incorporate flow direction, including:

- Considering use of a radial impact area when directional release routes can be determined. Only a half circle with a three-mile radius for the downgradient portion (and a half-mile radius for the rest of the circle) should be considered when scoring;
- Differentiating between upgradient and downgradient areas using topographic maps, evaluating water levels at wells, and noting the presence of major surface water bodies;
- Expending the effort to obtain accurate data and considering selected upgradient locations as a precaution against unanticipated anomalies;
- Excluding drinking water wells where analytical data prove no contamination is present;
- Having a "professional" review available information and conduct a site visit;
- Using available flow direction data and developing regionally based defaults when no data are available;
- Installing piezometers to determine flow direction in the PA/SI phase and when no ground water flow data are available;
- Incorporating ground water flow direction into the "depth to aquifer" and "distance to nearest well/population served" scores; and
- Affording responsible parties the opportunity to determine flow direction.

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Figure 5

Ground Water Migration Pathway

PROPOSED HRS

Likelihood of Release	**X**	**Waste Characteristics**	**X**	**Targets**
Observed Release		Toxicity/Mobility		Maximally Exposed Individual
or		Hazardous Waste Quantity		Population
Potential to Release				Ground Water Use
Containment				Wellhead Protection Area
Net Precipitation				
Depth to Aquifer/ Hydraulic Conductivity				
Sorptive Capacity				

FINAL HRS

Likelihood of Release	**X**	**Waste Characteristics**	**X**	**Targets**
Observed Release		Toxicity/Mobility		Nearest Well
or		Hazardous Waste Quantity		Population
Potential to Release				Resources
Containment				Wellhead Protection Area
Net Precipitation				
Depth to Aquifer				
Travel Time				

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Commenters suggested that data on ground water flow are either readily available or can be easily obtained at reasonable cost and are no more imprecise than other aspects of the HRS. Some commenters stated that the level of effort required to estimate the direction of ground water flow is no greater than that required to determine other hydrogeologic parameters in the HRS.

EPA reviewed a range of options for considering ground water flow direction in evaluating targets. For the reasons discussed above under "Use of Available Data," the Agency decided that it was not feasible to adopt a tiered approach in the targets factors for evaluating ground water flow direction. EPA does not agree that increased accuracy warrants the increased complexity of accounting for ground water flow direction, because this level of accuracy is not required for a screening tool that is intended to assess relative risk. This level of accuracy, however, is needed to determine the extent of remedial action and, therefore, is appropriate at the time of the RI.

EPA disagrees with the argument that determining ground water flow direction is no more difficult than determining other ground water factors. Aquifer interconnections and discontinuities as well as hydraulic conductivity and depth to aquifer, which are evaluated in the final rule, are geologic features that are unlikely to change over the short-term. In contrast, ground water flow direction can be influenced by factors such as seasonal flows and pumping from well fields. In addition, the ground water flow direction may be different in each aquifer at the site, and the direction of hazardous substance migration is not always the same as the direction of ground water flow. Therefore, data on ground water flow direction would need to be considerably more extensive than would the data required to document the other hydrogeologic factors. EPA notes that in the final rule, many of the other hydrogeologic factors considered have been simplified and the sorptive capacity factor has been dropped. EPA also notes that ground water flow direction was not identified in SARA as a portion of the HRS requiring further examination, even though ground water flow direction was not considered in the original HRS and the Agency had received criticism similar to the above comments prior to enactment of SARA.

Although the final rule does not consider ground water flow direction directly in evaluating targets, it does consider flow direction indirectly in the method used to evaluate target populations. If wells have not been contaminated by the site, as the commenters assume upgradient wells would not be, the population drawing from those wells is distance weighted and, thus, populations drawing from the wells would have to be substantial before a large number of points could be assigned. Moreover, in addition to providing a measure of the population at risk from the site, the target factors afford a measure of the value of the ground water resources in the area of the site and of the potential need for expanded uses of the ground water.

Aquifer interconnections. Aquifer interconnections facilitate the transfer of ground water or hazardous substances between aquifers. The final rule specifies that if aquifer interconnections occur within two miles of the sources at the site (or within areas of observed ground water contamination attributed to sources at the site that extend beyond two miles from the sources), the interconnected aquifers are treated as a single aquifer for the purposes of scoring the site. Thus, for example, when an observed release to a shallow aquifer has been identified, targets using deeper aquifers interconnected to the shallow aquifer are included in the evaluation of the combined aquifer. This approach is common to the original as well as the revised HRS.

In practice, EPA has found that studies in the field to determine whether aquifers are interconnected in the vicinity of a site will generally require resources more consistent with remedial investigations than SIs, especially where installation of deep wells is necessary to conduct aquifer testing. Thus, EPA has in the past relied largely on existing information to make such determinations and the Agency finds it necessary to continue that approach. Examples of the types of information useful in identifying aquifer interconnections were given in the proposed rule. This information includes literature or well logs indicating that no lower relative hydraulic conductivity layer or confining layer separates the aquifers being assessed (e.g., presence of a layer with a hydraulic conductivity lower by two or more orders of magnitude); literature or well logs indicating that a lower relative hydraulic conductivity layer or confining layer separating the aquifers is not continuous through the two-mile radius (i.e., hydrogeologic interconnections between the aquifers are identified); evidence that withdrawals of water from one aquifer (e.g., pumping tests, aquifer tests, well tests) affect water levels in another aquifer; and observed migration of any constituents from one aquifer to another within two miles. For this last type of information, the mechanism of vertical migration does not have to be defined, and the constituents do not have to be attributable to the site being evaluated. Other mechanisms that can cause interconnection (e.g., boreholes, mining activities, faults, etc.) will also be considered. While the descriptive text has been removed from the rule, the approaches mentioned in the proposed rule will be used in making aquifer interconnection determinations. In general, EPA will base such determinations on the best information available; in the absence of definitive studies and where costs of field studies are prohibitive, the Agency will rely on expert opinion (e.g., U.S. Geological Survey staff or State geologists). In the absence of such information, EPA assumes that aquifers are not interconnected.

Ground water potential to release factors. EPA proposed replacing the depth to the aquifer of concern and permeability factors of the original HRS with depth to aquifer/hydraulic conductivity and sorptive capacity factors. EPA received more than 75 comments on these factors, in addition to general comments on evaluating ground water potential to release in response to the ANPRM.

Several commenters supported consideration of depth to aquifer in evaluating the ground water migration pathway. One commenter stated that use of a depth to aquifer/hydraulic conductivity matrix, which was intended to reflect travel time to ground water, was an improvement over considering these two parameters individually and additively. Concerns were raised, however, about how to determine depth to aquifer. In addition, commenters stated that the two-mile radius for evaluating hydrogeologic factors should be extended to four miles, while others commented that the distance should be measured from vertical points as near to the source as possible.

Commenters generally supported the proposal to include hydraulic conductivity, although many believed that the proposed method was too complicated; several commenters suggested that the single least conductive layer(s) should be used. Another concern was the lack of data for determining hydraulic conductivity. One commenter stated that unless data can confirm that the geologic strata extend throughout the entire area of a site, assigning a hydraulic conductivity value is highly questionable.

Some commenters offered alternative approaches to evaluating hydraulic conductivity. These included replacing the proposed method with:

- Assigned "confidence levels" tied to professional estimates based on regional data and judgment;
- Consideration of actual travel time in the unsaturated zone; or
- An assumption of maximum hydraulic conductivity among the various geological layers below the site.

More than 20 comments were received on the sorptive capacity factor, but there was little consensus among the commenters. A number of commenters agreed that the factor should be added, but stated that the approach was not detailed enough and that more waste- and site-specific information should be required. Other commenters agreed that the factor was an improvement, but said that sorptive capacity should be dropped because the waste- and site-specific information needed for an accurate evaluation cannot be collected during a screening process. Others said that it was too complex as proposed and should be dropped.

Based on these comments and the field test results, EPA examined the depth to aquifer/hydraulic conductivity and sorptive capacity factors. The examination showed that the lowest hydraulic conductivity layer(s) accounted for almost all of the travel time to the aquifer if a one-foot or three-foot minimum layer thickness was used. Accordingly, in the final rule, the depth to aquifer/hydraulic conductivity factor has been replaced with a simpler factor, travel time, which is determined using a matrix of the hydraulic conductivity and thickness of the lowest hydraulic conductivity layer(s) with at least a three-foot thickness. (See § 3.1.2.4 and Table 3–7 of the final rule.)

To conform with the change limiting the travel time factor to the least conductive layer(s), and to meet the goal of simplification, a change to the sorptive capacity factor was necessary. The proposed rule evaluated this factor using all layers between the source and the aquifer. In reexamining this factor, EPA concluded that depth to aquifer is one of the major parameters affecting total sorbent content, at least within the HRS ranges for the factor. Depth to aquifer also indirectly reflects geochemical retardation mechanisms because, all else being equal, the effect of these retardation mechanisms increases as the depth to aquifer increases. At the field test sites, using only the layer(s) of lowest hydraulic conductivity decreased the calculated sorbent content between 10 and 99 percent. For these reasons, EPA has decided to replace the sorptive capacity factor with a depth to aquifer factor. (See § 3.1.2.3 and Table 3–5 of the final rule).

M. Surface Water Migration Pathway

The proposed rule made major changes to the evaluation of releases or threatened releases to surface water. The pathway was divided into four threats: drinking water, human food chain, recreational use, and environmental. Other changes included consideration of flood potential; revision of potential overland flow; addition of dilution weights for potentially contaminated populations; extension of the target distance limit to 15 miles; revision of the persistence factor to consider more degradation mechanisms; addition of a bioaccumulation factor for evaluation of human food chain toxicity/persistence and populations; addition of ecosystem toxicity to evaluate the environmental threat; and addition of a maximally exposed individual factor (MEI) factor to the drinking water threat. Figure 6 shows the proposed rule and the overland flow/flood migration component of the surface water migration pathway in the final rule.

Recreational use threat. SARA stated that the HRS should consider threats to surface water used for recreation and drinking water, and the proposed HRS included a recreational use threat in the surface water migration pathway. A number of States, several companies and trade associations, and two Federal agencies identified problems with the proposed recreational use threat. Some commenters objected to weighting it as heavily as the drinking water threat, while others suggested that evaluating the threat was too complicated for use in a screening tool. Many commenters said that proposed methods for assigning values to recreation areas were too broadly drawn and that a limited number of recreation areas should be considered. Two commenters suggested using actual attendance data, and one commenter suggested that recreational uses be considered in other pathways as well.

EPA's field test indicated that the recreational use threat evaluation was too complex for HRS purposes and, at the same time, was not very accurate. Several field test participants commented that the recreation target population was difficult to evaluate and that the approach for determining population was inaccurate and time-consuming. In addition, the population factor did not provide meaningful discrimination among sites. The proposed rule used the physical characteristics (e.g., capital improvements) of a recreational site as the basis for determining the distance limit used to evaluate population, but because major and minor sites may have the same types of capital improvements (e.g., boat ramps, picnic facilities), the same distance limit could be associated with a minor recreation area and a major recreation area. The alternative approach would be to require actual use data to evaluate targets; however, site-specific population data are not available for many recreation areas, making it difficult to obtain accurate estimates of the population at risk. The target distance limits, which ranged from 10 to 125 miles, also contributed to the problems with evaluating targets. The Agency invited comments on refining these calculations; no alternative approaches were suggested, and EPA did not identify viable alternatives.

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Figure 6

Surface Water Migration Pathway

PROPOSED HRS

Likelihood of Release **X** **Drinking Water Threat**

Observed Release
or
Potential to Release

By Overland Flow
- Containment
- Runoff
- Distance to Surface Water

By Flood
- Containment
- Flood Frequency

Drinking Water Threat

Waste Characteristics	**X**	**Targets**
Toxicity/Persistence Hazardous Waste Quantity		Maximally Exposed Individual Population Surface Water Use

+

Human Food Chain Threat

Waste Characteristics	**X**	**Targets**
Toxicity/Persistence/ Bioaccumulation Hazardous Waste Quantity		Population Fishery Use

+

Recreational Use Threat

Waste Characteristics	**X**	**Targets**
Toxicity/Persistence/Dose Adjusting Factor Hazardous Waste Quantity		Population

+

Environmental Threat

Waste Characterisitics	**X**	**Targets**
Ecosystem Toxicity/ Persistence Hazardous Waste Quantity		Sensitive Environments

Figure 6

Surface Water Migration Pathway - Overland Flow/Flood Component

FINAL HRS

Likelihood of Release X **Drinking Water Threat**

Observed Release
or
Potential to Release

By Overland Flow
Containment
Runoff
Distance to Surface Water
By Flood
Containment
Flood Frequency

Drinking Water Threat

Waste Characteristics X **Targets**
Toxicity/Persistence
Hazardous Waste Quantity

Nearest Intake
Population
Resources

\+

Human Food Chain Threat

Waste Characteristics X **Targets**
Toxicity/Persistence/ Bioaccumulation
Hazardous Waste Quantity

Food Chain Individual
Population

\+

Environmental Threat

Waste Characteristics X **Targets**
Ecosystem Toxicity/ Persistence/Bioaccumulation
Hazardous Waste Quantity

Sensitive Environments

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EPA is also concerned that many qualities of recreation areas (e.g., uniqueness, attractiveness, value) cannot be readily quantified or measured, which poses significant problems for a screening tool. Therefore, the recreational use threat has been removed from the final rule. Instead, factors related to recreational use are being included in the assessment of resource factors in the air, surface water, and ground water migration pathways. (See the discussion of resources factors above and §§ 3.3.3, 4.1.2.3.3, 4.2.2.3.3, and 6.3.3 of the rule.) Recreational use is also a major component of the evaluation of the attractiveness/accessibility factor in the soil exposure pathway (see § 5.2.1.1 of the rule).

Human food chain. SARA requires that EPA consider "the damage to natural resources which may affect the human food chain * * *" Accordingly, the surface water migration pathway of the proposed rule included evaluation of threats to human health via the aquatic food chain.

A number of commenters suggested that terrestrial food chain threats should also be evaluated because most of the food eaten in the United States originates on land, and the terrestrial human food chain is, therefore, more important than the aquatic human food chain. Commenters specifically stated that the HRS should account for human food chain threats involving irrigated crops, livestock, and game animals. One commenter stated that the SARA mandate would not be fulfilled if only aquatic human food chain threats were evaluated.

After conducting an investigation into possible methods, EPA determined that it would not be practical to include a separate evaluation of terrestrial human food chain threats in the HRS. The terrestrial food chain is more complex and site-specific and is less understood than the aquatic food chain, and its assessment requires considerably more data. These factors render evaluation of the relative risks associated with the terrestrial human food chain well beyond the capability of a screening system such as the HRS. The final rule, therefore, does not separately evaluate terrestrial human food chain threats. These threats are, however, considered indirectly under the resources target components in the air migration pathway, ground water migration pathway, soil exposure pathway, and drinking water threat portion of the surface water migration pathway.

The proposed rule required the estimation of bioaccumulation potentials for hazardous substances posing threats via the human food chain. One commenter stated that the estimation of bioaccumulation potentials requires excessive time and resources, and that this step should be dropped from the HRS.

EPA disagrees and considers the bioaccumulation potentials of hazardous substances to be among the most important factors determining the degree of human health threat posed by substances via the human food chain. Substances that do not bioaccumulate pose less of a threat via the human food chain than substances that bioaccumulate, all else being equal. Conversely, substances with high bioaccumulation potentials can pose very significant threats via the human food chain even if they are only moderately toxic, or are present in modest quantities. EPA believes that compiling bioaccumulation potential tables will reduce the effort and resources required to score this factor.

EPA received several comments stating that bioaccumulation potential was not given sufficient weight in the evaluation of human food chain threats. EPA evaluated the use of bioaccumulation potential during the field test and determined that there was considerable uncertainty related to this factor, in part because of major differences in uptake associated with different species in different environments. In addition, bioconcentration values have been computed for only a few species for most substances. In light of this uncertainty, EPA decided that bioaccumulation potential should not be given additional weight in the HRS. In addition, as part of the structural changes discussed in Section III B, the bioaccumulation potential factor was moved from the targets factor category to the waste characteristics factor category so that it is evaluated consistently with the other waste characteristics factors that reflect exposure. As part of these changes, the use of the bioaccumulation potential factor in selecting the substance posing the greatest hazard also has been modified.

The final rule broadens the definition of actual contamination of the human food chain by modifying one criterion and adding a new criterion defining actual contamination. The proposed rule defined a fishery as actually contaminated if (1) the fishery was closed as a result of contamination and a substance for which the fishery was closed had been documented in an observed release from the site, or (2) a tissue sample from a human food chain organism from the fishery was found to contain a hazardous substance at a concentration level exceeding the FDAAL for that substance in fish tissue and the substance had been documented in an observed release from the site. In both cases, at least a portion of the fishery must be within the boundaries of the observed release.

Under the final rule, the former criterion (closed fishery) remains essentially unchanged. The latter criterion (tissue contamination) has been modified: A fishery is considered actually contaminated if the concentration of a hazardous substance in tissue of an essentially sessile benthic human food chain organism from the watershed is at a level that meets the criteria for an observed release from the site and at least a portion of the fishery is within the boundaries of the observed release. A new criterion has also been added: A fishery is considered actually contaminated if a hazardous substance having a bioaccumulation potential factor value of 500 or greater either is present in an observed release established by direct observation or is present in a surface water or sediment sample at a level that meets the criteria for an observed release from the site and at least a portion of the fishery is within the boundaries of the observed release. Only the portion of a fishery within the boundaries of an observed release is considered actually contaminated.

EPA broadened the definition of actually contaminated fisheries on the basis of field test results. With the more narrow definition in the proposed rule, few actually contaminated fisheries were identified because:

(1) Closed fisheries did not exist at most sites;

(2) Hazardous substance concentration data from tissues of applicable organisms were available for only a small portion of fisheries; and

(3) FDAALs exist for only a relatively small number of hazardous substances.

The final rule also introduces two levels of actually contaminated fisheries or portions of fisheries:

- Level I: Applicable when concentrations of site-related hazardous substances meeting the criteria for actual contamination of the fishery equal or exceed the benchmark concentration levels established in the final rule based on FDAALs, screening concentrations corresponding to elevated cancer risks, and screening concentrations corresponding to elevated chronic, non-cancer toxicity risks via oral exposures. The final rule allows Level I contamination to be established based on hazardous substance concentrations in tissue samples from "organisms other than essentially sessile benthic organisms" (e.g., fish, lobsters, crabs), even though these organisms cannot be used to establish observed releases or actual contamination.

- Level II: Applicable to all actually contaminated fisheries (or portions of actually contaminated fisheries) not meeting Level I criteria.

The final rule assigns human food chain populations associated with Level I concentrations tenfold greater weight than those associated with Level II concentrations. The final rule also describes the procedures for determining, where applicable, the part of a fishery subject to Level I concentrations, the part subject to Level II concentrations, and/or the part subject to potential contamination.

EPA received several comments suggesting that, to be consistent with the other threats, a maximally exposed individual factor should be incorporated into the human food chain threat. The Agency agrees, and to provide this consistency the final rule incorporates a maximally exposed individual factor (the food chain individual) into the human food chain targets factor category. As with similar factors in other pathways and threats, the food chain individual is assigned points according to the level of contamination. Where actual contamination of a fishery is documented, the food chain individual factor is assigned 50 points for Level I and 45 points for Level II concentrations. Where no actual contamination of a fishery is documented, but there is documentation of an observed release of a hazardous substance having a bioaccumulation potential factor value of 500 or greater to a watershed containing a fishery within the target distance limit, the food chain individual is assigned a value of 20 points. Where there are no observed releases to surface water or no observed release of a hazardous substance with a bioaccumulation potential factor value of 500 or greater, but a fishery is present (i.e., there is a potentially contaminated fishery) within the target distance limit, the food chain individual is assigned points ranging from 0 to 20, depending on the dilution weight assigned to the associated surface water body.

The proposed rule estimated human food chain production of actually contaminated or potentially contaminated fisheries based on harvest data or stocking data for those fisheries, if available. Where such data were not available, production estimates were based on productivity of the surface water body or the estimated standing crop of aquatic biota in the fisheries. The proposed rule included a table of standing crop default values for estimating human food chain production of the fishery.

EPA received numerous comments to the effect that the standing crop default table was difficult to use, provided several different values for some water bodies and none for others, and provided unreliable data. Several commenters stated that standing crop values are not an appropriate basis for estimating aquatic human food chain production. One commenter pointed out that standing crop estimates do not correlate well with harvest for various water body types. Another commenter stated that estimates of harvest from fish and game officials are preferable to standing crop default values because standing crop is a measure of biomass (weight of all edible living organisms in the water body) rather than productivity.

EPA agrees with the commenters. In the final rule, estimates of fishery human food chain production are based on fish harvest data (including stocking data) as opposed to standing crop data. When site-specific data are not available, harvest rates are to be estimated based on the average harvest per unit area for the particular water body type under assessment and the geographic area in which the water body is located.

Ground water discharge to surface water. A number of commenters and field test participants suggested that the HRS should consider the potential impact of ground water discharges to surface water because contaminated ground water can be a significant source of surface water contamination. Field test participants noted that some sites have no overland flow route, but surface water can be contaminated through ground water discharges.

EPA agrees and has added a ground water to surface water migration component to the surface water migration pathway. Figure 7 shows the structure of this component. The surface water migration pathway, therefore, now includes two components: The overland flow/flood migration component, which retains the structure of the surface water migration pathway as proposed (except for the changes discussed in this preamble), and the new ground water to surface water migration component. Either or both components may be scored; if both are scored, the surface water migration pathway score is the higher of the two scores. EPA selected the higher of the two scores rather than combining them because, if scores were combined, the amount of hazardous substances at the site available to migrate via each component would have to be apportioned between the two components. The site-specific data needed to determine the appropriate apportionment are rarely available.

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Figure 7

Surface Water Migration Pathway - Ground Water to Surface Water Component[1]

FINAL HRS

Likelihood of Release X **Drinking Water Threat**

Observed Release
or
Potential to Release
Containment
Net Precipitation
Depth to Aquifer
Travel Time

Waste Characteristics X **Targets**
Toxicity/Mobility/Persistence
Hazardous Waste Quantity

Nearest Intake
Population
Resources

\+

Human Food Chain Threat

Waste Characteristics X **Targets**
Toxicity/Mobility/Persistence/Bioaccumulation
Hazardous Waste Quantity

Food Chain Individual
Population

\+

Environmental Threat

Waste Characteristics X **Targets**
Ecosystem Toxicity/Mobility/Persistence/Bioaccumulation
Hazardous Waste Quantity

Sensitive Environments

New component.

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The ground water to surface water migration component evaluates three threats: drinking water, human food chain, and environmental. The component is scored only if: (1) A portion of the surface water is within one mile of any source at the site that could release to ground water; (2) there is no discontinuity in the uppermost aquifer between the source and the portion of the surface water within one mile of the source; and (3) the bottom of the surface water is at or below the top of the aquifer. The target distance limit for the component is determined the same way as for the overland flow/flood component. For each threat, likelihood of release is based on either observed release or potential to release. An observed release is established if, and only if, there is an observed release to the uppermost aquifer, while potential to release is based on ground water potential to release factors, except that only the uppermost aquifer is considered. (See § 4.2.2.1.2.)

The hazardous waste quantity factor is scored in the same way it is scored for the overland flow/flood migration component, except that only sources that could release to ground water are considered (see § 4.2.2.2.2). Toxicity, ground water mobility, and surface water persistence are considered in selecting the substance potentially posing the greatest hazard in drinking water (see § 4.2.2.2.1). By considering ground water mobility, the final rule reflects the fraction of a hazardous substance expected to be released from the sources and to migrate through ground water to the surface water body. For human food chain and environmental threats, bioaccumulation (or ecosystem bioaccumulation) potential is also considered in selecting the substance potentially posing the greatest hazard (see § 4.2.3.2.1).

The targets factors in this component are evaluated in the same way as targets factors in the overland flow/flood migration component, except that a dilution-weight adjustment is combined with the surface water dilution weights for populations potentially exposed to contamination. The dilution-weight adjustment was added because the HRS assumes that hazardous substances migrate via ground water in all directions from a site. Under this assumption, except in those instances where the surface water body completely surrounds the site, only a portion of the hazardous substances can be assumed to reach the surface water through the ground water. The dilution-weight adjustment accounts for the portion of the hazardous substances assumed to be available to migrate to surface water through ground water. The probable point of entry is defined as the shortest straight-line distance, within the aquifer boundaries, from the sources at the site to the surface water body. Therefore, the actual targets considered may differ somewhat from targets evaluated in the overland flow/flood migration component because the two probable points of entry may differ. This approach might allow evaluation of intakes, fisheries, and sensitive environments that may be exposed to contamination from a site but are upstream from the point of overland flow entry.

N. Soil Exposure Pathway

The onsite exposure pathway, which was added to the HRS in the proposed rule, has been renamed the soil exposure pathway in the final rule. The pathway was primarily designed to assess the potential threats posed by direct exposure to wastes and contaminated surficial materials at a site. It evaluated two threats—the resident population and the nearby population. In the proposed rule, the resident population threat included three types of targets: High risk population on a property with observed contamination, all other residents and people attending school or day care on a property with observed contamination, and terrestrial sensitive environments in which there is observed contamination. The nearby population was based on people who live or attend school within a one-mile travel distance and who did not meet the criteria for resident population. Figure 8 summarizes the proposed and final rules.

A number of commenters supported the inclusion of the pathway, but raised issues related to its evaluation. For example, commenters objected to evaluating the waste characteristics factor category solely on toxicity. Three commenters objected to limiting the high risk population to children under seven. Other commenters stated that collecting data on the high risk population would be difficult. A number of commenters questioned how the onsite area and area of contamination would be defined and how accessibility of the site was evaluated.

In response to these comments and to the field test results, EPA has made a number of changes to the soil exposure pathway. The name of the pathway has been changed to be more consistent with terminology used in the Superfund human health evaluation process.

As suggested by commenters, the final rule limits the area within which human targets are evaluated for the resident population threat to locations within property boundaries and within a distance limit of 200 feet from an area of observed contamination. The 200-foot limit accounts for those situations where the property boundary is very large, and exposure to contaminated surficial materials is unlikely or infrequent because of the distance of residences, schools, or work places from an area of observed contamination on the same property.

To make the pathway consistent with the other pathways and in response to comments, the final rule includes hazardous waste quantity in the waste characteristics factor category and multiplies it by the factor value for toxicity. New factors, resident individual and nearby individual, have been added to make the pathway consistent with the other pathways, all of which assign values for the maximally exposed individual (e.g., nearest individual or intake). Population is evaluated using two levels of actual contamination based on health-based benchmarks. Separate consideration of the high risk population (children under seven) has been eliminated because the field test indicated that this factor could greatly add to the time and expense of scoring a site yet resulted in little discrimination among sites. This change also makes the soil exposure pathway more consistent with the other pathways.

In the nearby population threat, the hazardous waste quantity factor in the likelihood of exposure factor category has been renamed "area of contamination" to reflect both the intent of the factor and how it is evaluated. The accessibility/frequency of use factor has been revised and renamed the "attractiveness/accessibility" factor. The revised factor emphasizes recreational uses of areas of observed contamination because they are most likely to result in exposures to contaminated surficial materials. In addition, the weighting of the nearby population relative to the resident population has been reduced to better reflect the relative levels of exposure for those threats.

A number of commenters questioned whether workers should be counted when evaluating target populations in the soil exposure pathway. One commenter suggested that soil exposure scoring should "not include activities at facilities that presently are regulated under the Occupational Safety and Health Administration (OSHA)." Other commenters, however, stated that workers should be counted in the target population. One commenter argued that not counting a facility's work force is inconsistent with other population counting techniques. Another commenter said that workers should be included in the resident population because the proposed method of calculating soil exposure pathway scores can result in inappropriately low scores when onsite workers are exposed to wastes or contaminated soil.

In response to these comments, the Agency investigated statutory, regulatory, and policy conditions that might restrict the inclusion of workers in the target population for the soil exposure pathway. This analysis found no broad statutory or regulatory authority for excluding workers covered by OSHA regulations from consideration as targets in the HRS. Although the definition of a release under CERCLA section 101(22) excludes "any release which results in exposure to persons solely within a workplace * * *" it only does so for purposes of claims by workers who are already covered by State worker compensation laws. The legislative history of section 101(22) specifically anticipated that authority under CERCLA might, in appropriate cases, be used to respond to releases within a workplace. Thus, the Agency concludes that there are no broad statutory or regulatory restrictions against consideration of activities at OSHA-regulated facilities.

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Figure 8

Soil Exposure Pathway

PROPOSED HRS

Resident Population Threat

Likelihood of Exposure	**X**	**Waste Characteristics**	**X**	**Targets**
Observed Contamination		Toxicity		High Risk Population
				Total Resident Population
				Terrestrial Sensitive Environments

+

Nearby Population Threat

Likelihood of Exposure	**X**	**Waste Characteristics**	**X**	**Targets**
Waste Quantity		Toxicity		Population Within 1 Mile
Accessibility/Frequency of Use				

FINAL HRS

Resident Population Threat

Likelihood of Exposure	**X**	**Waste Characteristics**	**X**	**Targets**
Observed Contamination		Toxicity		Resident Individual
		Hazardous Waste Quantity		Resident Population
				Workers
				Resources
				Terrestrial Sensitive Environments

+

Nearby Population Threat

Likelihood of Exposure	**X**	**Waste Characteristics**	**X**	**Targets**
Attractiveness/Accessibility		Toxicity		Population Within 1 Mile
Area of Contamination		Hazardous Waste Quantity		Nearby Individual

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The soil exposure pathway is designed to account for exposures and health risks resulting from ingestion of contaminated surficial materials. Because ingestion exposures are comparable for some types of workers and residents, the Agency has decided to include workers in the resident population threat. However, substantial variability in the kinds of workers and work activities at sites (e.g., indoor and outdoor) leads to considerable variability in exposure potential. The Agency believes that determining specific categories or types of workers is beyond the scope of HRS data collection. Thus, workers are assigned target points on a prorated basis: 5 points are assigned for sites with up to 100 workers; 10 points for sites with 101 to 1,000 workers, and 15 points for greater than 1,000 workers. Prorating workers will reduce the data collection effort. Evaluation of workers is not affected by health-based benchmarks. (See § 5.1.3.3.) Nearby workers are not counted in the nearby population because the Agency considers it unlikely that workers from nearby workplaces would regularly visit contaminated areas outside the property boundary of their workplace during the workday, and because there is no way to estimate accurately the number of workers who might.

O. Air Migration Pathway

The proposed rule made several significant changes to the air migration pathway in the original HRS. In response to the SARA mandate to consider potential as well as actual releases to air, the proposed rule included an evaluation of the potential to release. The proposed rule also added a mobility factor to the waste characteristics factor category and an MEI factor to the targets category. Finally, the proposed rule added explicit distance weighting factors for evaluating all factors in the targets category. Figure 9 shows the proposed air migration pathway and the final rule pathway.

The public provided numerous comments on these changes and raised new issues as well. The most significant new issue concerned the structural inconsistency in the treatment of gases and particulates in the proposed air migration pathway. For example, commenters observed that in the potential to release evaluation, it was possible to assign a high containment value to a source with good gas containment and poor particulate containment while assigning high source type and mobility values based on the presence of gaseous hazardous substances. This combination would yield an inappropriately high potential to release value. This concern was also noted in discussions with field test personnel.

The Agency agrees with these commenters and investigated methods to better reflect the differences between gases and particulates. As a result of these analyses, EPA has made several changes to the final rule in both the likelihood of release and waste characteristics factor categories.

In the likelihood of release factor category, the final rule evaluates source potential to release separately for gases and particulates. Only those sources containing gaseous hazardous substances are evaluated for gas potential to release, and only those sources containing hazardous substances that can be released as particulates are evaluated for particulate potential to release. This change in potential to release structure necessitated other changes in the scoring of potential to release including development of separate gas and particulate source type factors and migration potential factors. The names of these latter factors were also changed to highlight the differences between potential to release "mobility" and waste characteristics "mobility." (See §§ 6.1.2.1.3, 6.1.2.2.3.)

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Figure 9

Air Migration Pathway

PROPOSED HRS

Likelihood of Release	X	Waste Characteristics	X	Targets
Observed Release		Toxicity/Mobility		Maximally Exposed Individual
or		Hazardous Waste Quantity		Population
Potential to Release				Land Use
Source Containment				Sensitive Environments
Source Type				
Source Mobility				

FINAL HRS

Likelihood of Release	X	Waste Characteristics	X	Targets
Observed Release		Toxicity/Mobility		Nearest Individual
or		Hazardous Waste Quantity		Population
Potential to Release				Resources
				Sensitive Environments
Gas				
Gas Containment				
Gas Source Type				
Gas Migration Potential				
Particulate				
Particulate Containment				
Particulate Source Type				
Particulate Migration Potential				

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In addition to these changes in the basic structure of the potential to release factors, the final rule includes several additional changes in the source type list, migration potential factors, and containment factors. Based on the experience gained in the field test, EPA added several source types to the source type list. Some of these additions (e.g., surface impoundment (not buried/backfilled): dry) simply clarify classifications that were implied in the proposed source type list. Other additions, such as source types involving biogas release, were considered early in the development of the proposed HRS but were not included originally in the interest of simplicity. Field test experience, however, indicated that their inclusion in the final rule was necessary. Finally, new distinctions within some source types (e.g., the various types of piles) were added partly in response to comments and partly as a result of field test experience. As applicable, source type values were also revised. (See §§ 6.1.2.1.2, 6.1.2.2.2 and Table 6–4.)

The revised gas and particulate migration potential factors are very similar to the proposed likelihood of release gas and particulate mobility factors. Several commenters questioned the need for including dry relative soil volatility in the final gas migration factor. A simplification analysis indicated that dry relative soil volatility was redundant, as it was almost completely determined by vapor pressure. Hence, the final gas migration potential factor includes only vapor pressure and Henry's law constant. The particulate migration potential factor in the final rule is simply the particulate component of the proposed potential to release mobility factor.

The containment factors were also changed as a result of the field test, a review of recent information on covering systems, the examination of air release rate models, and the public comments on the need for simplicity in the final rule. The final list of containment descriptions eliminated many redundant descriptions and changed others, retaining only those distinctions that are necessary based on type of source. (See §§ 6.1.2.1.1, 6.1.2.2.1 and Tables 6–3, 6–9.) As discussed in Section III F above, two new mobility factors were developed for the waste characteristics factor category.

Commenters generally supported the concept of distance weighting target factors. However, several disagreed with the approach used to develop the proposed factor values. Some commenters suggested basing the factor values on long-term meteorology and the size of the site, while others suggested that additional atmospheric phenomena (e.g., particulate deposition) be reflected in the final values. As a result of these comments, EPA has revised the distance weighting factors used in the final rule to reflect long-term atmospheric phenomena. Analyses indicated that particulate deposition and other similar phenomena as well as site size were not sufficiently significant within four miles of a site to warrant their inclusion in the final factor values. EPA also notes that the distance weighting factor values are now incorporated in the population factor value table. (See § 6.3.2.4 and Table 6–17.)

P. Large Volume Wastes

Mining waste sites. A number of commenters representing mining companies, trade associations, and State and Federal agencies commented on how the proposed HRS would score mining waste sites; commenters representing waste management facilities raised similar issues in regard to their sites. This section summarizes and addresses the major issues addressed by these commenters.

Commenters raised several concerns regarding the appropriate consideration of background levels of metals in documenting direct or indirect releases from mining waste sites. One commenter recommended that in determining direct releases from a mining waste site, EPA should consider the natural characteristics of the site prior to mining and the changes in migration rates resulting from mining. The commenter explained that the concentration of metals in a mining waste pile may be similar to or less than natural concentrations in soil or rocks below and adjacent to the pile. To document indirect releases, the commenter suggested that EPA require collection of detailed information on site geology and hydrological gradients to ensure proper consideration of background levels. Finally, the commenter asserted that although it is appropriate to weight observed releases more heavily than potential releases at sites with synthetic organic hazardous substances, the criteria used to define observed release are not valid at sites with natural sources of metals. Another commenter agreed and suggested that because of background levels of inorganic elements, the proposed HRS could identify as an observed release concentrations unrelated to mining activities.

EPA recognizes that natural background concentrations of metals in soil or rocks can affect the measured concentration necessary to establish an observed release at a mining waste site. This consideration is reflected in the requirement that concentrations significantly above background be shown to establish an observed release. Moreover, EPA has clarified the observed release criteria in the final rule to explain that they specify minimum differences necessary to establish an observed release by chemical analysis.

Several commenters questioned the treatment of metals in the ground water mobility factor. One commenter stated that the proposed HRS is biased against mining waste sites because it gives greater consideration to the accurate assessment of the mobility of organic substances than to that of naturally occurring metals. The commenter noted that the proposed persistence factor for the surface water migration pathway accounts for the degradation of hazardous substances in the environment through four processes. None of these processes, according to the commenter, applies to metallic elements, which received a default value of 3 (the highest possible score for persistence). Another commenter stated that decreased mobility was considered only for organic compounds, even though inorganic compounds are immobile in some situations.

One commenter stated that adding a metals mobility factor, as EPA's Science Advisory Board (SAB) recommended, would allow the HRS to reflect more accurately the potential for metallic elements to migrate in the aqueous phase. Two commenters were concerned that metals would be assigned a "worst-case" default value for mobility. On the other hand, another commenter stated that consideration of the mobility of metals in the revised HRS would at least partially rectify the bias in the current HRS against high-volume, low-concentration mining wastes.

A number of these commenters appear to have misunderstood the proposed rule. Metals were not automatically assigned the maximum value as a default in the ground water mobility factor, but rather were assigned values based on their coefficient of aqueous migration. The final rule automatically assigns the maximum value for mobility only to metals establishing an observed release by chemical analysis, which is the same way organics and nonmetallic inorganics are evaluated. For metals and metal compounds not establishing an observed release by chemical analysis, mobility is based on water solubility and distribution coefficient (K_d), the same as for organics and nonmetallic inorganics. If none of the hazardous substances (including metals, organics, and nonmetallic inorganics) eligible to be evaluated for the site can be assigned a mobility factor value based on available data, § 3.2.1.2 of the final rule assigns a mobility factor value of 0.002 for all of the hazardous substances. This value was selected based on a review of the range of mobility factor values assigned to those hazardous substances (including metals) for which data were available for assigning mobility factor values. The value of 0.002 is clearly not a worst-case default (which would be 1.0).

EPA believes that the persistence factor is not biased against metals. Elemental metals do not degrade and, therefore, should receive higher scores for persistence than other substances subject to degradation processes.

One commenter claimed that the soil exposure pathway is likely to bias the HRS scores of mining waste sites toward higher values because such sites contain large volumes of waste covering large surface areas, and because of geographic factors, these large areas are seldom secured against direct public access. In addition, according to the commenter, the public may be attracted to mining waste sites. The commenter suggested that the soil exposure pathway incorrectly assumes there is an exposure because there is access to mining waste sites.

EPA does not agree that the soil exposure pathway is biased against mining waste sites. The pathway evaluates exposures of people via contact with surficial hazardous substances. The Agency believes that, all else being equal, large contaminated surface areas with public access, including those associated with mining waste sites, should receive higher scores for the soil exposure pathway than smaller sites with more restricted access. Even sites with large contaminated surface areas are unlikely to be assigned high scores except when they are near residential areas or include a listed sensitive environment. As some commenters representing mining-related activities have noted in the past, most mines are located some distance from inhabited areas.

Three commenters stated that the original HRS was biased against sites such as mining waste sites that are characterized by high volumes of waste with relatively low concentrations of toxic constituents. Two of these commenters suggested that mining wastes would be appropriate for hazardous constituent quantity determination because such wastes are relatively homogeneous (compared to other wastes) and, therefore, have fairly consistent concentrations. One of these two commenters also stated that the hazardous waste quantity factor equations in Table 2–14 of the proposed rule should be revised to be less conservative. The remaining commenter suggested that the proposed HRS was still biased against mining waste sites because they are still scored based on the quantity of waste rather than on the concentration of the waste at the point of exposure.

EPA does not agree that the HRS is biased against high-volume, low-concentration waste sites. The final rule incorporates concentration data in three factors: (1) Likelihood of release (concentration data can be used for establishing an observed release); (2) hazardous waste quantity (concentration data, if available and adequate, can be used for calculating hazardous constituent quantity); and (3) targets (concentrations of hazardous substances present in drinking water wells or at other exposure points can be used to determine weightings for nearest individuals (or wells or intakes), populations, and sensitive environments factors). EPA has not explicitly required concentration data for all sites because of the substantial costs for obtaining these data and the very high degree of uncertainty associated with data collected during SIs.

EPA requested that the SAB review issues related to large-volume waste sites before the NPRM was published. The SAB final report is available in the CERCLA docket. Two commenters stated that the Agency did not adequately consider the SAB's recommendations for revising the HRS, specifically those concerning the use of mobility data.

The SAB, in its review of the original HRS, examined whether large-volume waste sites (e.g., mining waste sites) had been treated differently than other waste sites and concluded that insufficient data were presented to demonstrate that the original HRS was biased against mining waste sites. However, the SAB noted that the original HRS had the potential for such a bias, particularly when scoring potential to release, because the original HRS did not consider mobility, concentration of hazardous constituents, and transport. The SAB suggested several possible modifications to improve the application of the HRS to mining waste sites.

Based in part on the SAB suggestions, EPA proposed several changes to the overall scoring process to make the HRS more accurately reflect risks associated with mining waste sites, notably, addition of a mobility factor to the air and ground water migration pathways, changes in the persistence factor, incorporation of a tiered hazardous waste quantity factor that can account for waste concentration data, and addition of health-based benchmarks for evaluating population. As explained in the NPRM, determining speciation of metals and pH, as the SAB had suggested, is not feasible given the temporal and spatial variations at hazardous waste sites and the limitations on SI data collection. Moreover, determining speciation is not feasible for most substances given EPA's current analytical procedures; requiring speciation analyses would add substantially to the cost of data collection.

Two commenters stated that the proposed HRS can significantly overestimate risks associated with mining waste sites that consist of high-volume, low-concentration wastes. One of these commenters recommended a "preliminary evaluation system" to more accurately reflect the actual risks associated with such sites and remove any bias in the HRS relative to other types of sites. This commenter also suggested that in proposing the HRS revisions, EPA had ignored the results of its own studies under RCRA sections 3001 and 8002, which the commenter believed to be more focused efforts to quantify risks from mining waste sites than the HRS revisions.

EPA does not believe that a separate "preliminary evaluation system" for scoring mining waste sites would be appropriate. A single HRS can be applied uniformly to all sites, allowing the Agency to evaluate sites relative to each other with respect to actual and potential hazards. The Agency examined the RCRA studies cited by the commenter before proposing HRS revisions. Those studies, which focus on the management of wastes at active facilities, concluded that many special study waste sites (e.g., mining) do not present very high risks, while others may present substantial risks. EPA believes that the conclusions of these studies and the Agency's subsequent regulatory determinations (i.e., not to regulate most mining wastes under RCRA Subtitle C) are not inconsistent with a determination that some mining waste releases can require Superfund response actions. Furthermore, the HRS is designed so that it can be applied to closed and abandoned sites as well as active sites.

Other large volume waste sites. Several commenters suggested that the proposed HRS did not meet CERCLA section 125 requirements for sites involving fossil fuel combustion wastes. These commenters generally agreed that section 125 requires EPA to consider the quantity and concentration of hazardous constituents in fossil fuel combustion wastes and that the proposed HRS had not adequately addressed this requirement.

One commenter supported the Agency's proposal to allow consideration of concentration data when such data are available. Three commenters stated that the proposed HRS would often assign fossil fuel combustion waste sites high scores in part because of the worst-case assumptions or "default values" for certain factors (i.e., hazardous waste quantity, toxicity, target populations). The commenters claimed that fossil fuel combustion waste sites receive high scores merely because of the large quantity of waste, although this waste presents no significant adverse environmental effects, and that these high scores are inconsistent with EPA's findings in the RCRA section 8002 study. One of the three commenters suggested that the proposed HRS retained certain deficiencies of the original HRS, such as assuming that all hazardous substances in the waste consist of the single most toxic constituent in the waste.

EPA does not believe that the approach taken in the final rule creates a bias against fossil fuel combustion wastes. Partly because concentration data are considered in the final rule, fossil fuel combustion waste sites are not expected to score disproportionately high when compared with other types of sites. The HRS assumes that it is not possible to determine in a consistent manner the relative contribution to risk of all hazardous substances found at sites. Given this assumption, EPA has determined that basing the toxicity of the combination of substances at a site on the toxicity of the substance posing the greatest hazard is a reasonable and appropriately conservative approach. In many cases, the substance posing the greatest hazard is not several orders of magnitude more toxic than other hazardous substances at the site. Therefore, the effect of this approach on the toxicity factor value—which is evaluated in one order of magnitude scoring categories—is not as great as some commenters have suggested (see also section III D). In addition, as noted above, worst-case defaults are not assigned for mobility; population factors have no default values.

Two commenters suggested that because CERCLA section 125 contains no statutory deadlines, EPA should take as much time as necessary to adequately respond. These commenters recommended that EPA extend the tiered approach of the hazardous waste quantity factor to other factors to take advantage of the extensive data on fossil fuel combustion wastes generated by the electric utility industry.

The Agency does not agree that the tiered approach used in the hazardous waste quantity factor should be extended to other factors for fossil fuel combustion waste sites (see also section III K). EPA believes that creating a separate HRS to score certain types of sites would not allow the Agency to provide a uniform measure of relative risk at a wide variety of sites, as Congress intended.

One commenter recommended that EPA consider using fate and transport models currently under development to incorporate quantitative representations of specific processes and mechanisms into the HRS. EPA carefully examined this possibility and concluded that although the use of fate and transport models could conceivably increase the accuracy of the HRS for some pathways, collection of the required site-specific data would be far too complex and costly. Fate and transport models are appropriate for a comprehensive risk assessment, but not for a screening tool such as the HRS. In addition, EPA's review suggested that it would be more difficult to achieve consistent results among users of such models than with the HRS. EPA points out that it used fate and transport models to develop the distance weighting factors used in the HRS target calculations, and also that the HRS incorporates several hazardous substance parameters (e.g., mobility) and site parameters (e.g., travel time) that are components of fate and transport models.

Two commenters expressed concern that the proposed HRS fails to account for the leachability of hazardous constituents as required by CERCLA section 125. According to the commenters, some hazardous constituents pose no risk via ground water because they will never be released to that medium. Thus, even if hazardous waste quantity and concentration are considered adequately, hazardous waste quantity scores for fossil fuel combustion sites will be erroneously high unless leachability is considered as well.

EPA examined the availability of leachate data and the feasibility of using such data for calculating hazardous substance quantity for all types of sources and wastes. The Agency decided against using leachate concentrations because:

- Leachate data are not available for all sources and wastes, and available leachate data on high-volume wastes and some landfills have limited applicability for estimating the quantity of leachable hazardous substances;
- Leachate data derived from lab studies are limited and do not realistically represent the universe of field conditions such as heterogeneity of wastes, chemistry of leachate, and density and pore volume of disposed wastes; and
- Any method for using leachate data could not be consistently or uniformly applied to all sites.

EPA also examined the feasibility of developing site-specific leachate data for estimating leachable hazardous substance quantity for the ground water migration pathway. EPA decided against this option because reliable estimation of leachable hazardous substance quantity requires comprehensive sampling of site-specific heterogeneous waste, which would be prohibitively expensive and not feasible. In some cases, such sampling would be technically unfeasible and unsafe.

EPA evaluated alternatives for developing a surrogate for estimating leachable hazardous substance quantity. The Agency found that adding the mobility factor to the ground water migration pathway, based both on solubilities and distribution coefficients (K_ds) of hazardous substances, and multiplying it by the hazardous waste quantity factor would be a feasible alternative for approximating the fraction of hazardous substance quantity expected to be released to ground water.

Q. Consideration of Removal Actions (Current Versus Initial Conditions)

The original HRS based the evaluation of factors on initial conditions. In the preamble to the proposed rule, EPA specifically requested comments on whether sites should be scored on the basis of initial or current conditions. The principal question is whether the effect of response actions, such as the removal of some quantity of the waste, should be considered when sites are scored. Initial conditions are defined by the timing of the response action; that is, initial conditions are the conditions that existed prior to any response action. For sites where no response action has occurred, initial and current conditions are the same for evaluating sites.

Of the 25 commenters responding to this issue, 15—including all industry commenters—supported scoring on current conditions. In the preamble of the proposed rule, EPA presented two approaches for considering response actions in HRS scores: (1) Consider these actions only for those pathways and factors for which they are most appropriate; and (2) consider these actions in all pathways, but make exceptions at sites where initial conditions more accurately reflect risks.

Those who stated a preference favored the second, specifying that the exceptions should be clearly defined in the final rule. These commenters stated that scoring all pathways on current conditions would encourage responsible parties to clean up sites quickly. They reasoned that if cleanups are delayed, the threat of migration of the hazardous substances increases; therefore, scoring on current conditions is consistent with the intent of CERCLA because it encourages rapid remedial action. One commenter said that scoring on initial conditions made little sense when, as a result of the cleanup, the level of residual contamination was below the level required by CERCLA.

Several proponents of scoring on current conditions stated that EPA's concern that responsible parties would clean up sites just enough to avoid being listed on the NPL was unfounded. They argued that the proposed scoring system is too complicated to manipulate, and that predicting the effect of partial cleanups on the final score would be difficult. Others suggested that where contamination remains, sampling during an SI will discover it.

Ten commenters did not fully support scoring on current conditions. Only one opposed any consideration of current conditions. Several commenters supported scoring the soil exposure and air migration pathways on current conditions. Others stated that response actions should be considered only when the actions are conducted under Federal or State direction, or when the action constitutes a complete cleanup. Several added that State actions should not be considered because it would penalize States with active remedial programs. One commenter suggested scoring sites on both current and initial conditions; if the response action had addressed all hazards, then the current conditions score should be used.

Based on public comment, EPA has decided to change its policy on consideration of removal actions. The Agency agrees that consideration of such actions in HRS scores is likely to increase incentives for rapid actions by responsible parties, reducing risks to the public and allowing for more cost effective expenditure of the Fund. In making this decision, EPA tried to balance the benefits of considering removal actions in HRS scores (e.g., increased incentives for rapid actions) while also ensuring that the HRS score reflects any continuing risks at sites where contamination occurred prior to any response action.

Therefore, EPA will calculate waste quantities based on current conditions. However, EPA believes the accuracy of this approach depends on being able to determine with reasonable confidence the quantity of hazardous constituents remaining in sources at the site and the quantity released into the environment. As a consequence, where the Agency does not have sufficient information to estimate the quantity of hazardous constituents remaining in the sources at the site and in the associated releases, a minimum factor value may be assigned to the hazardous waste quantity factor value. Thus, removal actions may not reduce waste quantity factor values unless the quantity of hazardous constituents remaining in sources and in releases can be estimated with reasonable confidence.

In addition to providing incentives for early response, this approach also provides incentives for potentially responsible parties to ascertain the extent of the remaining contamination at sites. Potentially responsible parties undertaking removal actions will have the primary responsibility for collecting any data needed to support a determination of the quantity of hazardous constituents remaining. EPA expects responsible parties may need to conduct sampling and analyses to determine the extent of hazardous substance migration in soils and other media in order to estimate with reasonable confidence the quantity of hazardous constituents remaining.

EPA decided not to limit the consideration of response actions to certain pathways (e.g., the soil exposure pathway) because this would overstate the risk at sites where removal of wastes has eliminated threats in all pathways. Moreover, a more limited approach to consideration of response actions would provide less incentive for rapid response action.

EPA will evaluate a site based on current conditions provided that response actions actually have removed wastes from the site for proper disposal or destruction in a facility permitted under the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TSCA), or by the Nuclear Regulatory Commission. HRS scoring will not consider the effects of responses that do not reduce waste quantities such as providing alternate drinking water supplies to populations with drinking water supplies contaminated by the site. In such cases, EPA believes that the initial targets factor should be used to reflect the adverse impacts caused by contamination of drinking water supplies; otherwise, a contaminated aquifer could be artificially shielded from further remediation. This decision is consistent with SARA section 118(a), which requires that EPA give high priority to sites where contamination from the site results in closed drinking water wells. Similarly, if residents are relocated or if a school is closed because of contamination due to the site, EPA will consider the initial targets in scoring the site.

As noted in the proposed rule preamble, EPA would only consider removals conducted prior to an SI. EPA believes that the SI is the appropriate time to evaluate conditions, because it is the source of most of the data used to score a site. Because response action at sites may be an ongoing process, it would be burdensome to recalculate scores continually to reflect such actions.

In response to commenters, EPA also considered whether response actions should be considered in HRS scores only if they are performed under a State or EPA order. EPA decided not to choose this approach for two reasons. First, it would diminish the incentive for an expeditious response at the site if a signed order were required. Second, because a response action must be conducted before the SI to be considered in the HRS score, there would be little information on site conditions upon which this order could be based.

EPA has also decided not to differentiate between response actions initiated by States and those conducted by other parties. The Agency believes this approach will help ensure consistent application of the HRS by avoiding situations where two similar sites are scored using different sets of rules. Moreover, although the Agency is sympathetic to concerns about disincentives to States for initiating actions, it believes that such cases will be rare. Many State (and Federal) removal actions are interim measures designed to stabilize conditions at the site. Given the more limited definition of response action noted above (e.g., removal of waste from the site for disposal or destruction in a RCRA-permitted facility), many actions conducted by States would not be considered in HRS scoring. In addition, in many cases, State and Federal removal actions are undertaken after an SI has been conducted. As noted above, EPA will only consider removals conducted before the SI in the HRS score.

R. Cutoff Score

In the NPRM preamble, EPA proposed that the cutoff score for the revised HRS be functionally equivalent to the current cutoff score of 28.5. The Agency also requested comment on three proposed options for determining functional equivalence:

- Option 1: Score sites using both the original and final rule, then use statistical analysis to determine what revised HRS score best corresponds to 28.5;
- Option 2: Choose a score that would result in an NPL of the same size as the NPL that would be created by using the original HRS; and
- Option 3: Identify the risk level that would correspond to 28.5 in the original HRS and then determine what revised HRS score corresponds to that risk level.

Some commenters stated that there cannot be a functional equivalence if the revisions have any meaning. They argued that if the revisions meet the statutory mandate to make the HRS more accurate, the scores should be different and, therefore, cannot be related. Several commenters supported the use of a functional equivalent, but were divided about which option should be used. One commenter stated that the 28.5 score should be evaluated to determine whether it reflected minimum risk levels. If it did, the commenter suggested that a functional equivalent would be appropriate and should be determined using equivalent risk levels (option 3), but also with an eye toward keeping the NPL to a manageable size (option 2).

Commenters not supporting the use of a functional equivalent suggested a variety of alternative approaches, including:

- Establish the cutoff score based on risk, without regard to the current cutoff level or a functional equivalent;
- Leave the score at 28.5;
- Propose a new cutoff score and a description of methodology in a public notice with a 60-day public comment period;
- Lower the cutoff score to provide an incentive to responsible parties to undertake remedial efforts and make it possible for sites where a removal action has taken place to make the NPL, thus reducing the controversy over whether to score sites based on current conditions;
- Raise the cutoff score by at least 20 points;
- Eliminate the present cutoff score by creating categories of sites instead of individual ranks as a means of prioritizing NPL sites;
- Amend the NPL annually to include only those sites that deserve priority attention (e.g., orphaned sites) and are likely to receive Superfund financing; or
- Rank all sites showing any degree of public health and/or environmental risk on a relative scale and perform remedial activities based on available funding.

In addition, four commenters felt that the cutoff score for the final rule should not be fixed until the technical merits and potential scores of representative sites are tested and compared using both the current and proposed HRS. Further, one commenter noted that the field test did not indicate the relationship between the revised HRS score for a given site and the current score; another added that until this equivalency issue is clarified, meaningful comment on any proposed revisions cannot be made.

Based on an analysis of 110 test sites, EPA has decided not to change the cutoff score at this time. This conclusion was reached after applying all three approaches to setting a cutoff score that would be functionally equivalent to 28.5. In its analysis, the Agency scored field test sites with both the original and revised HRS. The data from these test sites show that few sites score in the range of 25 to 30 with the revised HRS model. The Agency believes that this range may represent a breakpoint in the distribution of site scores and that the sites scoring above the range of 25–30 are clearly the types of sites that the Agency should capture with a screening model. Because the analysis did not point to a single number as the appropriate cutoff, the Agency has decided to continue to employ 28.5 as a management tool for identifying sites that are candidates for the National Priorities List.

EPA believes that the cutoff score has been, and should continue to be, a mechanism that allows it to make objective decisions on national priorities. Because the HRS is intended to be a screening system, the Agency has never attached significance to the cutoff score as an indicator of a specific level of risk from a site, nor has the Agency intended the cutoff to reflect a point below which no risk was present. The score of 28.5 is not meant to imply that risky and non-risky sites can be precisely distinguished. Nevertheless, the cutoff score has been a useful screening tool that has allowed the Agency to set priorities and to move forward with studying and, where appropriate, cleaning up hazardous waste sites. The vast majority of sites scoring above 28.5 in the past have been shown to present risks. EPA believes that a cutoff score of 28.5 will continue to serve this crucial function.

IV. Section-by-Section Analysis of Rule Changes

Besides the changes discussed above, EPA has made substantial editorial revisions in the rule being adopted today. Source characterization is discussed in section 2 of the final rule, along with factors that are evaluated in each pathway. These factors include hazardous waste quantity, toxicity, and evaluation of targets based on benchmarks. The order of presentation of the pathways has been changed to ground water, surface water, soil exposure, and air. Following the four sections describing the pathways, a section has been added explaining how to evaluate sites that have radionuclides either as the only hazardous substances at the site or in combination with other hazardous substances.

In general, descriptive text that provided background information has been removed as have references and data sources; the sections have been rewritten to make the rule easier to read and to apply. The figures presenting overviews of the pathways and the scoring sheets have been revised throughout to reflect changes in the rule and assigned values.

This section describes, for each section of the rule and each table, the specific substantive changes; editorial changes that do not affect the content of the rule are not generally noted.

Section 1 Introduction

The text explaining the background of the HRS and describing the rule has been removed. Definitions of a number of additional terms used in the rule have been added for clarity. The definition of "hazardous substance" has been revised for clarification. The definition of "site" has been clarified and now indicates that the area between sources may also be considered part of the site. The definition of "source" has been revised to explain that those volumes of air, ground water, surface water, or surface water sediments that become contaminated by migration of hazardous substances are not considered a source, except contaminated ground water plumes or contaminated surface water sediments may be considered a source if they cannot be attributed to an identified source. In addition, the definition of source now includes soils contaminated by migration of hazardous substances.

Under the original HRS, the Agency took the approach that all feasible efforts should be made to identify sources before listing a site on the NPL. If, after an appropriate effort has failed to identify a source, the Agency believed that the contamination was likely to have originated at the type of source that would be addressed under Superfund, such sites were listed. Subsequent investigations after listing have generally identified a specific source. In some cases, EPA has not listed contaminated media without clearly identified sources because it appeared the source of pollution would not be addressed by Superfund programs; an example of such a source would be extensive, low-level contamination of surface water sediments caused by pesticide applications. EPA has found this approach to be generally workable and will continue to evaluate, on a case-by-case basis, whether sites with no identified sources should be listed.

Where contaminated media with no identified sources exist, the final rule generally assigns a hazardous waste quantity factor value to such contamination, with the value depending on whether there are any targets subject to Level I or Level II concentrations. For contaminated sediments in the surface water migration pathway, if there is a clearly defined direction of flow, target distances are measured from the point of observed sediment contamination that is farthest upstream. For ground water plumes and for contaminated sediments where there is no clear direction of flow, the center of the observed ground water or sediment contamination is used for the purpose of measuring target distance limits.

Section 2 Evaluations Common to Multiple Pathways

This section covers factors and evaluations common to multiple pathways. The major changes to these factors include: observed release criteria have been revised; the toxicity factor has been changed to a linear rather than a log scale; scales for hazardous waste quantity have been made linear and expanded, and the hazardous waste quantity minimum value has been changed; the waste characteristics factor category score is now obtained by multiplying the factor values and using a table to assign the final score; use of benchmarks has been extended to all pathways and to the nearest individual (well/intake) factor; and the methods for comparisons to benchmarks have been changed as have the benchmarks used. The purpose of this part is to make the rule less repetitious by presenting full explanations of the evaluation of certain factors only once rather than in each pathway in which they occur. Exceptions related to radionuclides are noted throughout the rule and referenced to Section 7.

Section 2.1 Overview. Introduces the pathways and threats included in HRS scoring.

Section 2.1.1 Calculation of HRS site score. Provides the equation used to calculate the final HRS score.

Section 2.1.2 Calculation of pathway score. Indicates, in general, how pathway scores are calculated and includes a sample pathway score sheet (Table 2–1).

Section 2.1.3 Common evaluations. Lists evaluations common to all pathways.

Section 2.2 Characterize sources. Introduces source characterization and references Table 2–2, the new sample source characterization worksheet.

Section 2.2.1 Identify sources. Explains that for the three migration pathways, sources are identified, and for the soil exposure pathway, areas of observed contamination are identified.

Section 2.2.2 Identify hazardous substances associated with a source. Covers information previously provided in the introduction to the waste characteristics factor category.

Section 2.2.3 Identify hazardous substances available to a pathway. Explains which hazardous substances may be considered available to each pathway. For the three migration pathways, the primary limitation on availability of a hazardous substance to a pathway is that the substance must be in a source with a containment factor value, for that pathway, greater than 0; that is, the hazardous substance must be available to migrate from its source to the medium evaluated. For the soil exposure pathway, the primary limitation is that the substance must meet the criteria for observed contamination and, for the nearby threat, it must also be accessible.

Section 2.3 Likelihood of release. Specifies the criteria for establishing an observed release (discussed in section III G of this preamble) and explains that potential to release factors are evaluated only when an observed release cannot be documented. Table 2–3, which replaces Table 2–2 in the proposed rule, provides the revised observed release criteria for chemical analyses for the migration pathways. Table 2–3 is also used in establishing observed contamination for the soil exposure pathway.

Section 2.4 Waste characteristics. Defines the waste characteristics factor category.

Section 2.4.1 Selection of substance potentially posing greatest hazard. Explains how to select the substance potentially posing the greatest hazard.

Section 2.4.1.1 Toxicity factor. Explains how to assign toxicity values. Changes in the approach to scoring toxicity are discussed in section III D of this preamble. Table 2–4 (proposed rule Table 2–11) has been revised to make the assigned factor values linear rather than logarithmic values; however, the relationship among the values has not changed. A provision to always assign lead (and its compounds) an HRS toxicity factor value of 10,000 was added as a result of changes since the time of the proposed rule in the way EPA develops chronic toxicity values for lead (i.e., reference doses, in units of intake (mg/kg-day), are no longer developed for lead).

Section 2.4.1.2 Hazardous substance selection. Lists which factors are combined, in each pathway or threat, to select the hazardous substance potentially posing the greatest hazard. For each migration pathway, each substance eligible for consideration is evaluated based on the combination of toxicity (human or ecosystem) and/or mobility, persistence, and bioaccumulation (or ecosystem bioaccumulation) potential. The substances selected for each pathway or threat are those with the highest combined values. For the soil exposure pathway, the substance with the highest toxicity value is selected from among substances that meet the criteria for observed contamination for the threat being evaluated. The use of bioaccumulation in the selection of substances in the human food chain threat has changed as a result of the structural changes discussed above. In the proposed rule, only substances with the highest bioaccumulation values were evaluated for toxicity/persistence; in the final rule, the substance with the highest combined toxicity/persistence/bioaccumulation value is selected in the human food chain threat of the overland flow/flood migration component. For the ground water to surface water migration component, mobility is also considered. This revised method better reflects the overall threat.

Section 2.4.2 Hazardous waste quantity. Describes how to calculate the hazardous waste quantity factor value, as explained in section III D of this preamble. The explanation has been simplified from that presented in the proposed rule, and a discussion of unallocated sources has been added. A discussion clarifying the method for evaluating hazardous waste quantity in the soil exposure pathway was also added, and clarifying language on this point was inserted throughout the subsections of § 2.4.2. Table 2–13 from the proposed rule has been eliminated.

Section 2.4.2.1 Source hazardous waste quantity. Details the measures that may be considered in evaluating hazardous waste quantity for a source or area of observed contamination.

Section 2.4.2.1.1 Hazardous constituent quantity. Explains how to assign a value to the hazardous constituent quantity factor. An explanation of the treatment of RCRA hazardous wastes has been added to clarify the scoring of these wastes. Table 2–5, Hazardous Waste Quantity Evaluation Equations (proposed rule Table 2–14), has been revised in several ways. The constant divisor of 10 has been moved from these equations and is now incorporated into the factor values assigned using Table 2–6. Two types of surface impoundments are now listed to ensure that buried surface impoundments are treated appropriately. The term "tanks" has been added to containers other than drums to clarify how tanks should be evaluated. Also, equations for calculating hazardous waste quantity based on area have been revised based on a study of waste sites. The study indicated that new depth assumptions should be used for some sources; the land treatment equation was revised based on data from the same study about typical loading rates in land treatment operations.

Section 2.4.2.1.2 Hazardous wastestream quantity. Explains how to assign a value for hazardous wastestream quantity based on the mass of the wastestream. An explanation of the treatment of RCRA hazardous wastes has been added to clarify the scoring of these wastes.

Section 2.4.2.1.3 Volume. Explains how to assign a value for source volume.

Section 2.4.2.1.4 Area. Explains how to assign a value for source area.

Section 2.4.2.1.5 Calculation of source hazardous waste quantity value. Explains how to assign a value to source hazardous waste quantity.

Section 2.4.2.2 Calculation of hazardous waste quantity factor value. Explains how to assign a factor value to hazardous waste quantity using Table 2–6. The values in Table 2–6 include several changes. The cap applied to the factor value (i.e., the lowest hazardous waste quantity value required to assign the maximum factor value) has been increased to reflect more accurately the range of hazardous substance quantities found at waste sites. The cap is set based on the maximum quantity found at current NPL sites. Rather than being assigned a maximum of 100, as in the proposed rule, the assigned factor values range to 1,000,000. Each factor value less than the cap is assigned for quantities that range across two orders of magnitude. The two-order-of-magnitude ranges reflect the uncertainty in estimates of both quantity and concentration of the hazardous substances in sources and associated releases as well as uncertainty in identifying all sources and associated releases. Using the ranges also simplifies documentation requirements. Non-zero values below 1 are rounded to 1 to ensure that sites with small amounts of hazardous substances will receive a non-zero score for waste characteristics. When hazardous constituent quantity data are incomplete, the minimum hazardous waste quantity factor value is 10, except for: (1) Migration pathways that have any target subject to Level I or II concentrations; and (2) migration pathways where there has been a removal action and the hazardous waste quantity factor value would be 100 or greater without consideration of the removal action. In these cases, the minimum hazardous waste quantity factor value has been changed to 100 (see sections III C and III Q above for further discussion of the new minimum values).

Section 2.4.3 Waste characteristics factor category value. Explains how to assign a value to the waste characteristics factor category. As discussed above, the final waste characteristics factor value is capped at 100 (1,000 with bioaccumulation potential). Values are assigned by placing the product of the waste characteristics factors into ranges of one order of magnitude, to a cap of 10^8 (10^{12} if bioaccumulation potential is considered).

Section 2.4.3.1 Factor category value. Explains how to use Table 2–7 to assign a value to waste characteristics when bioaccumulation (or ecosystem bioaccumulation) potential is not considered.

Section 2.4.3.2 Factor category value, considering bioaccumulation potential. Explains how to use Table 2–7 to assign a value to waste characteristics when bioaccumulation (or ecosystem bioaccumulation) potential is considered.

Section 2.5 Targets. Explains how targets factors are evaluated. This approach generally involves three levels of evaluation (Level I, Level II, and Potential) and the use of media-specific concentration benchmarks, as discussed in section III H of this preamble. Level III has been dropped; use of benchmarks has been extended to all pathways and to factors that assign values to the nearest individual (well/intake). Also discusses assigning level based on direct observation and describes when tissue samples that do not establish actual contamination may be used in comparisons to benchmarks.

Section 2.5.1 Determination of level of actual contamination at a sampling location. Explains the approach used for evaluating the level of actual contamination at a sampling location; changes have been made to allow the level of actual contamination in the human food chain threat to be based on tissue samples from aquatic food chain organisms that cannot be used to establish an observed release.

Section 2.5.2 Comparison to benchmarks. Lists benchmarks and explains how to determine whether benchmarks have been equalled or exceeded (see section III H of this preamble); changes have been made to allow the level of actual contamination in the human food chain threat to be based on tissue samples from aquatic food chain organisms that cannot be used to establish an observed release.

Section 3 Ground Water Migration Pathway

The ground water migration pathway evaluates threats resulting from releases or potential releases of hazardous substances to aquifers. The major changes specific only to this pathway include replacement of the depth to aquifer/hydraulic conductivity and sorptive capacity factors with travel time and depth to aquifer factors; a revised approach for assigning mobility values; removal of the ground water use factors and their replacement by a resources factor; evaluation of the nearest well factor based on benchmarks; and revisions to scoring of sites having both karst and non-karst aquifers present.

Section 3.0 Ground Water Migration Pathway. Descriptive text has been removed. Figure 3–1 has been revised to reflect revisions to the factors evaluated, and Table 3–1 has been revised to reflect the new factor category values throughout.

Section 3.0.1 General considerations. The title has been changed.

Section 3.0.1.1 Ground water target distance limit. An explanation of the treatment of contaminated ground water plumes with no identified source has been added. For these plumes, measurement of the target distance limit begins at the center of the area of observed ground water contamination;

the center is determined based on available data.

Section 3.0.1.2 Aquifer boundaries. Descriptive text has been removed.

Section 3.0.1.2.1 Aquifer interconnections. Descriptive text has been removed as have examples of information useful for identifying aquifer interconnections.

Section 3.0.1.2.2 Aquifer discontinuities. Descriptive text has been removed.

Section 3.0.1.3 Karst aquifer. Descriptive text has been removed, and references to factors have been revised to reflect changes in factors. Text was added to clarify that karst aquifers underlying any portion of the sources at a site are given special consideration.

Section 3.1 Likelihood of release. Descriptive text has been removed.

Section 3.1.1 Observed release. Description of the criteria for establishing an observed release has been revised as discussed in Section III G of this preamble.

Section 3.1.2 Potential to release. Text has been revised to reflect changes in the factors evaluated and to clarify that karst aquifers underlying any portion of the sources at a site are given special consideration in evaluating depth to aquifer and travel time.

Section 3.1.2.1 Containment. Explanatory text has been removed and the ground water containment table is referenced. Only sources that meet the minimum size requirement (i.e., that have a source hazardous waste quantity value of 0.5 or higher) are used in assigning containment factor values. This requirement has been added to ensure that very small, uncontained sources do not unduly influence the score. For example, a site might have a large, but highly contained source and a very small, uncontained source; without a minimum size requirement, potential to release could be assigned the maximum value based on the very small source, which could overestimate the potential hazard posed by the site. If no source meets the minimum size requirement, the highest ground water containment factor value assigned to the sources at the site is used as the factor value. Table 3–2—Containment Factor Values for Ground Water Migration Pathway, has been simplified by combining repetitious items and has been moved from an attachment to the proposed rule into the body of the rule.

Section 3.1.2.2 Net precipitation. A new map has been added as Figure 3–2 to assign net precipitation factor values. The equation for calculating monthly potential evapotranspiration was clarified. Descriptive text has been removed.

Section 3.1.2.3 Depth to aquifer. As described in section III L of this preamble, the depth to aquifer factor has replaced the sorptive capacity factor and is no longer combined in a matrix with hydraulic conductivity for scoring. Table 3–5 is new and provides the factor values. The depth to aquifer factor reflects the geochemical retardation capacity of the subsurface materials, which generally increases as the depth increases. Depth to aquifer factor values are assigned to three depth ranges. Clarifying language was added related to karst aquifers.

Section 3.1.2.4 Travel time. As discussed in section III L of this preamble, this factor replaces the depth to aquifer/hydraulic conductivity factor and is based on the least conductive layer(s) rather than on the conductivities of all layers between the hazardous substances and the aquifer. Table 3–7 has been revised to reflect these changes. Table 3–5 from the proposed rule has been renumbered as Table 3–6. Text on how to obtain information to score this factor has been removed. Clarifying language was added related to karst aquifers.

Section 3.1.2.5 Calculation of potential to release factor value. Text has been revised to reflect new factor names.

Section 3.1.3 Calculation of likelihood of release factor category value. New maximum value of 550 based on observed release has been added.

Section 3.2 Waste characteristics. Descriptive text has been removed.

Section 3.2.1 Toxicity/mobility. Descriptive text has been removed.

Section 3.2.1.1 Toxicity. References § 2.4.1.1.

Section 3.2.1.2 Mobility. As discussed in sections III F and III P of this preamble, the method for assigning mobility values to hazardous substances has been revised. Table 3–8 has been revised. Mobility values are now linear rather than categorical place holders and are assigned in a matrix combining water solubility and distribution coefficients. Mobility values may now vary by aquifer for a specific hazardous substance. The maximum mobility value is no longer assigned based on observed release by direct observation. A factor value of 0 is no longer assigned for mobility, as had been the case under the proposed rule, where categorical place-holder values were used; because mobility is now multiplied by toxicity and hazardous waste quantity, assigning a 0 value would result in a pathway score of 0. This result could understate the risk posed by a site with a large volume of highly toxic hazardous substances with low mobility. Furthermore, given the uncertainties about estimates of mobility in ground water and their applicability in site-specific situations, EPA determined that a 0 value should not be assigned to the mobility factor under any conditions.

Section 3.2.1.3 Calculation of toxicity/mobility factor value. Text has been simplified. Table 3–9 (proposed rule Table 3–10), the matrix for assigning factor values, has been revised to reflect the linear nature of the assigned values. Values for a specific hazardous substance may now vary by aquifer.

Section 3.2.2 Hazardous waste quantity. References § 2.4.2.

Section 3.2.3 Calculation of waste characteristics factor category value. Text has been revised to indicate the multiplication of the factors, the new maximum value, and the table used to assign the factor category value.

Section 3.3 Targets. Text has been revised to reflect the new names for factors. Descriptive text has been removed. Table 3–10 (Table 3–12 in the proposed rule) has been modified to list the revised benchmarks in this pathway.

Section 3.3.1 Nearest well. Title has been changed from maximally exposed individual. Text has been added to explain how to evaluate nearest wells with documented contamination (at Level I and II) and those potentially contaminated. Text was added to assign Level II contamination to any drinking water well where an observed release was established by direct observation. This section also explains how to evaluate wells drawing from karst aquifers. Table 3–11 has been renamed and the factor values have been changed. See section III B of this preamble for a discussion of the changes to assigned values for this factor.

Section 3.3.2 Population. As discussed in section III H, population is evaluated using health-based benchmarks for drinking water. For populations potentially exposed, population ranges are used to evaluate the factor. This section explains whom to count for population. Populations served by wells whose water is blended with that from other drinking water sources are to be apportioned based on the well's relative contribution to the total blended system. The rule includes instructions on the type of data to use when determining relative contributions of wells and intakes. This change is intended to reflect more accurately the exposure to populations through blended systems. The rule also includes instructions on how to apportion population for systems with standby wells or standby surface water intakes.

Section 3.3.2.1 Level of contamination. Explains how to evaluate population based on concentrations of hazardous substances in samples. Text was added to assign Level II contamination to any drinking water wells where there is an observed release by direct observation.

Section 3.3.2.2 Level I concentrations. Explains how to evaluate populations exposed to Level I concentrations. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 3.3.2.3 Level II concentrations. Explains how to evaluate populations exposed to Level II concentrations. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 3.3.2.4 Potential contamination. Explains how to assign values to populations potentially exposed to contamination from the site. The formula for calculating population values has been modified to reflect both the revised method for evaluating karst aquifers (see below) and the use of distance-weighted population values from Table 3–12, which has been added to assign distance-weighted values for populations in each distance category. The values are determined for each distance category and are then added across distance categories, and the sum is divided by 10 to derive the factor value for potentially contaminated population. The assigned values in Table 3–12 were determined by statistical simulation to yield the same population value, on average, as the use of the formulas in the proposed rule. The use of range values has been adopted as part of the simplification discussed in section III A. The rounding rules have also changed. The method for evaluating karst aquifers has been simplified and is explained in this section. Table 3–14 in the proposed rule, which included dilution weighting factors for the general case and for two special cases, has been removed, and the two special karst cases are no longer evaluated. (The generally applicable dilution factors for karst have not changed and are all incorporated into the distance-weighted population values in Table 3–12.) The scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 3.3.2.5 Calculation of population factor value. Has been revised to reflect the changes in the evaluation of actually contaminated wells. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 3.3.3 Resources. Describes how points are assigned to resource uses of ground water. Points may be assigned if there are no drinking water wells within the target distance limit, but the water is usable for drinking water. This scoring allows for consideration of potential future uses of the aquifers. (See section III I of this preamble for a discussion of the relative weighting of these factors.)

Section 3.3.4 Wellhead protection area. Explains how to assign values to this factor. The maximum value is assigned when a source or an observed release lies partially or fully within a wellhead protection area applicable to the aquifer being evaluated, and this value has been changed from 50 to 20 to adjust for scale changes. A new criterion for scoring this factor has been added. If a wellhead protection area applicable to the aquifer being evaluated is within the target distance limit and neither of the other conditions is met, a value of five is assigned. This change allows the HRS to place a value on the resource.

Section 3.3.5 Calculation of targets factor category value. Has been revised to reflect changes in the factor names. The rounding rule has been changed, and the scoring cap was eliminated.

Section 3.4 Ground water migration score for an aquifer. Text has been revised to reflect the new divisor for normalizing pathway scores.

Section 3.5 Calculation of ground water migration pathway score. Text has been simplified.

In addition to the above noted changes, the sorptive capacity factor has been eliminated and replaced by the depth to aquifer factor, as have the tables used to assign values to this factor (Tables 3–6 and 3–7 in the proposed rule). The ground water use factors have also been eliminated as have the tables used to assign their values (Tables 3–15 and 3–16 in the proposed rule). Figures 3–2, 3–3, and 3–4 and Tables 3–4, 3–8, 3–9, 3–13 of the proposed rule have been removed.

Section 4 Surface Water Migration Pathway

The surface water migration pathway evaluates threats resulting from releases or potential releases of hazardous substances to surface water bodies. One major change to this pathway is the addition of a new component for scoring ground water discharge to surface water; either this component or the overland flow/flood migration component or both may be scored. For each component, three threats are evaluated: drinking water threat, human food chain threat, and environmental threat. Other major changes specific to this pathway include elimination of the recreational use threat; simplification of overland flow potential to release factors; modifications to the human food chain threat including addition of a food chain individual; modifications to the treatment of bioaccumulation potential and addition of a similar factor, ecosystem bioaccumulation potential, to the evaluation of the environmental threat; modifications to the persistence factor; revisions to the dilution weights; additions of benchmarks, extension of benchmarks to evaluation of the nearest intake, and addition of levels of contamination to the human food chain targets; modifications to criteria for establishing actual food chain contamination; elimination of the surface water use factor; addition of a resources factor to the targets evaluation in the drinking water threat; and revisions to sensitive environments.

Section 4.0 Surface Water Migration Pathway. New structure of the pathway is explained. Descriptive text has been removed. Figure 4–1 has been revised to reflect revisions to the factors evaluated, and Table 4–1 has been revised to reflect the new factor category values throughout.

Section 4.0.1 Migration components. Explains how to score the two migration components.

Section 4.0.2 Surface water categories. A definition of coastal tidal waters has been added. Some surface water bodies that belong in this new category were listed in other categories in the proposed rule (e.g., bays and wetlands contiguous with oceans). Isolated perennial wetlands have been added to the definition of lakes; salt water harbors largely protected by seawalls have been removed from the definition of lakes. Ocean has been defined more precisely as areas seaward from the baseline of the Territorial Sea. Contiguous bays have been removed from, and wetlands contiguous to the Great Lakes have been added to ocean and ocean-like bodies. These definitional changes/clarifications more accurately reflect the different characteristics of the water bodies.

Section 4.1 Overland flow/flood migration component. As discussed in section III M of this preamble, the surface water migration pathway has been divided into two components. The overland flow/flood component is essentially the surface water migration pathway as proposed except that the recreational use threat has been eliminated.

Section 4.1.1 General considerations. Consists of several subsections.

Section 4.1.1.1 Definition of the hazardous substance migration path for overland flow/flood migration component. Text has been simplified.

Section 4.1.1.2 Target distance limit. Explains target distance limits for sites in general and adds an explanation of how to calculate the target distance limit for contaminated sediments with no identified source. For these latter sources only, when there is a clearly defined direction of flow, the target distance limit is measured beginning at the observed sediment contamination farthest upstream; when there is no clearly defined direction of flow, the target distance limit is measured from the center of the area of observed sediment contamination. Discusses the determination of whether surface water targets are subject to actual or potential contamination. Also, text was added to assign Level II to targets subject to actual contamination based on direct observation.

Section 4.1.1.3 Evaluation of the overland flow/flood migration component. Explains that for multiple watersheds, highest score assigned to a watershed is used instead of summing watershed scores as proposed.

Section 4.1.2 Drinking water threat. Descriptive text has been removed.

Section 4.1.2.1 Drinking water threat—likelihood of release. Text has been simplified to clarify when potential to release factors need to be evaluated.

Section 4.1.2.1.1 Observed release. Text has been revised to reflect the changed maximum value.

Section 4.1.2.1.2 Potential to release. Text has been revised to reflect the changed maximum value and has been simplified.

Section 4.1.2.1.2.1 Potential to release by overland flow. Explains when overland flow potential to release is not evaluated.

Section 4.1.2.1.2.1.1 Containment. Text has been revised to reflect changes in the numbering of the containment table. Only sources that meet the minimum size requirement (i.e., that have a source hazardous waste quantity value of 0.5 or higher) are used in assigning containment values. This requirement has been added to ensure that very small, uncontained sources do not unduly influence the score. For example, a site might have a large, but highly contained source and a very small, uncontained source; without a minimum size requirement, the potential to release could be assigned the maximum value based on the very small source, which could overestimate the potential hazard posed by the site. If no source meets the minimum size requirement, the source with the highest surface water containment factor value is used. Descriptive text has been removed. Table 4–2, Containment Factor Values for Surface Water Migration Pathway, has been simplified by combining repetitious items and has been moved from an attachment to the proposed rule into this section of the final rule.

Section 4.1.2.1.2.1.2 Runoff. Text on evaluating rainfall has been simplified by removing explanatory references. The runoff curve number has been simplified by substituting a soil group designation in its place. Table 4–4 (proposed rule Table 4–2) has been revised to list only the soil group designations. Based on analyses of runoff and actual drainage area sizes, Table 4–3 (proposed rule Table 4–3) has been revised by changing the divisions of drainage area size. Table 4–5 (proposed rule Table 4–4) has been revised to reflect the changes related to the use of soil group designations. Table 4–6 (proposed rule Table 4–5) has been revised so that the heading in the table reads Rainfall/Runoff Value; the values assigned have been adjusted on the basis of both the higher maximum value assigned to the factor category and the analyses described above. Explanatory text has been removed.

Section 4.1.2.1.2.1.3 Distance to surface water. Values assigned to distance to surface water factor values in Table 4–7 (proposed rule Table 4–6) have been revised to adjust for the higher maximum assigned to the factor category.

Section 4.1.2.1.2.1.4 Calculation of the factor value for potential to release by overland flow. Has not been changed except for assigned value.

Section 4.1.2.1.2.2 Potential to release by flood. Descriptive text has been removed.

Section 4.1.2.1.2.2.1 Containment (flood). Text in Table 4–8 (proposed rule Table 4–7) has been revised to incorporate new language on required documentation on containment. The requirement for certification by an engineer has been dropped. The new documentation requirements have been added to make the rule consistent with RCRA requirements.

Section 4.1.2.1.2.2.2 Flood frequency. Values assigned to this factor by Table 4–9 (proposed rule Table 4–8) have been revised to better reflect probabilities and to adjust for the higher maximum assigned to the factor category. Descriptive text has been removed.

Section 4.1.2.1.2.2.3 Calculation of the factor value for potential to release by flood. Has been revised to reflect a minimum size requirement for sources.

Section 4.1.2.1.2.3 Calculation of potential to release factor value. Text has been simplified, and the assigned value has been changed.

Section 4.1.2.1.3 Calculation of drinking water threat—likelihood of release factor category value. Text has been simplified. The maximum value has been changed, and the maximum for potential to release is no longer equal to the maximum for observed release.

Section 4.1.2.2 Drinking water threat—waste characteristics. Descriptive text has been removed.

Section 4.1.2.2.1 Toxicity/persistence. Editorial changes have been made.

Section 4.1.2.2.1.1 Toxicity. References § 2.4.1.1.

Section 4.1.2.2.1.2 Persistence. As discussed in section III F of this preamble, several changes have been made to this factor, including the deletion of free-radical oxidation as a decay process and the inclusion of consideration of K_{ow} to account for sorption to sediments. Table 4–10 (proposed rule Table 4–9) has been revised to change the values assigned from categorical numbers to linear scales. The divisions among the half-lives for rivers, oceans, coastal tidal waters, and Great Lakes have changed based on a study of travel time, and the text has been modified to clarify the procedure for determining whether to base the persistence factor on lakes or on rivers, oceans, coastal tidal waters, and Great Lakes. A factor value of 0 is no longer assigned for persistence, as had been the case under the proposed rule, where categorical place-holder values were used; because persistence is now multiplied by toxicity and hazardous waste quantity, assigning a 0 value would result in a pathway score of 0. This result could understate the risk posed by a site with a large volume of highly toxic hazardous substances with low persistence. Furthermore, given the uncertainties about half-life estimates and their applicability in site-specific situations, EPA determined that a 0 value should not be assigned to the persistence factor under any conditions. The text has been modified to clarify selection of an appropriate default value. Table 4–11—Persistence Values—Log K_{ow}, has been added. Descriptive text has been removed.

Section 4.1.2.2.1.3 Calculation of toxicity/persistence factor value. Table reference has been changed to reflect the change in numbering. Table 4–12 (proposed rule Table 4–10) has been changed to reflect the multiplicative relationship.

Section 4.1.2.2.2 Hazardous waste quantity. References § 2.4.2.

Section 4.1.2.2.3 Calculation of drinking water threat—waste characteristics factor category value. Text has been revised to indicate the multiplication of the factors, the new maximum value, and the table used to assign the factor category value.

Section 4.1.2.3 Drinking water threat—targets. Descriptive text has been removed. Text was added to assign Level II to actual contamination based on direct observation.

Section 4.1.2.3.1 Nearest intake. Title and the factor name have been changed. As discussed in Section III B of this preamble, this factor is now assigned values based on health-based benchmarks. Instructions for how to assign dilution weights to closed lakes and lakes with no surface flow entering have been added. Table 4–13, Surface Water Dilution Weights (proposed rule Table 4–11), has been revised to add more types of surface water bodies and to change the dilution weights. These changes have been made to reflect more accurately the flow ranges of water bodies and are based on analysis of data on flow rates and dilution.

Section 4.1.2.3.2 Population. As explained above, population is evaluated based on two levels of actual contamination. Targets potentially contaminated are dilution weighted and are assigned values based on ranges. Populations served by intakes which are blended with water from other drinking water sources are to be apportioned based on the intake's relative contribution to the total blended system. The rule includes instructions on the type of data to use when determining relative contributions of intakes and wells. This change is intended to reflect more accurately the exposure of populations through blended systems. The rule also includes instructions on how to apportion population for systems with standby wells or standby surface water intakes.

Section 4.1.2.3.2.1 Level of contamination. Explains how to evaluate population based on the level of contamination to which they are exposed.

Section 4.1.2.3.2.2 Level I concentrations. Descriptive text has been removed. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 4.1.2.3.2.3 Level II concentrations. Text has been simplified and revised to reflect the changes discussed above. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 4.1.2.3.2.4 Potential contamination. Equation used to calculate this factor has been revised as discussed above. A new table, Table 4–14, Dilution-Weighted Population Values for Potential Contamination Factor for Surface Water Migration Pathway, has been added to assign values, which are then added across different surface water body types and divided by 10 to derive the value for potentially contaminated population. The assigned values in Table 4–14 for each population range category were determined by statistical simulation to yield the same population value, on average, as the use of the formulas in the proposed rule. The use of range values has been added as part of the simplification discussed in section III A. The rounding rule has also been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 4.1.2.3.2.5 Calculation of population factor value. Explains how to combine values assigned to the three population groups. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 4.1.2.3.3 Resources. As discussed in section III J of this preamble, this factor has been added to account for the potential impact of surface water contamination on resource uses.

Section 4.1.2.3.4 Calculation of drinking water threat—targets factor category value. Has been revised to reflect the changes in this factor category. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 4.1.2.4 Calculation of drinking water threat score for a watershed. Text has been simplified. The divisor has changed.

Section 4.1.3 Human food chain threat. Descriptive text has been removed.

Section 4.1.3.1 Human food chain threat—likelihood of release. Section references have been changed.

Section 4.1.3.2 Human food chain threat—waste characteristics. Text has been simplified.

Section 4.1.3.2.1 Toxicity/persistence/bioaccumulation. Text has been simplified and modified because of the change in the use of bioaccumulation potential in selecting the substance potentially posing the greatest hazard.

Section 4.1.3.2.1.1 Toxicity. Has been changed to reference § 2.4.1.1. Also changed so that evaluation of toxicity is not limited to substances with the highest bioaccumulation potential.

Section 4.1.3.2.1.2 Persistence. Clarifies how to evaluate persistence for contaminated sediment sources, and adds coastal tidal waters as a category of surface water. Also changed so that evaluation of persistence is not limited to substances with the highest bioaccumulation potential.

Section 4.1.3.2.1.3 Bioaccumulation potential. As described in section III M of this preamble, the method of accounting for bioaccumulation potential in the selection of the substance potentially posing the greatest hazard has been changed. In the final rule, bioaccumulation potential is considered together with toxicity and persistence rather than as a primary selection criterion. This change was made because all three factors are now scored on linear scales. In addition, where data exist, separate bioconcentration factor values are assigned for salt water and fresh water; the text now clarifies that the higher of these values is used for fisheries in brackish water and for sites with fisheries present in both salt water and fresh water. The adjustment for biomagnification has been dropped because it tended to double count bioaccumulation. Both Table 4–15 (Table 4–14 in the proposed rule) and the text have been modified to clarify the data hierarchy for assigning bioaccumulation potential factor values. Also, Table 4–15 now makes it clear that the assigned values for bioaccumulation potential are on a linear scale.

Section 4.1.3.2.1.4 Calculation of toxicity/persistence/bioaccumulation factor value. Explains how to calculate a toxicity/persistence/bioaccumulation value. Table 4–16, Toxicity/Persistence/Bioaccumulation, has been added to assign the factor value.

Section 4.1.3.2.2 Hazardous waste quantity. References § 4.1.2.2.2.

Section 4.1.3.2.3 Calculation of human food chain threat—waste characteristics factor category value. Text has been revised to indicate the multiplication of the toxicity/persistence and hazardous waste quantity factor values, subject to a maximum, and the further multiplication of that product by the bioaccumulation potential factor value, subject to a maximum for this second product, and to reference the table for assigning the factor category value.

Section 4.1.3.3 Human food chain threat—targets. Has been revised to reflect addition of the new food chain individual and the deletion of the fishery use factor. As discussed in section III M of this preamble, criteria for establishing a fishery subject to actual contamination have been revised. Text was added to describe the additional tissue samples that can be used to establish Level I contamination.

Section 4.1.3.3.1 Food chain individual. As discussed in section III M of this preamble, this factor is new. This section explains how to assign a value to the factor.

Section 4.1.3.3.2 Population. Has been changed as discussed in section III M of this preamble.

Section 4.1.3.3.2.1 Level I concentrations. The approach to calculating this factor value has been revised as discussed in section III M of this preamble. The rounding rule has been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 4.1.3.3.2.2 Level II concentrations. Explains how to assign values as discussed in section III M of this preamble. The rounding rule has been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 4.1.3.3.2.3 Potential human food chain contamination. The approach to calculating this factor value has been revised as discussed in section III M of this preamble. The rounding rule has been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 4.1.3.3.2.4 Calculation of the population factor value. Text has been revised to omit the maximum. The rounding rule has been changed, and the scoring cap was eliminated.

Section 4.1.3.3.3 Calculation of human food chain threat—targets factor category value. Explains how to calculate the targets value. The rounding rule has been changed, and the scoring cap was eliminated.

Section 4.1.3.4 Calculation of human food chain threat score for a watershed. Text has been simplified. The divisor has changed.

Section 4.1.4 Environmental threat. Descriptive text has been removed.

Section 4.1.4.1 Environmental threat—likelihood of release. Section references have been changed.

Section 4.1.4.2 Environmental threat—waste characteristics. Descriptive text has been removed.

Section 4.1.4.2.1 Ecosystem toxicity/persistence/bioaccumulation. Text has been revised to include the addition of ecosystem bioaccumulation potential as a multiplicative factor.

Section 4.1.4.2.1.1 Ecosystem toxicity. The approach for evaluating ecosystem toxicity has been revised. Additions have been made to the data hierarchy (see section III J of this preamble), and a default value of 100 was added to cover the situation where appropriate aquatic toxicity data were unavailable for all of the substances being evaluated. Table 4–19 (proposed rule Table 4–23) has been revised to make the factor linear and to eliminate the rating category of 0 (except when data are unavailable for a given substance); these changes make the ecosystem toxicity factor more consistent with the toxicity factor in the other pathways and threats. Text was added to clarify the evaluation of ecosystem toxicity for brackish water.

Section 4.1.4.2.1.2 Persistence. Section references have been changed. Clarifies how to evaluate persistence for contaminated sediment sources, and adds coastal tidal waters as a category of surface water.

Section 4.1.4.2.1.3 Ecosystem bioaccumulation potential. As explained in section III J of this preamble, this factor is new for this threat and is evaluated similarly to (but with several key differences from) the bioaccumulation potential factor in the human food chain threat.

Section 4.1.4.2.1.4 Calculation of ecosystem toxicity/persistence/bioaccumulation factor value. Section references have been changed. Table 4–20 (proposed rule Table 4–24) has been changed to reflect the changes in the values for the factors. Table 4–21, Ecosystem Toxicity/Persistence/Bioaccumulation Values, is new and assigns values for the combined toxicity/persistence/bioaccumulation factor.

Section 4.1.4.2.2 Hazardous waste quantity. Section references have been changed.

Section 4.1.4.2.3 Calculation of environmental threat—waste characteristics factor category value. Text has been revised to indicate the multiplication of the ecosystem toxicity/persistence and hazardous waste quantity factor values, subject to a maximum, and the further multiplication of that product by the ecosystem bioaccumulation potential factor value, subject to a maximum for this second product, and to reference the table for assigning the factor category value.

Section 4.1.4.3 Environmental threat—targets. Descriptive text has been removed.

Section 4.1.4.3.1 Sensitive environments. Explains how to evaluate sensitive environments. Table 4–22, Ecological-Based Benchmarks for Hazardous Substances in Surface Water, has been revised as described in section III H of this preamble. The rounding rule has also been changed.

Section 4.1.4.3.1.1 Level I concentrations. Explains the new method of evaluating wetlands based on wetland frontage, or, in some situations, wetland perimeter. Table 4–23, Sensitive Environments Rating Values, has been revised as discussed in section III J of this preamble. Table 4–24, Wetlands Rating Values for Surface Water Migration Pathway, has been added to assign values to wetlands based on the total length of wetlands. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 4.1.4.3.1.2 Level II concentrations. Has been revised to reflect the method of evaluating wetlands. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 4.1.4.3.1.3 Potential contamination. Has been revised to reflect the method of evaluating wetlands. The rounding rule has also been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 4.1.4.3.1.4 Calculation of environmental threat—targets factor category value. Has been revised to remove the maximum from the targets factor category. The rounding rule has also been changed.

Section 4.1.4.4 Calculation of environmental threat score for a watershed. Divisor for the threat has changed. A cap of 60 was explicitly placed on the environmental threat score, which results in the same maximum possible threat score as in the proposed rule. (In the proposed rule, environmental threat targets were capped at 120, which resulted in an environmental threat score maximum of 60.) However, in the final rule the targets category is uncapped and can score higher than 120 to compensate for low scores in other factor categories.

Section 4.1.5 Calculation of overland flow/flood migration component score for a watershed. Explains how to calculate the score for the watershed.

Section 4.1.6 Calculation of overland flow/flood migration component score. Explains how to calculate the score for the component based on the highest watershed score (in the proposed rule watershed scores were summed).

Section 4.2 Ground water to surface water migration component. As discussed in section III M of this preamble, this component has been added to the rule to account for contamination of surface water bodies through ground water migration of hazardous substances. Thus, all sections referring to this component are new.

Section 4.2.1 General considerations.

Section 4.2.1.1 Eligible surface waters. Explains the conditions that must apply before this component is scored. In general, this component is scored only when there is a surface water within one mile of a source, the top of the uppermost aquifer is at or above the bottom of the surface water, and no aquifer discontinuity is established between the source and the portion of surface water within one mile of the source. Exceptions are also explained.

Section 4.2.1.2 Definition of the hazardous substance migration path for ground water to surface water migration component. Explains that the migration path is defined as shortest straight-line distance, within the aquifer boundary, from a source to surface water.

Section 4.2.1.3 Observed release of a specific hazardous substance to surface water in-water segment. Explains that before an observed release of an individual hazardous substance can be established to the surface water in-water segment, the substance must meet the criteria for an observed release both to ground water and to surface water (this requirement does not affect the actual scoring of observed release). Also clarifies the use of samples from the surface water in-water segment.

Section 4.2.1.4 Target distance limit. Explains the criteria for determining the target distance limit and for establishing whether targets are subject to actual or potential contamination.

Section 4.2.1.5 Evaluation of the ground water to surface water migration component. Explains the general approach for evaluating this component. Figure 4–2, Overview of Ground Water to Surface Water Migration Component, is new. Table 4–25, which is new, provides the scoring sheets for this component.

Section 4.2.2 Drinking water threat. Explains the general approach for evaluating this threat.

Section 4.2.2.1 Drinking water threat—likelihood of release. Explains the general approach for evaluating this factor category.

Section 4.2.2.1.1 Observed release. Explains that scoring an observed release is based on releases to ground water.

Section 4.2.2.1.2 Potential to release. Explains that scoring is based on the scoring of potential release to uppermost aquifer.

Section 4.2.2.1.3 Calculation of drinking water threat—likelihood of release factor category value. Explains how to assign the factor category value.

Section 4.2.2.2 Drinking water threat—waste characteristics. Explains the general approach for evaluating this factor category.

Section 4.2.2.2.1 Toxicity/mobility/persistence. Explains the approach for evaluating these factors.

Section 4.2.2.2.1.1 Toxicity. Explains that toxicity values are assigned to all hazardous substances available to migrate to ground water.

Section 4.2.2.2.1.2 Mobility. Explains that the mobility value is assigned to all hazardous substances available to migrate to ground water.

Section 4.2.2.2.1.3 Persistence. Explains that this factor value is assigned as in the drinking water threat for the overland flow/flood migration component for all hazardous substances available to migrate to ground water.

Section 4.2.2.2.1.4 Calculation of toxicity/mobility/persistence factor value. Explains that the factor value is the highest value assigned to any hazardous substance evaluated using Table 4–26, which is new.

Section 4.2.2.2.2 Hazardous waste quantity. Explains that hazardous waste quantity is calculated for hazardous substances available to migrate to ground water.

Section 4.2.2.2.3 Calculation of drinking water threat—waste characteristics factor category value. Explains how to calculate the factor category value.

Section 4.2.2.3 Drinking water threat—targets. Explains the general approach for evaluating this factor category.

Section 4.2.2.3.1 Nearest intake. Explains how to determine the dilution weight adjustment using Table 4–27, which was added, and how to assign factor values. Figure 4–3 was added to illustrate determination of the ground water to surface water angle. (See section III O of this preamble for a discussion of this adjustment.)

Section 4.2.2.3.2 Population. This section parallels other population factor sections.

Section 4.2.2.3.2.1 Level I concentrations. Parallels the population factor sections in the overland flow/flood migration component.

Section 4.2.2.3.2.2 Level II concentrations. Parallels the population factor sections in the overland flow/flood migration component.

Section 4.2.2.3.2.3 Potential contamination. Parallels the population factor sections in the overland flow/flood migration component, except for addition of the dilution weight adjustment.

Section 4.2.2.3.2.4 Calculation of population factor value. Parallels other population factor sections.

Section 4.2.2.3.3 Resources. Parallels other resources factor sections.

Section 4.2.2.3.4 Calculation of the drinking water threat—targets factor category value. Explains how to calculate the factor category value.

Section 4.2.2.4 Calculation of drinking water threat score for a watershed. Explains how to calculate the score for a watershed.

Section 4.2.3 Human food chain threat. Lists the factors evaluated.

Section 4.2.3.1 Human food chain threat—likelihood of release. Explains how to assign the factor category value.

Section 4.2.3.2 Human food chain threat—waste characteristics. Lists the factors evaluated.

Section 4.2.3.2.1 Toxicity/mobility/persistence/bioaccumulation. Explains how to calculate these factor values using Table 4–28, which is new.

Section 4.2.3.2.1.1 Toxicity. Explains how to calculate this factor value.

Section 4.2.3.2.1.2 Mobility. Explains how to calculate this factor value.

Section 4.2.3.2.1.3 Persistence. Explains how to calculate this factor value.

Section 4.2.3.2.1.4 Bioaccumulation potential. Explains how to calculate this factor value.

Section 4.2.3.2.1.5 Calculation of toxicity/mobility/persistence/bioaccumulation factor value. Explains how to calculate this value using Tables 3–9, 4–26, and 4–28.

Section 4.2.3.2.2 Hazardous waste quantity. Explains how to assign the factor value.

Section 4.2.3.2.3 Calculation of human food chain threat—waste characteristics factor category value. Explains how to calculate this factor category value.

Section 4.2.3.3 Human food chain threat—targets. Explains the factors to be evaluated.

Section 4.2.3.3.1 Food chain individual. Explains how to assign the factor value.

Section 4.2.3.3.2 Population. Explains how to calculate this factor value.

Section 4.2.3.3.2.1 Level I concentrations. Parallels the population factor in the human food chain threat for the overland flow/flood migration component.

Section 4.2.3.3.2.2 Level II concentrations. Parallels the population factor in the human food chain threat for the overland flow/flood migration component.

Section 4.2.3.3.2.3 Potential human food chain contamination. Parallels the population factor in the human food chain threat for the overland flow/flood component, except for addition of the dilution weight adjustment.

Section 4.2.3.3.2.4 Calculation of the population factor value. Explains how to calculate this factor value.

Section 4.2.3.3.3 Calculation of human food chain threat—targets factor category value. Explains how to calculate this factor category value.

Section 4.2.3.4 Calculation of human food chain threat score for a watershed. Explains how to calculate the score for a watershed.

Section 4.2.4 Environmental threat. Lists the factors evaluated.

Section 4.2.4.1 Environmental threat—likelihood of release. Explains how to calculate this factor category value.

Section 4.2.4.2 Environmental threat—waste characteristics. Explains how to calculate this factor category value.

Section 4.2.4.2.1 Ecosystem toxicity/mobility/persistence/bioaccumulation. Explains how to calculate these factor values.

Section 4.2.4.2.1.1 Ecosystem toxicity. Explains how to calculate this factor value.

Section 4.2.4.2.1.2 Mobility. Explains how to calculate this factor value.

Section 4.2.4.2.1.3 Persistence. Explains how to calculate this factor value.

Section 4.2.4.2.1.4 Ecosystem bioaccumulation potential. Parallels the ecosystem bioaccumulation evaluation in the overland flow/flood component, except expands the species considered as discussed in section III J.

Section 4.2.4.2.1.5 Calculation of ecosystem toxicity/mobility/persistence/bioaccumulation factor value. Explains how to calculate this factor value using Tables 3–9, 4–29, and 4–30, which were added.

Section 4.2.4.2.2 Hazardous waste quantity. Explains how to calculate this factor value.

Section 4.2.4.2.3 Calculation of environmental threat—waste characteristics factor category value. Explains how to calculate this factor category value.

Section 4.2.4.3 Environmental threat—targets. Explains how to calculate this factor category value.

Section 4.2.4.3.1 Sensitive environments. Explains how to calculate this factor value.

Section 4.2.4.3.1.1 Level I concentrations. Parallels factor sections in the overland flow/flood migration component.

Section 4.2.4.3.1.2 Level II concentrations. Parallels factor sections in the overland flow/flood migration component.

Section 4.2.4.3.1.3 Potential contamination. Parallels factor sections in the overland flow/flood migration component, except for addition of the dilution weight adjustment.

Section 4.2.4.3.1.4 Calculation of environmental threat—targets factor category value. Explains how to calculate the value for the factor category.

Section 4.2.4.4 Calculation of environmental threat score for a watershed. Explains how to calculate this threat score for a watershed.

Section 4.2.5 Calculation of ground water to surface water migration component score for a watershed. Explains how to calculate a watershed score for this component.

Section 4.2.6 Calculation of ground water to surface water migration component score. Explains how to calculate this score based on the scores for watersheds evaluated for this component.

Section 4.3 Calculation of surface water migration pathway score. Explains how to assign the pathway score.

In addition to the above noted changes, the recreational use threat has been eliminated. The drinking water use and other use factors have also been eliminated as have the tables (4–12 and 4–13 in the proposed rule) that related to scoring these factors. Figures 4–1, 4–2, and 4–3 as well as Tables 4–15, and 4–17 through 4–22 from the proposed rule have been eliminated.

Section 5 Soil Exposure Pathway

The soil exposure pathway evaluates threats resulting from contamination of surface material. The major changes specific to this pathway include revision of the name of the pathway; elimination of children under seven as a population that must be counted and evaluated separately; addition of hazardous waste quantity to the waste characteristics factor category; inclusion of workers in the evaluation of resident population targets; weighting of resident population based on benchmarks; inclusion of the nearest individual factor in both the resident and nearby targets factor category; inclusion of a resources factor in the resident population evaluation; and revisions to the sensitive environments factor.

Section 5.0 Soil Exposure Pathway. The name of the pathway has been changed from onsite exposure to soil exposure. Descriptive text has been removed. Figure 5–1 has been revised to reflect revisions to the factors evaluated. Table 5–1 has been revised to reflect the new factor category values throughout, which were made more consistent with the other pathways.

Section 5.0.1 General considerations. Has been revised to reflect the redefinition of source, discussed in section III N of this preamble. The methods for establishing areas of observed contamination and for determining the hazardous substances associated with an area of observed contamination have been clarified. The instructions have been revised to make clear that any part of a site that is covered by a permanent or otherwise maintained impermeable material such as asphalt is not considered in evaluating the pathway.

Section 5.1 Resident population threat. Has been revised to specify when the resident population threat should be evaluated. The requirements state that this threat is scored when there is an area of observed contamination within the property boundary and within 200 feet of a residence, school, day care center, or workplace, or within the boundaries of terrestrial sensitive environments and specified resources.

Section 5.1.1 Likelihood of exposure. Text has been simplified.

Section 5.1.2 Waste characteristics. Evaluation of waste characteristics has been changed to include hazardous waste quantity as well as toxicity. Hazardous waste quantity was added to the factor category in response to comments that the pathway did not consider the dose relationship; the combination of hazardous waste quantity and toxicity is a surrogate for that relationship and makes the pathway more consistent with the rest of the rule. The text has been revised to reflect the change.

Section 5.1.2.1 Toxicity. References the section explaining how to assign toxicity factor values.

Section 5.1.2.2 Hazardous waste quantity. This section is new and explains how to assign a value to this factor. Table 5–2, Hazardous Waste Quantity Evaluation Equations for Soil Exposure Pathway, is a revision of Table 2–14 from the proposed rule. This table differs from Table 2–5 of the final rule because generally only the top two feet of an area of observed contamination are considered in evaluating the pathway. Landfills, contaminated soils, waste piles, land treatment areas, dry surface impoundments, and buried/backfilled surface impoundments, which can be evaluated based on their volume in Table 2–5, are evaluated for this pathway using the area measure because the area measure now has a two-foot depth built into the equation. Surface impoundments containing hazardous substances present as liquids, tanks, and containers may be evaluated based on volume because it is possible that a person could wade, swim, reach, or fall to a depth greater than two feet.

Section 5.1.2.3 Calculation of waste characteristics factor category value. Explains how to combine the toxicity and hazardous waste quantity factor values, subject to the new maximum.

Section 5.1.3 Targets. This factor category has been revised substantially. As discussed in section III N above, the high-risk target population has been eliminated, and workers have been added as targets. Table 5–3, Health-Based Benchmarks for Hazardous Substances in Soils, has been added to list benchmarks appropriate for this pathway.

Section 5.1.3.1 Resident individual. The resident individual factor has been added for consistency with other pathways.

Section 5.1.3.2 Resident population. Explains how to evaluate the resident population using health-based benchmarks, described in section III H above, and how to estimate this population.

Section 5.1.3.2.1 Level I concentrations. Explains how to assign a value for this new factor.

Section 5.1.3.2.2 Level II concentrations. Explains how to assign a value for this new factor.

Section 5.1.3.2.3 Calculation of resident population factor value. Explains how to calculate this factor value.

Section 5.1.3.3 Workers. Explains how to evaluate workers.

Section 5.1.3.4 Resources. Explains how to assign values if the area of observed contamination includes land used for commercial agriculture, commercial silviculture, or commercial livestock grazing or production.

Section 5.1.3.5 Terrestrial sensitive environments. The value assigned for this factor has been revised so that the value is based on the sum of the values assigned to terrestrial sensitive environments in areas of observed contamination, rather than on the highest scoring terrestrial sensitive environment. The maximum value that can be assigned to this factor is limited, but is higher than under the proposed rule. The limit is determined by scoring the pathway with only sensitive environments in the targets factor category; the pathway score under these conditions may not exceed 60 points. The sensitive environments listed in Table 5–5 have been modified. The text has been simplified and references changed to correspond to changes in the rule. The rounding rule has been changed.

Section 5.1.3.6 Calculation of resident population targets factor category value. Explains how to calculate the factor category value from the revised factors. The rounding rule has been changed.

Section 5.1.4 Calculation of resident population threat score. Has only minor editorial changes.

Section 5.2 Nearby population threat. Introductory text has been clarified.

Section 5.2.1 Likelihood of exposure. Lists the factors evaluated.

Section 5.2.1.1 Attractiveness/accessibility. As explained in section III N of this preamble, the name of this factor has changed as have the criteria used to assign values. This factor now emphasizes the use of the area by the general public. Descriptive text has been removed. Table 5–6 (proposed rule Table 5–4) has been changed by redefining the criteria and the assigned values, and by adding a value of 0 for sites that are physically inaccessible to the public.

Section 5.2.1.2 Area of contamination. The title of this section has been changed. This factor is now based solely on area of contamination, which relates to the likelihood of exposure, unlike hazardous waste quantity, which serves as part of the surrogate for dose. Values are assigned using Table 5–7, which is new.

Section 5.2.1.3 Likelihood of exposure factor category value. Text has been revised to reflect the new names of the factors. Table 5–8 (proposed rule Table 5–5) has been revised in response to the changes noted above for the attractiveness/accessibility and area of contamination factors.

Section 5.2.2 Waste characteristics. Text has been revised to reflect changes in the factor category.

Section 5.2.2.1 Toxicity. Explains how to evaluate the toxicity factor for the nearby population threat.

Section 5.2.2.2 Hazardous waste quantity. This section is new, as is consideration of this factor in this threat. As discussed above, this factor has been added in response to comments and to make the pathway more consistent with the other pathways. The section explains how to assign the factor value.

Section 5.2.2.3 Calculation of waste characteristics factor category value. Explains how to combine the toxicity and hazardous waste quantity factor values, subject to the new maximum.

Section 5.2.3 Targets. Descriptive text has been removed.

Section 5.2.3.1 Nearby individual. This section is new and explains how to assign a value to the nearby individual (i.e., resident or student with shortest travel distance) if there is no resident individual. The factor has been added to make the nearby threat consistent with other pathways. Table 5–9, Nearby Individual Factor Values, is new.

Section 5.2.3.2 Population within one mile. This section is new and includes the text that previously appeared under the Targets section. The section explains how to assign a value using Table 5–10. The text has been revised for clarity. Table 5–10, Distance-Weighted Population Values for Nearby Population Threat, is new. The table assigns distance-weighted values for population in each travel distance category. The values in the table were determined by statistical simulation to yield the same population, on average, as the use of the formulas in the proposed rule. The distance weights have been modified as follows: for travel distance of >0 to ¼ mile, the assigned distance weight is 0.025; for >¼ to ½ mile, 0.0125, and for >½ to 1 mile, 0.00625. The use of population ranges has been adopted as part of the simplification discussed in section III A.

Section 5.2.3.3 Calculation of nearby population targets factor category value. Text has been revised to reflect the changes in the targets factor category and in the rounding rule.

Section 5.2.4 Calculation of nearby population threat score. Minor editorial changes only.

Section 5.3 Calculation of the soil exposure pathway score. Has been changed to reflect the change in the value used as a divisor.

In addition to the above noted changes, Figures 5–2 and 5–3 and Tables 5–4 and 5–6 from the proposed rule have been removed.

Section 6 Air Migration Pathway

The air migration pathway evaluates the relative threat resulting from releases or potential releases of hazardous substances, either as gases or particulates, to the air. The major changes specific to this pathway include separate evaluation of gas and particulates in the likelihood to release factor category; inclusion of benchmarks to evaluate population and the nearest individual; weighting of sensitive environments based on actual or potential contamination; revision of the distance weights; deletion of the land use factor and inclusion of a resources factor in the evaluation of population; and revisions to the mobility factor.

Section 6.0 Air Migration Pathway. Descriptive text has been removed. Figure 6-1 has been revised to reflect revisions to the factors evaluated, and Table 6-1 has been revised to reflect the new factor category values throughout.

Section 6.1 Likelihood of release. Has been revised to eliminate explanatory text and to add instructions about which factors to evaluate for this factor category.

Section 6.1.1 Observed release. As discussed in section III G of this preamble, the specific criteria have been revised.

Section 6.1.2 Potential to release. As explained in section III O of this preamble, the method for evaluating this factor has been revised. Gas potential to release and particulate potential to release are evaluated separately. The explanatory text has been removed.

Section 6.1.2.1 Gas potential to release. Explains how this factor is evaluated. Table 6-2 (proposed rule Table 2-3) has been revised to apply only to the gas potential to release factors.

Section 6.1.2.1.1 Gas containment. Descriptive text has been removed. Table 6-3 (proposed rule Table 2-5) has been simplified. The depth requirements and other containment requirements have been revised based on public comment, the field test, and a review of recent information on covering systems. Consideration of biogas releases has been added. Assigned values have been revised and also reflect the revised maximum value for the factor.

Section 6.1.2.1.2 Gas source type. New source types have been added to Table 6-4 (proposed rule Table 2-6), and the assigned values have been revised. As explained in section III O of this preamble, new source types and subgroups for specific types have been added, in response to comments and the field test, to make this factor easier to evaluate. Treatment of sources when no source meets the minimum size has been clarified.

Section 6.1.2.1.3 Gas migration potential. As explained in section III O of this preamble, this section has been renamed and the approach for assigning values changed slightly. This section explains how to assign values to each substance and subsequently to the source using Tables 6-5, 6-6, and 6-7. Dry soil relative volatility has been removed as a measure of gas migration potential. The footnotes have been removed from Table 6-5 (proposed rule Table 2-7) and the name has been changed to "Values for Vapor Pressure and Henry's Constant." The titles of Tables 6-6 and 6-7 have been changed. The values assigned have also been changed to reflect the revised maximum value for the factor category. Descriptive text has been removed.

Section 6.1.2.1.4 Calculation of gas potential to release value. Explains how to calculate this value.

Section 6.1.2.2 Particulate potential to release. Explains how this factor is evaluated. Table 6-8 (proposed rule Table 2-3) has been revised to apply only to the particulate potential to release factors.

Section 6.1.2.2.1 Particulate containment. References Table 6-9 (Table 2-5 from the proposed rule). The criteria and values assigned using this table have been changed, as discussed in section III O of this preamble. Considerations of depth have been added for particulates.

Section 6.1.2.2.2 Particulate source type. In response to comments, new kinds of source types and subgroups of source types have been added to make this factor easier to score. The values assigned have been revised to reflect the changed factor category maximum. Treatment of sources when no source meets the minimum size has been clarified.

Section 6.1.2.2.3 Particulate migration potential. Has been renamed. Descriptive text has been removed. Proposed rule Figure 2-3 has been simplified, expanded, and renumbered as Figure 6-2. Proposed rule Table 2-9 has been renumbered as Table 6-10.

Section 6.1.2.2.4 Calculation of particulate potential to release value. Describes how to calculate this value.

Section 6.1.2.3 Calculation of potential to release factor value for the site. Text has been simplified and modified to account for gas and particulate potential to release.

Section 6.1.3 Calculation of likelihood of release factor category value. Describes calculation procedure.

Section 6.2 Waste characteristics. Descriptive text has been removed.

Section 6.2.1 Toxicity/mobility. Text has been simplified.

Section 6.2.1.1 Toxicity. Descriptive text has been removed and § 2.4.1.1 is referenced.

Section 6.2.1.2 Mobility. As explained in section III F of this preamble, the scoring of this factor has changed. Gas mobility is now based only on vapor pressure. The maximum value assigned for particulate mobility is no longer the same as the maximum assigned for gas mobility. The particulate mobility values are assigned based on Figure 6-3 or the equation in the text along with Table 6-12. The values assigned have been put on linear scales to be consistent with the new structure of the waste characteristics factor category. The text has been simplified.

Section 6.2.1.3 Calculation of toxicity/mobility factor value. Table 6-13, proposed rule Table 2-12, the matrix for assigning toxicity/mobility factor values has been revised to reflect the changes in values assigned to both factors.

Section 6.2.2 Hazardous waste quantity. Descriptive text has been removed and § 2.4.2 is referenced.

Section 6.2.3 Calculation of waste characteristics factor category value. The text has been revised to indicate the multiplication of the component factors, the new maximum value, and the table used to assign the factor category value.

Section 6.3 Targets. The target distance limit has been modified to include targets beyond four miles when an observed release extends beyond that distance. Text has been added to explain how to evaluate populations and sensitive environments exposed to actual contamination. Text was added to clarify that actual contamination based on an observed release established by direct observation should be considered Level II. Table 6-14, Health-Based Benchmarks for Hazardous Substances in Air, has been added to list the benchmarks used for this pathway. Table 6-15, Air Migration Pathway Distance Weights (proposed rule Table 2-16), has been revised to reflect changes in the distance weights discussed in section III O of this preamble.

Section 6.3.1 Nearest individual. The title has been changed from maximally exposed individual. As discussed above, this factor is now evaluated based on actual contamination and potential contamination. The name of Table 6-16 (proposed rule Table 2-15) has been changed and the values have been revised based on changes to the distance weights. Descriptive text has been removed.

Section 6.3.2 Population. Evaluation of population based on health-based benchmarks has been added as discussed in section III H of this preamble.

Section 6.3.2.1 Level of contamination. Explains how to evaluate population based on concentrations of hazardous substances in samples.

Section 6.3.2.2 Level I concentrations. Explains how to evaluate populations exposed to Level I concentrations. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 6.3.2.3 Level II concentrations. Explains how to evaluate populations exposed to Level II concentrations.

Section 6.3.2.4 Potential contamination. Explains how to assign values to populations potentially exposed to contamination from the site. The formula for calculating population values has been revised. Table 6–17, which assigns distance-weighted values for populations in each distance category, has been added. The values in the table were determined by statistical simulation to yield the same population, on average, as the use of the formulas in the proposed rule. The use of population ranges has been adopted as part of the simplification discussed in section III A. The rounding rule has been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 6.3.2.5 Calculation of the population factor value. Explains how to calculate the factor value. The scoring cap was eliminated.

Section 6.3.3 Resources. Explains how to assign points to resources, which in this pathway is based on the presence of commercial agriculture, commercial silviculture, and major or designated recreation areas.

Section 6.3.4 Sensitive environments. Explains how sensitive environments are evaluated based on actual and potential contamination. The maximum value that can be assigned to this factor is limited, but is greater than in the proposed rule. The limit is determined by scoring the pathway with only sensitive environments in the targets factor category; the pathway score under these conditions may not exceed 60 points.

Section 6.3.4.1 Actual contamination. Explains how to assign factor values for sensitive environments subject to actual contamination and how to assign values to wetlands based on total acreage. A new Table 6–18, Wetlands Rating Values for the Air Migration Pathway, has been added to assign values to wetlands based on acreage.

Section 6.3.4.2 Potential contamination. Explains how to calculate the factor value for potentially contaminated sensitive environments and how to assign values to wetlands based on total acreage within each distance category. The rounding rule has been changed.

Section 6.3.4.3 Calculation of sensitive environments factor value. Explains how to calculate the factor value. The rounding rule has been changed.

Section 6.3.5 Calculation of targets factor category value. Text has been revised to reflect the new names for factors.

Section 6.4 Calculation of air migration pathway score. Text has been revised to reflect the new divisor.

In addition to the above noted changes, the land use factor, Figure 2–2, and Tables 2–2, 2–3, 2–13, 2–17, and 2–19 in the proposed rule have been removed.

Section 7 Sites Containing Radioactive Substances

This entire part of the rule is new. As discussed in section III E of the preamble, this section has been added to provide direction on evaluating sites containing radioactive substances. Table 7–1 lists factors evaluated differently for such sites.

Section 7.1 Likelihood of release/likelihood of exposure. Explains the approach to evaluating the factor category.

Section 7.1.1 Observed release/observed contamination. Explains how to evaluate observed release (observed contamination) for radionuclides. The evaluation differs for radionuclides that occur naturally or are ubiquitous in the environment, for man-made radionuclides without ubiquitous background concentrations in the environment, and for gamma-emitting radionuclides in the soil exposure pathway. This section also explains the appropriate procedures for sites with mixed radioactive and other hazardous substances.

Section 7.1.2 Potential to release. Explains that potential to release factors are evaluated on the physical and chemical properties of radionuclides, not their radioactivity.

Section 7.2 Waste characteristics. Lists the factors evaluated.

Section 7.2.1 Human toxicity. Explains how to assign toxicity values to radioactive substances and describes appropriate procedures for sites containing mixed radionuclides and other hazardous substances.

Section 7.2.2 Ecosystem toxicity. Explains that ecosystem toxicity for radionuclides is assigned a value in the same way as is human toxicity except that the default value is 100 rather than 1,000.

Section 7.2.3 Persistence. Explains that radioactive substances are assigned persistence values based solely on half-life—radioactive half-life and volatilization half-life. Explains how to evaluate persistence for mixed radioactive and other hazardous substances.

Section 7.2.4 Selection of the substance potentially posing greatest hazard. The section explains how to select the substance potentially posing the greatest hazard.

Section 7.2.5 Hazardous waste quantity. Explains how to evaluate the hazardous waste quantity factor for sites containing radioactive substances.

Section 7.2.5.1 Source hazardous waste quantity for radionuclides. Describes differences between the migration pathways and the soil exposure pathway.

Section 7.2.5.1.1 Radionuclide constituent quantity (Tier A). Explains how to evaluate radionuclide constituent quantity for radionuclides.

Section 7.2.5.1.2 Radionuclide wastestream quantity (Tier B). Explains how to evaluate radionuclide wastestream quantity for radionuclides.

Section 7.2.5.1.3 Calculation of source hazardous waste quantity value for radionuclides. Explains how to assign a source value.

Section 7.2.5.2 Calculation of hazardous waste quantity factor value for radionuclides. Explains how to calculate the hazardous waste quantity factor value for radionuclides and describes use of the minimum value, which is either 10 or 100 (as described in section 2.4.2.2 above).

Section 7.2.5.3 Calculation of hazardous waste quantity factor value for sites containing mixed radioactive and other hazardous substances. Explains how to calculate the factor value for these sites.

Section 7.3 Targets. Explains how to evaluate targets at sites containing radioactive substances and sites containing radioactive and other hazardous substances.

Section 7.3.1 Level of contamination at a sampling location. Explains how to determine the appropriate level of contamination.

Section 7.3.2 Selection of benchmarks and comparisons with observed release/observed contamination. This section lists the benchmarks and explains how they are used in determining the level of contamination.

V. Required Analyses

A. Executive Order No. 12291

Under Executive Order No. 12291, the Agency must judge whether a regulation is "major" and thus subject to the requirement of a Regulatory Impact Analysis. The rule published today is not major because the rule will not result in an effect on the economy of $100 million or more, will not result in increased costs or prices, will not have significant adverse effects on competition, employment, investment, productivity, and innovation, and will not significantly disrupt domestic and export markets.

To estimate the costs associated with the final rule, a final economic analysis entitled "Economic Impact Analysis of the Revised Hazard Ranking System" was prepared as an addendum to the December 1987 economic impact analysis (EIA) to incorporate new data. As in the January 1988 EIA, the total annual cost of implementing the final rule is estimated as a function of the number of Screening SIs (SSI) and Listing SIs (LSI) that will be conducted annually and the unit cost of each. In the January 1988 EIA, estimates of total costs were developed assuming 1,130 SSIs and 100 LSIs would be conducted annually. The Agency now estimates that 1,100 SIs will be conducted annually (EPA is no longer using the terms SSI and LSI). The total annual cost is estimated to be $78.8 million, the sum of the cost of conducting 1,000 SIs at a unit cost of $55,000, 70 SIs for NPL sites (without monitoring wells) at a unit cost of $100,000, and 30 SIs for NPL sites (with monitoring wells) at a unit cost of $160,000.

To estimate the incremental cost of implementing the final revised version of the HRS, the unit cost of conducting all preremedial listing activities using the current HRS from the January 1988 EIA is updated. That cost was estimated to be $58,200 in the January 1988 EIA, and was developed assuming the PA had already been conducted. The 1988 estimate is a function of 480 hours of Field Investigation Team (FIT) technical time valued at $40 per hour and 30 samples being evaluated at a unit cost of $1,300 per sample. To compare the costs of the current HRS to those developed above for the final revised version of the HRS, the FIT technical time is valued at $50 per hour and each sample evaluation is estimated to cost $1,000. The revised total cost of conducting all listing activities beyond the PA for the current HRS, therefore, is estimated to be $54,000. In addition, the average level of effort for a PA under the current HRS is estimated to be 60 hours, and the unit cost of the PA, assuming a $50 FIT hourly rate, is estimated to be $3,000.

Based on these revisions, the annual cost of using the current HRS is estimated to be $65.4 million, the sum of the cost of conducting 2,000 PAs at a unit cost of $3,000 ($6 million) and the cost of conducting 1,100 SIs at a unit cost of $54,000 ($59.4 million). Compared to the current HRS, the annual incremental cost of using the final revised version of the HRS is estimated to be $13.4 million. On the basis of this evaluation, implementing the final revised version of the HRS would not constitute a major rule, because the annual incremental cost of the final rule is less than $100 million. No negative economic effects are anticipated from this rule.

B. Regulatory Flexibility Determination

Appendix A of the December 1987 EIA includes an assessment of the ability of responsible parties to pay the costs of HRS scoring under the current HRS and the three alternative scoring mechanisms considered at that time. That analysis evaluated the impact of HRS costs under each ranking methodology on the financial viability of 15 sample companies. Under that analysis, only the smallest sample firm (one with an average net income of $53,700) was expected to have difficulty in paying the costs of conducting a complete SI under each of the alternative ranking scenarios. The new unit cost of a complete SI developed during the Phase I field test and used in this economic analysis falls within the range of costs already evaluated in appendix A of the December 1987 EIA. Given the previous analysis, EPA concludes that most sample firms are healthy enough financially to be able to afford the expenditures associated with HRS site inspections. Responsible Parties (RPs) that are financially similar to the smallest firm (Firm 15 in appendix A of the December 1987 RIA), however, do not have the assets or the income to enable them to assume payments similar to the estimates derived for the SI done under the current HRS or the final revised version of the HRS.

The Regulatory Flexibility Act of 1980 requires that Federal agencies explicitly consider the effects of proposed and existing regulations on small entities and examine alternative regulations that would reduce significant adverse impacts on small entities. The small entities that could be affected by the revisions to the HRS are small businesses and small municipalities that are responsible for hazardous wastes at a site. Based on the updated analysis presented here, EPA concludes that using the final rule is unlikely to result in a significant impact on a substantial number of small entities. As discussed in the December 1987 EIA, this conclusion is drawn because small firms are no more or less likely to be responsible parties than are large firms. In addition, when they are RPs, small firms usually are one of several companies responsible for a site and probably would not bear the full burden of liability for HRS expenditures and other cleanup costs.

C. Paperwork Reduction Act

The information collection requirements contained in this rule have been approved by the Office of Management and Budget (OMB) under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.*, and has assigned OMB control number 2050–0095.

Public reporting burden for this collection of information is estimated to be 620 hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Chief, Information Policy Branch, PM—U.S. Environmental Protection Agency, 401 M St., SW., Washington, DC 20460; and the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503, marked "Attention: Desk Officer for EPA."

D. Federalism Implications

E.O. 12612 requires agencies to assess whether a regulation will have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPA has determined that this regulation does not have federalism implications and that, therefore, a Federalism Assessment is not required.

List of Subjects in 40 CFR Part 300

Air pollution controls, Chemicals, Hazardous materials, Intergovernmental relations, Natural resources, Oil pollution, Reporting and recordkeeping, Superfund, Waste treatment and disposal, Water pollution control, Water supply.

Dated: November 9, 1990.

William K. Reilly,

Administrator.

40 CFR part 300 is amended as follows:

PART 300—[AMENDED]

1. The authority citation for part 300 continues to read as follows:

Authority: 42 U.S.C. 9605; 33 U.S.C. 1321(c)(2); E.O. No. 117535, 38 FR 21243; E.O No. 12580, 52 FR 2923.

2. Part 300, appendix A is revised to read as follows:

Appendix A to Part 300—The Hazard Ranking System

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1.0 Introduction

The Hazard Ranking System (HRS) is the principal mechanism the U.S. Environmental Protection Agency (EPA) uses to place sites on the National Priorities List (NPL). The HRS serves as a screening device to evaluate the potential for releases of uncontrolled hazardous substances to cause human health or environmental damage. The HRS provides a measure of relative rather than absolute risk. It is designed so that it can be consistently applied to a wide variety of sites.

1.1 Definitions

Acute toxicity: Measure of toxicological responses that result from a single exposure to a substance or from multiple exposures within a short period of time (typically several days or less). Specific measures of acute toxicity used within the HRS include lethal dose$_{50}$ (LD$_{50}$) and lethal concentration$_{50}$ (LC$_{50}$), typically measured within a 24-hour to 96-hour period.

Ambient Aquatic Life Advisory Concentrations (AALACs): EPA's advisory concentration limit for acute or chronic toxicity to aquatic organisms as established under section 304(a)(1) of the Clean Water Act, as amended.

Ambient Water Quality Criteria (AWQC): EPA's maximum acute or chronic toxicity concentrations for protection of aquatic life and its uses as established under section 304(a)(1) of the Clean Water Act, as amended.

Bioconcentration factor (BCF): Measure of the tendency for a substance to accumulate in the tissue of an aquatic organism. BCF is determined by the extent of partitioning of a substance, at equilibrium, between the tissue of an aquatic organism and water. As the ratio of concentration of a substance in the organism divided by the concentration in water, higher BCF values reflect a tendency for substances to accumulate in the tissue of aquatic organisms. [unitless].

Biodegradation: Chemical reaction of a substance induced by enzymatic activity of microorganisms.

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (Pub. L. 96–510, as amended).

Chronic toxicity: Measure of toxicological responses that result from repeated exposure to a substance over an extended period of time (typically 3 months or longer). Such responses may persist beyond the exposure or may not appear until much later in time than the exposure. HRS measures of chronic toxicity include Reference Dose (RfD) values.

Contract Laboratory Program (CLP): Analytical program developed for CERCLA waste site samples to fill the need for legally defensible analytical results supported by a high level of quality assurance and documentation.

Contract-Required Detection Limit (CRDL). Term equivalent to contract-required quantitation limit, but used primarily for inorganic substances.

Contract-Required Quantitation Limit (CRQL): Substance-specific level that a CLP laboratory must be able to routinely and reliably detect in specific sample matrices. It is not the lowest detectable level achievable, but rather the level that a CLP laboratory should reasonably quantify. The CRQL may or may not be equal to the quantitation limit of a given substance in a given sample. For HRS purposes, the term CRQL refers to both the contract-required quantitation limit and the contract-required detection limit.

Curie (Ci): Measure used to quantify the amount of radioactivity. One curie equals 37 billion nuclear transformations per second, and one picocurie (pCi) equals 10^{-12} Ci.

Decay product: Isotope formed by the radioactive decay of some other isotope. This newly formed isotope possesses physical and chemical properties that are different from those of its parent isotope, and may also be radioactive.

Detection Limit (DL): Lowest amount that can be distinguished from the normal random "noise" of an analytical instrument or method. For HRS purposes, the detection limit used is the method detection limit (MDL) or, for real-time field instruments, the detection limit of the instrument as used in the field.

Dilution weight: Parameter in the HRS surface water migration pathway that reduces the point value assigned to targets as the flow or depth of the relevant surface water body increases. [unitless].

Distance weight: Parameter in the HRS air migration, ground water migration, and soil exposure pathways that reduces the point value assigned to targets as their distance increases from the site. [unitless].

Distribution coefficient (K_d): Measure of the extent of partitioning of a substance between geologic materials (for example, soil, sediment, rock) and water (also called partition coefficient). The distribution coefficient is used in the HRS in evaluating the mobility of a substance for the ground water migration pathway. [ml/g].

ED_{10} (10 percent effective dose): Estimated dose associated with a 10 percent increase in response over control groups. For HRS purposes, the response considered is cancer. [milligrams toxicant per kilogram body weight per day (mg/kg-day)].

Food and Drug Administration Action Level (FDAAL): Under section 408 of the Federal Food, Drug and Cosmetic Act, as amended, concentration of a poisonous or deleterious substance in human food or animal feed at or above which FDA will take legal action to remove adulterated products from the market. Only FDAALs established for fish and shellfish apply in the HRS.

Half-life: Length of time required for an initial concentration of a substance to be halved as a result of loss through decay. The HRS considers five decay processes: biodegradation, hydrolysis, photolysis, radioactive decay, and volatilization.

Hazardous substance: CERCLA hazardous substances, pollutants, and contaminants as defined in CERCLA sections 101(14) and 101(33), except where otherwise specifically noted in the HRS.

Hazardous wastestream: Material containing CERCLA hazardous substances (as defined in CERCLA section 101(14)) that was deposited, stored, disposed, or placed in, or that otherwise migrated to, a source.

HRS *"factor":* Primary rating elements internal to the HRS.

HRS *"factor category":* Set of HRS factors (that is, likelihood of release [or exposure], waste characteristics, targets).

HRS *"migration pathways":* HRS ground water, surface water, and air migration pathways.

HRS *"pathway":* Set of HRS factor categories combined to produce a score to measure relative risks posed by a site in one of four environmental pathways (that is, ground water, surface water, soil, and air).

HRS *"site score":* Composite of the four HRS pathway scores.

Henry's law constant: Measure of the volatility of a substance in a dilute solution of water at equilibrium. It is the ratio of the vapor pressure exerted by a substance in the gas phase over a dilute aqueous solution of that substance to its concentration in the solution at a given temperature. For HRS purposes, use the value reported at or near 25° C. [atmosphere-cubic meters per mole ($atm\text{-}m^3/mol$)].

Hydrolysis: Chemical reaction of a substance with water.

Karst: Terrain with characteristics of relief and drainage arising from a high degree of rock solubility in natural waters. The majority of karst occurs in limestones, but karst may also form in dolomite, gypsum, and salt deposits. Features associated with karst terrains typically include irregular topography, sinkholes, vertical shafts, abrupt ridges, caverns, abundant springs, and/or disappearing streams. Karst aquifers are associated with karst terrain.

LC_{50} (lethal concentration, 50 percent): Concentration of a substance in air [typically micrograms per cubic meter ($\mu g/m^3$)] or water [typically micrograms per liter ($\mu g/l$)] that kills 50 percent of a group of exposed organisms. The LC_{50} is used in the HRS in assessing acute toxicity.

LD_{50} (lethal dose, 50 percent): Dose of a substance that kills 50 percent of a group of exposed organisms. The LD_{50} is used in the HRS in assessing acute toxicity [milligrams toxicant per kilogram body weight (mg/kg)].

Maximum Contaminant Level (MCL): Under section 1412 of the Safe Drinking Water Act, as amended, the maximum permissible concentration of a substance in water that is delivered to any user of a public water supply.

Maximum Contaminant Level Goal (MCLG): Under section 1412 of the Safe Drinking Water Act, as amended, a nonenforceable concentration for a substance in drinking water that is protective of adverse human health effects and allows an adequate margin of safety.

Method Detection Limit (MDL): Lowest concentration of analyte that a method can detect reliably in either a sample or blank.

Mixed radioactive and other hazardous substances: Material containing both radioactive hazardous substances and nonradioactive hazardous substances, regardless of whether these types of substances are physically separated, combined chemically, or simply mixed together.

National Ambient Air Quality Standards (NAAQS): Primary standards for air quality established under sections 108 and 109 of the Clean Air Act, as amended.

National Emission Standards for Hazardous Air Pollutants (NESHAPs): Standards established for substances listed under section 112 of the Clean Air Act, as amended. Only those NESHAPs promulgated in ambient concentration units apply in the HRS.

Octanol-water partition coefficient (K_{ow} [or P]): Measure of the extent of partitioning of a substance between water and octanol at equilibrium. The K_{ow} is determined by the ratio between the concentration in octanol divided by the concentration in water at equilibrium. [unitless].

Organic carbon partition coefficient (K_{oc}): Measure of the extent of partitioning of a substance, at equilibrium, between organic carbon in geologic materials and water. The higher the K_{oc}, the more likely a substance is to bind to geologic materials than to remain in water. [ml/g].

Photolysis: Chemical reaction of a substance caused by direct absorption of solar energy (direct photolysis) or caused by other substances that absorb solar energy (indirect photolysis).

Radiation: Particles (alpha, beta, neutrons) or photons (x- and gamma-rays) emitted by radionuclides.

Radioactive decay: Process of spontaneous nuclear transformation, whereby an isotope of one element is transformed into an isotope of another element, releasing excess energy in the form of radiation.

Radioactive half-life: Time required for one-half the atoms in a given quantity of a specific radionuclide to undergo radioactive decay.

Radioactive substance: Solid, liquid, or gas containing atoms of a single radionuclide or multiple radionuclides.

Radioactivity: Property of those isotopes of elements that exhibit radioactive decay and emit radiation.

Radionuclide/radioisotope: Isotope of an element exhibiting radioactivity. For HRS purposes, "radionuclide" and "radioisotope" are used synonymously.

Reference dose (RfD): Estimate of a daily exposure level of a substance to a human population below which adverse noncancer health effects are not anticipated. [milligrams toxicant per kilogram body weight per day (mg/kg-day)].

Removal action: Action that removes hazardous substances from the site for proper disposal or destruction in a facility permitted under the Resource Conservation and Recovery Act or the Toxic Substances Control Act or by the Nuclear Regulatory Commission.

Roentgen (R): Measure of external exposures to ionizing radiation. One roentgen equals that amount of x-ray or gamma radiation required to produce ions carrying a charge of 1 electrostatic unit (esu) in 1 cubic centimeter of dry air under standard conditions. One microroentgen (μR) equals 10^{-6} R.

Sample quantitation limit (SQL): Quantity of a substance that can be reasonably quantified given the limits of detection for the methods of analysis and sample characteristics that may affect quantitation (for example, dilution, concentration).

Screening concentration: Media-specific benchmark concentration for a hazardous substance that is used in the HRS for comparison with the concentration of that hazardous substance in a sample from that media. The screening concentration for a specific hazardous substance corresponds to its reference dose for inhalation exposures or for oral exposures, as appropriate, and, if the substance is a human carcinogen with a weight-of-evidence classification of A, B, or C, to that concentration that corresponds to its 10^{-6} individual lifetime excess cancer risk for inhalation exposures or for oral exposures, as appropriate.

Site: Area(s) where a hazardous substance has been deposited, stored, disposed, or placed, or has otherwise come to be located. Such areas may include multiple sources and may include the area between sources.

Slope factor (also referred to as cancer potency factor): Estimate of the probability of response (for example, cancer) per unit intake of a substance over a lifetime. The slope factor is typically used to estimate upper-bound probability of an individual developing cancer as a result of exposure to a particular level of a human carcinogen with a weight-of-evidence classification of A, B, or C. [$(mg/kg\text{-}day)^{-1}$ for non-radioactive substances and $(pC_i)^{-1}$ for radioactive substances].

Source: Any area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance. Sources do not include those volumes of air, ground water, surface water, or surface water sediments that have become contaminated by migration, except: in the case of either a ground water plume with no identified source or contaminated surface water sediments with no identified source, the plume or contaminated sediments may be considered a source.

Target distance limit: Maximum distance over which targets for the site are evaluated. The target distance limit varies by HRS pathway.

Uranium Mill Tailings Radiation Control Act (UMTRCA) Standards: Standards for radionuclides established under sections 102, 104, and 108 of the Uranium Mill Tailings Radiation Control Act, as amended.

Vapor pressure: Pressure exerted by the vapor of a substance when it is in equilibrium with its solid or liquid form at a given temperature. For HRS purposes, use the value reported at or near 25° C. [atmosphere or torr].

Volatilization: Physical transfer process through which a substance undergoes a change of state from a solid or liquid to a gas.

Water solubility: Maximum concentration of a substance in pure water at a given temperature. For HRS purposes, use the value reported at or near 25° C. [milligrams per liter (mg/l)].

Weight-of-evidence: EPA classification system for characterizing the evidence supporting the designation of a substance as a human carcinogen. EPA weight-of-evidence groupings include:

> Group A: Human carcinogen--sufficient evidence of carcinogenicity in humans.
>
> Group B1: Probable human carcinogen--limited evidence of carcinogenicity in humans.
>
> Group B2: Probable human carcinogen--sufficient evidence of carcinogenicity in animals.
>
> Group C: Possible human carcinogen--limited evidence of carcinogenicity in animals.
>
> Group D: Not classifiable as to human carcinogenicity--applicable when there is no animal evidence, or when human or animal evidence is inadequate.
>
> Group E: Evidence of noncarcinogenicity for humans.

2.0 Evaluations Common to Multiple Pathways

2.1 *Overview.* The HRS site score (S) is the result of an evaluation of four pathways:

- Ground Water Migration (S_{gw}).
- Surface Water Migration (S_{sw}).
- Soil Exposure (S_s).
- Air Migration (S_a).

The ground water and air migration pathways use single threat evaluations, while the surface water migration and soil exposure pathways use multiple threat evaluations. Three threats are evaluated for the surface water migration pathway: drinking water, human food chain, and environmental. These threats are evaluated for two separate migration components--overland/flood migration and ground water to surface water migration. Two threats are evaluated for the soil exposure pathway: resident population and nearby population.

The HRS is structured to provide a parallel evaluation for each of these pathways and threats. This section focuses on these parallel evaluations, starting with the calculation of the HRS site score and the individual pathway scores.

2.1.1 *Calculation of HRS site score.* Scores are first calculated for the individual pathways as specified in sections 2 through 7 and then are combined for the site using the following root-mean-square equation to determine the overall HRS site score, which ranges from 0 to 100:

$$S = \sqrt{\frac{S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2}{4}}$$

2.1.2 *Calculation of pathway score.* Table 2-1, which is based on the air migration pathway, illustrates the basic parameters used to calculate a pathway score. As Table 2-1 shows, each pathway (or threat) score is the product of three "factor categories": likelihood of release, waste characteristics, and targets. (The soil exposure pathway uses likelihood of exposure rather than likelihood of release.) Each of the three factor categories contains a set of factors that are assigned numerical values and combined as specified in sections 2 through 7. The factor values are rounded to the nearest integer, except where otherwise noted.

2.1.3 *Common evaluations.* Evaluations common to all four HRS pathways include:

- Characterizing sources.
  - –Identifying sources (and, for the soil exposure pathway, areas of observed contamination [see section 5.0.1]).
  - –Identifying hazardous substances associated with each source (or area of observed contamination).
  - –Identifying hazardous substances available to a pathway.

TABLE 2-1.—SAMPLE PATHWAY SCORESHEET

Factor category	Maximum value	Value assigned
Likelihood of Release		
1. Observed Release	550	
2. Potential to Release	500	
3. Likelihood of Release (higher of lines 1 and 2)	550	
Waste Characteristics		
4. Toxicity/Mobility	(a)	
5. Hazardous Waste Quantity	(a)	
6. Waste Characteristics	100	
Targets		
7. Nearest Individual		
7a. Level I	50	
7b. Level II	45	
7c. Potential Contamination	20	
7d. Nearest Individual (higher of lines 7a, 7b, or 7c)	50	
8. Population		
8a. Level I	(b)	
8b. Level II	(b)	
8c. Potential Contamination	(b)	
8d. Total Population (lines 8a+8b+8c)	(b)	
9. Resources	5	
10. Sensitive Environments	(b)	
10a. Actual Contamination	(b)	
10b. Potential Contamination	(b)	
10c. Sensitive Environments (lines 10a+10b)	(b)	
11. Targets (lines 7d+8d+9+10c)	(b)	

12. **Pathway Score** is the product of Likelihood of Release, Waste Characteristics, and Targets, divided by 82,500. Pathway scores are limited to a maximum of 100 points.

[a] Maximum value applies to waste characteristics category. The product of lines 4 and 5 is used in Table 2-7 to derive the value for the waste characteristics factor category.

[b] There is no limit to the human population or sensitive environments factor values. However, the pathway score based solely on sensitive environments is limited to a maximum of 60 points.

- Scoring likelihood of release (or likelihood of exposure) factor category.
  - –Scoring observed release (or observed contamination).
  - –Scoring potential to release when there is no observed release.
- Scoring waste characteristics factor category.
  - –Evaluating toxicity.
  - –Combining toxicity with mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential, as appropriate to the pathway (or threat).
  - –Evaluating hazardous waste quantity.
  - –Combining hazardous waste quantity with the other waste characteristics factors.
  - –Determining waste characteristics factor category value.
- Scoring targets factor category.
  - –Determining level of contamination for targets.

These evaluations are essentially identical for the three migration pathways (ground water, surface water, and air). However, the evaluations differ in certain respects for the soil exposure pathway.

Section 7 specifies modifications that apply to each pathway when evaluating sites containing radioactive substances.

Section 2 focuses on evaluations common at the pathway and threat levels. Note that for the ground water and surface water migration pathways, separate scores are *calculated for each aquifer (see section 3.0)* and each watershed (see sections 4.1.1.3 and 4.2.1.5) when determining the pathway scores for a site. Although the evaluations in section 2 do not vary when different aquifers or watersheds are scored at a site, the specific factor values (for example, observed release, hazardous waste quantity, toxicity/mobility) that result from these evaluations can vary by aquifer and by watershed at the site. This can occur through differences both in the specific sources and targets eligible to be evaluated for each aquifer and watershed and in whether observed releases can be established for each aquifer and watershed. Such differences in scoring at the aquifer and *watershed level are addressed in sections 3* and 4, not section 2.

2.2 *Characterize sources.* Source characterization includes identification of the following:

- Sources (and areas of observed contamination) at the site.
- Hazardous substances associated with these sources (or areas of observed contamination).
- Pathways potentially threatened by these hazardous substances.

Table 2–2 presents a sample worksheet for source characterization.

2.2.1 *Identify sources.* For the three *migration pathways, identify* the sources at the site that contain hazardous substances. Identify the migration pathway(s) to which each source applies. For the soil exposure pathway, identify areas of observed contamination at the site (see section 5.0.1).

TABLE 2–2.—SAMPLE SOURCE CHARACTERIZATION WORKSHEET

Source: ________

A. Source dimensions and hazardous waste quantity.

Hazardous constituent quantity: _____

Hazardous wastestream quantity: _____

Volume: _____

Area: _____

Area of observed contamination: _____

B. Hazardous substances associated with the source.

Hazardous substance	Available to pathway						
	Air		Ground water (GW)	Surface water (SW)		Soil	
	Gas	Particulate		Overland/ flood	GW to SW	Resident	Nearby

2.2.2 *Identify hazardous substances associated with a source.* For each of the three migration pathways, consider those hazardous substances documented in a source (for example, by sampling, labels, manifests, oral or written statements) to be associated with that source when evaluating each pathway. In some instances, a hazardous substance can be documented as being present at a site (for example, by labels, manifests, oral or written statements), but the specific source(s) containing that hazardous substance cannot be documented. For the three migration pathways, in those instances when the specific source(s) cannot be documented for a hazardous substance, consider the hazardous substance to be present in each source at the site, except sources for which definitive information indicates that the hazardous substance was not or could not be present.

For an area of observed contamination in the soil exposure pathway, consider only those hazardous substances that meet the criteria for observed contamination for that area (see section 5.0.1) to be associated with that area when evaluating the pathway.

2.2.3 *Identify hazardous substances available to a pathway.* In evaluating each migration pathway, consider the following hazardous substances available to migrate from the sources at the site to the pathway:

- Ground water migration.
  - –Hazardous substances that meet the criteria for an observed release (see section 2.3) to ground water.
  - –All hazardous substances associated with a source with a ground water containment factor value greater than 0 (see section 3.1.2.1).
- Surface water migration—overland/flood component.
  - –Hazardous substances that meet the criteria for an observed release to surface water in the watershed being evaluated.
  - –All hazardous substances associated with a source with a surface water containment factor value greater than 0 for the watershed (see sections 4.1.2.1.2.1.1 and 4.1.2.1.2.2.1).
- Surface water migration—ground water to surface water component.
  - –Hazardous substances that meet the criteria for an observed release to ground water.
  - –All hazardous substances associated with a source with a ground water containment factor value greater than 0 (see sections 4.2.2.1.2 and 3.1.2.1).
- Air migration.
  - –Hazardous substances that meet the criteria for an observed release to the atmosphere.
  - –All gaseous hazardous substances associated with a source with a gas containment factor value greater than 0 (see section 6.1.2.1.1).
  - –All particulate hazardous substances associated with a source with a particulate containment factor value greater than 0 (see section 6.1.2.2.1).
- For each migration pathway, in those instances when the specific source(s) containing the hazardous substance cannot be documented, consider that hazardous substance to be available to migrate to the pathway when it can be associated (see section 2.2.2) with at least one source having a containment factor value greater than 0 for that pathway.

In evaluating the soil exposure pathway, consider the following hazardous substances available to the pathway:

- Soil exposure—resident population threat.
  - All hazardous substances that meet the criteria for observed contamination at the site (see section 5.0.1).
- Soil exposure—nearby population threat.
  - All hazardous substances that meet the criteria for observed contamination at areas with an attractiveness/accessibility factor value greater than 0 (see section 5.2.1.1).

2.3 *Likelihood of release.* Likelihood of release is a measure of the likelihood that a waste has been or will be released to the environment. The likelihood of release factor category is assigned the maximum value of 550 for a migration pathway whenever the criteria for an observed release are met for that pathway. If the criteria for an observed release are met, do not evaluate potential to release for that pathway. When the criteria for an observed release are not met, evaluate potential to release for that pathway, with a maximum value of 500. The evaluation of potential to release varies by migration pathway (see sections 3, 4 and 6).

Establish an observed release either by direct observation of the release of a hazardous substance into the media being evaluated (for example, surface water) or by chemical analysis of samples appropriate to the pathway being evaluated (see sections 3, 4, and 6). The minimum standard to establish an observed release by chemical analysis is analytical evidence of a hazardous substance in the media significantly above the background level. Further, some portion of the release must be attributable to the site. Use the criteria in Table 2-3 as the standard for determining analytical significance. (The criteria in Table 2-3 are also used in establishing observed contamination for the soil exposure pathway, see section 5.0.1.) Separate criteria apply to radionuclides (see section 7.1.1).

TABLE 2-3.—OBSERVED RELEASE CRITERIA FOR CHEMICAL ANALYSIS

Sample Measurement < Sample Quantitation Limit[a]

No observed release is established.

Sample Measurement ≥ SAMPLE QUANTITATION LIMIT[a]

An observed release is established as follows:

- If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds the sample quantitation limit.[a]
- If the background concentration equals or exceeds the detection limit, an observed release is established when the sample measurement is 3 times or more above the background concentration.

[a] If the sample quantitation limit (SQL) cannot be established, determined if there is an observed release as follows:

—If the sample analysis was performed under the EPA Contract Laboratory Program, use the EPA contract-required quantitation limit (CRQL) in place of the SQL.

—If the sample analysis is not performed under the EPA Contract Laboratory Program, use the detection limit (DL) in place of the SQL.

2.4 *Waste characteristics.* The waste characteristics factor category includes the following factors: hazardous waste quantity, toxicity, and as appropriate to the pathway or threat being evaluated, mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential.

2.4.1 *Selection of substance potentially posing greatest hazard.* For all pathways (and threats), select the hazardous substance potentially posing the greatest hazard for the pathway (or threat) and use that substance in evaluating the waste characteristics category of the pathway (or threat). For the three migration pathways (and threats), base the selection of this hazardous substance on the toxicity factor value for the substance, combined with its mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential factor values, as applicable to the migration pathway (or threat). For the soil exposure pathway, base the selection on the toxicity factor alone.

Evaluation of the toxicity factor is specified in section 2.4.1.1. Use and evaluation of the mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential factors vary by pathway (or threat) and are specified under the appropriate pathway (or threat) section. Section 2.4.1.2 identifies the specific factors that are combined with toxicity in evaluating each pathway (or threat).

2.4.1.1 *Toxicity factor.* Evaluate toxicity for those hazardous substances at the site that are available to the pathway being scored. For all pathways and threats, except the surface water environmental threat, evaluate human toxicity as specified below. For the surface water environmental threat, evaluate ecosystem toxicity as specified in section 4.1.4.2.1.1.

Establish human toxicity factor values based on quantitative dose-response parameters for the following three types of toxicity:

- Cancer—Use slope factors (also referred to as cancer potency factors) combined with weight-of-evidence ratings for carcinogenicity. If a slope factor is not available for a substance, use its ED_{10} value to estimate a slope factor as follows:

$$\text{Slope factor} = \frac{1}{6\,(ED_{10})}$$

- Noncancer toxicological responses of chronic exposure—use reference dose (RfD) values.
- Noncancer toxicological responses of acute exposure—use acute toxicity parameters, such as the LD_{50}.

Assign human toxicity factor values to a hazardous substance using Table 2-4, as follows:

- If RfD and slope factor values are both available for the hazardous substance, assign the substance a value from Table 2-4 for each. Select the higher of the two values assigned and use it as the overall toxicity factor value for the hazardous substance.
- If either an RfD or slope factor value is available, but not both, assign the hazardous substance an overall toxicity factor value from Table 2-4 based solely on the available value (RfD or slope factor).
- If neither an RfD nor slope factor value is available, assign the hazardous substance an overall toxicity factor value from Table 2-4 based solely on acute toxicity. That is, consider acute toxicity in Table 2-4 only when both RfD and slope factor values are not available.
- If neither an RfD, nor slope factor, nor acute toxicity value is available, assign the hazardous substance an overall toxicity factor value of 0 and use other hazardous substances for which information is available in evaluating the pathway.

TABLE 2-4.—TOXICITY FACTOR EVALUATION

Chronic Toxicity (Human)

Reference dose (RfD) (mg/kg-day)	Assigned value
RfD < 0.0005	10,000
0.0005 ≤ RfD < 0.005	1,000
0.005 ≤ RfD < 0.05	100
0.05 ≤ RfD < 0.5	10
0.5 ≤ RfD	1
RfD not available	0

Carcinogenicity (Human)

Weight-of-evidence[a]/slope factor (mg/kg-day)$^{-1}$			Assigned value
A	B	C	
0.5 ≤ SF[b]	5 ≤ SF	50 ≤ SF	10,000
0.05 ≤ SF < 0.5	0.5 ≤ SF < 5	5 ≤ SF < 50	1,000
SF < 0.05	0.05 ≤ SF < 0.5	0.5 ≤ SF < 5	100
— — —	SF < 0.05	SF < 0.5	10
Slope factor not available.	Slope factor not available.	Slope factor not available.	0

[a] A, B, and C refer to weight-of-evidence categories. Assign substances with a weight-of-evidence category of D (inadequate evidence of carcinogenicity) or E (evidence of lack of carcinogenicity) a value of 0 for carcinogenicity.

[b] SF = Slope factor.

TABLE 2-4.—TOXICITY FACTOR EVALUATION—CONCLUDED

Acute Toxicity (Human)

Oral LD_{50} (mg/kg)	Dermal LD_{50} (mg/kg)	Dust or mist LC_{50} (mg/l)	Gas or vapor LC_{50} (ppm)	Assigned value
— — —	— — —	— — —	— — —	— — —
$LD_{50} < 5$	$LD_{50} < 2$	$LC_{50} < 0.2$	$LC_{50} < 20$	1,000
$5 \leq LD_{50} < 50$	$2 \leq LD_{50} < 20$	$0.2 \leq LC_{50} < 2$	$20 \leq LC_{50} < 200$	100
$50 \leq LD_{50} < 500$	$20 \leq LD_{50} < 200$	$2 \leq LC_{50} < 20$	$200 \leq LC_{50} < 2,000$	10
$500 \leq LD_{50}$	$200 \leq LD_{50}$	$20 \leq LC_{50}$	$2,000 \leq LC_{50}$	1
LD_{50} not available	LD_{50} not available	LC_{50} not available	LC_{50} not available	0

If a toxicity factor value of 0 is assigned to all hazardous substances available to a particular pathway (that is, insufficient toxicity data are available for evaluating all the substances), use a default value of 100 as the overall human toxicity factor value for all hazardous substances available to the pathway. For hazardous substances having usable toxicity data for multiple exposure routes (for example, inhalation and ingestion), consider all exposure routes and use the highest assigned value, regardless of exposure route, as the toxicity factor value.

For HRS purposes, assign both asbestos and lead (and its compounds) a human toxicity factor value of 10,000.

Separate criteria apply for assigning factor values for human toxicity and ecosystem toxicity for radionuclides (see sections 7.2.1 and 7.2.2).

2.4.1.2 *Hazardous substance selection.* For each hazardous substance evaluated for a migration pathway (or threat), combine the human toxicity factor value (or ecosystem toxicity factor value) for the hazardous substance with a mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential factor value as follows:

- Ground water migration.
  - –Determine a combined human toxicity/mobility factor value for the hazardous substance (see section 3.2.1).
- Surface water migration-overland/flood migration component.
  - –Determine a combined human toxicity/persistence factor value for the hazardous substance for the drinking water threat (see section 4.1.2.2.1).
  - –Determine a combined human toxicity/persistence/bioaccumulation factor value for the hazardous substance for the human food chain threat (see section 4.1.3.2.1).
  - –Determine a combined ecosystem toxicity/persistence/bioaccumulation factor value for the hazardous substance for the environmental threat (see section 4.1.4.2.1).
- Surface water migration-ground water to surface water migration component.
  - –Determine a combined human toxicity/mobility/persistence factor value for the hazardous substance for the drinking water threat (see section 4.2.2.2.1).
  - –Determine a combined human toxicity/mobility/persistence/bioaccumulation factor value for the hazardous substance for the human food chain threat (see section 4.2.3.2.1).
  - –Determine a combined ecosystem toxicity/mobility/persistence/bioaccumulation factor value for the hazardous substance for the environmental threat (see section 4.2.4.2.1).
- Air migration.
  - –Determine a combined human toxicity/mobility factor value for the hazardous substance (see section 6.2.1).

Determine each combined factor value for a hazardous substance by multiplying the individual factor values appropriate to the pathway (or threat). For each migration pathway (or threat) being evaluated, select the hazardous substance with the highest combined factor value and use that substance in evaluating the waste characteristics factor category of the pathway (or threat).

For the soil exposure pathway, select the hazardous substance with the highest human toxicity factor value from among the substances that meet the criteria for observed contamination for the threat evaluated and use that substance in evaluating the waste characteristics factor category.

2.4.2 *Hazardous waste quantity.* Evaluate the hazardous waste quantity factor by first assigning each source (or area of observed contamination) a source hazardous waste quantity value as specified below. Sum these values to obtain the hazardous waste quantity factor value for the pathway being evaluated.

In evaluating the hazardous waste quantity factor for the three migration pathways, allocate hazardous substances and hazardous wastestreams to specific sources in the manner specified in section 2.2.2, except: consider hazardous substances and hazardous wastestreams that cannot be allocated to any specific source to constitute a separate "unallocated source" for purposes of evaluating only this factor for the three migration pathways. Do not, however, include a hazardous substance or hazardous wastestream in the unallocated source for a migration pathway if there is definitive information indicating that the substance or wastestream could only have been placed in sources with a containment factor value of 0 for that migration pathway.

In evaluating the hazardous waste quantity factor for the soil exposure pathway, allocate to each area of observed contamination only those hazardous substances that meet the criteria for observed contamination for that area of observed contamination and only those hazardous wastestreams that contain hazardous substances that meet the criteria for observed contamination for that area of observed contamination. Do not consider other hazardous substances or hazardous wastestreams at the site in evaluating this factor for the soil exposure pathway.

2.4.2.1 *Source hazardous waste quantity.* For each of the three migration pathways, assign a source hazardous waste quantity value to each source (including the unallocated source) having a containment factor value greater than 0 for the pathway being evaluated. Consider the unallocated source to have a containment factor value greater than 0 for each migration pathway.

For the soil exposure pathway, assign a source hazardous waste quantity value to each area of observed contamination, as applicable to the threat being evaluated.

For all pathways, evaluate source hazardous waste quantity using the following four measures in the following hierarchy:

- Hazardous constituent quantity.
- Hazardous wastestream quantity.
- Volume.
- Area.

For the unallocated source, use only the first two measures.

Separate criteria apply for assigning a source hazardous waste quantity value for radionuclides (see section 7.2.5).

2.4.2.1.1 *Hazardous constituent quantity.* Evaluate hazardous constituent quantity for the source (or area of observed contamination) based solely on the mass of CERCLA hazardous substances (as defined in CERCLA section 101(14), as amended) allocated to the source (or area of observed contamination), except:

- For a hazardous waste listed pursuant to section 3001 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976 (RCRA), 42 U.S.C. 6901 et seq., determine its mass for the evaluation of this measure as follows:
  - –If the hazardous waste is listed solely for Hazard Code T (toxic waste), include only the mass of constituents in the hazardous waste that are CERCLA hazardous substances and not the mass of the entire hazardous waste.
  - –If the hazardous waste is listed for any other Hazard Code (including T plus any other Hazard Code), include the mass of the entire hazardous waste.
- For a RCRA hazardous waste that exhibits the characteristics identified under section 3001 of RCRA, as amended, determine its mass for the evaluation of this measure as follows:

- If the hazardous waste exhibits only the characteristic of toxicity (or only the characteristic of EP toxicity), include only the mass of constituents in the hazardous waste that are CERCLA hazardous substances and not the mass of the entire hazardous waste.
- If the hazardous waste exhibits any other characteristic identified under section 3001 (including any other characteristic plus the characteristic of toxicity [or the characteristic of EP toxicity]), include the mass of the entire hazardous waste.

Based on this mass, designated as C, assign a value for hazardous constituent quantity as follows:

- For the migration pathways, assign the source a value for hazardous constituent quantity using the Tier A equation of Table 2–5.
- For the soil exposure pathway, assign the area of observed contamination a value using the Tier A equation of Table 5–2 (section 5.1.2.2).

If the hazardous constituent quantity for the source (or area of observed contamination) is adequately determined (that is, the total mass of all CERCLA hazardous substances in the source and releases from the source [or in the area of observed contamination] is known or is estimated with reasonable confidence), do not evaluate the other three measures discussed below. Instead assign these other three measures a value of 0 for the source (or area of observed contamination) and proceed to section 2.4.2.1.5.

If the hazardous constituent quantity is not adequately determined, assign the source (or area of observed contamination) a value for hazardous constituent quantity based on the available data and proceed to section 2.4.2.1.2.

TABLE 2–5.—HAZARDOUS WASTE QUANTITY EVALUATION EQUATIONS

Tier	Measure	Units	Equation for assigning value[a]
A	**Hazardous constituent quantity (C)**	lb	C
B[b]	**Hazardous wastestream quantity (W)**	lb	W/5,000
C[b]	**Volume (V)**		
	Landfill	yd^3	V/2,500
	Surface impoundment	yd^3	V/2.5
	Surface impoundment (buried/backfilled)	yd^3	V/2.5
	Drums[c]	gallon	V/500
	Tanks and containers other than drums	yd^3	V/2.5
	Contaminated soil	yd^3	V/2,500
	Pile	yd^3	V/2.5
	Other	yd^3	V/2.5
D[b]	**Area (A)**		
	Landfill	ft^2	A/3,400
	Surface impoundment	ft^2	A/13
	Surface impoundment (buried/backfilled)	ft^2	A/13
	Land treatment	ft^2	A/270
	Pile[d]	ft^2	A/13
	Contaminated soil	ft^2	A/34,000

TABLE 2–5.—HAZARDOUS WASTE QUANTITY EVALUATION EQUATIONS—Concluded

[a] Do not round to nearest integer.

[b] Convert volume to mass when necessary: 1 ton=2,000 pounds=1 cubic yard=4 drums=200 gallons.

[c] If actual volume of drums is unavailable, assume 1 drum=50 gallons.

[d] Use land surface area under pile, not surface area of pile.

2.4.2.1.2 *Hazardous wastestream quantity.* Evaluate hazardous wastestream quantity for the source (or area of observed contamination) based on the mass of hazardous wastestreams plus the mass of any additional CERCLA pollutants and contaminants (as defined in CERCLA section 101[33], as amended) that are allocated to the source (or area of observed contamination). For a wastestream that consists solely of a hazardous waste listed pursuant to section 3001 of RCRA, as amended or that consists solely of a RCRA hazardous waste that exhibits the characteristics identified under section 3001 of RCRA, as amended, include the mass of that entire hazardous waste in the evaluation of this measure.

Based on this mass, designated as W, assign a value for hazardous wastestream quantity as follows:

- For the migration pathways, assign the source a value for hazardous wastestream quantity using the Tier B equation of Table 2–5.
- For the soil exposure pathway, assign the area of observed contamination a value using the Tier B equation of Table 5–2 (section 5.1.2.2).

Do not evaluate the volume and area measures described below if the source is the unallocated source or if the following condition applies:

- The hazardous wastestream quantity for the source (or area of observed contamination) is adequately determined—that is, total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source (or for the area of observed contamination) is known or is estimated with reasonable confidence.

If the source is the unallocated source or if this condition applies, assign the volume and area measures a value of 0 for the source (or area of observed contamination) and proceed to section 2.4.2.1.5. Otherwise, assign the source (or area of observed contamination) a value for hazardous wastestream quantity based on the available data and proceed to section 2.4.2.1.3.

2.4.2.1.3 *Volume.* Evaluate the volume measure using the volume of the source (or the volume of the area of observed contamination). For the soil exposure pathway, restrict the use of the volume measure to those areas of observed contamination specified in section 5.1.2.2.

Based on the volume, designated as V, assign a value to the volume measure as follows:

- For the migration pathways, assign the source a value for volume using the appropriate Tier C equation of Table 2–5.
- For the soil exposure pathway, assign the area of observed contamination a value for volume using the appropriate Tier C equation of Table 5–2 (section 5.1.2.2).

If the volume of the source (or volume of the area of observed contamination, if applicable) can be determined, do not evaluate the area measure. Instead, assign the area measure a value of 0 and proceed to section 2.4.2.1.5. If the volume cannot be determined (or is not applicable for the soil exposure pathway), assign the source (or area of observed contamination) a value of 0 for the volume measure and proceed to section 2.4.2.1.4.

2.4.2.1.4 *Area.* Evaluate the area measure using the area of the source (or the area of the area of observed contamination). Based on this area, designated as A, assign a value to the area measure as follows:

- For the migration pathways, assign the source a value for area using the appropriate Tier D equation of Table 2–5.
- For the soil exposure pathway, assign the area of observed contamination a value for area using the appropriate Tier D equation of Table 5–2 (section 5.1.2.2).

2.4.2.1.5 *Calculation of source hazardous waste quantity value.* Select the highest of the values assigned to the source (or area of observed contamination) for the hazardous constituent quantity, hazardous wastestream quantity, volume, and area measures. Assign this value as the source hazardous waste quantity value. Do not round to the nearest integer.

2.4.2.2 *Calculation of hazardous waste quantity factor value.* Sum the source hazardous waste quantity values assigned to all sources (including the unallocated source) or areas of observed contamination for the pathway being evaluated and round this sum to the nearest integer, except: if the sum is greater than 0, but less than 1, round it to 1. Based on this value, select a hazardous waste quantity factor value for the pathway from Table 2–6.

TABLE 2–6.—HAZARDOUS WASTE QUANTITY FACTOR VALUES

Hazardous waste quantity value	Assigned value
0	0
1[a] to 100	1[b]
Greater than 100 to 10,000	100
Greater than 10,000 to 1,000,000	10,000
Greater than 1,000,000	1,000,000

[a] If the hazardous waste quantity value is greater than 0, but less than 1, round it to 1 as specified in text.

[b] For the pathway, if hazardous constituent quantity is not adequately determined, assign a value as specified in the text; do not assign the value of 1.

For a migration pathway, if the hazardous constituent quantity is adequately determined (see section 2.4.2.1.1) for all sources (or all portions of sources and releases remaining after a removal action), assign the value from Table 2–6 as the hazardous waste quantity factor value for the pathway. If the hazardous constituent quantity is not adequately determined for one or more sources (or one or more portions of sources or releases remaining after a removal action) assign a factor value as follows:

- If any target for that migration pathway is subject to Level I or Level II concentrations (see section 2.5), assign either the value from Table 2–6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway.
- If none of the targets for that pathway is subject to Level I or Level II concentrations, assign a factor value as follows:

–If there has been no removal action, assign either the value from Table 2–6 or a value of 10, whichever is greater, as the hazardous waste quantity factor value for that pathway.

–If there has been a removal action:

– –Determine values from Table 2–6 with and without consideration of the removal action.

– –If the value that would be assigned from Table 2–6 without consideration of the removal action would be 100 or greater, assign either the value from Table 2–6 with consideration of the removal action or a value of 100, whichever is greater, as the hazardous waste quantity factor value for the pathway.

– –If the value that would be assigned from Table 2–6 without consideration of the removal action would be less than 100, assign a value of 10 as the hazardous waste quantity factor value for the pathway.

For the soil exposure pathway, if the hazardous constituent quantity is adequately determined for all areas of observed contamination, assign the value from Table 2–6 as the hazardous waste quantity factor value. If the hazardous constituent quantity is not adequately determined for one or more areas of observed contamination, assign either the value from Table 2–6 or a value of 10, whichever is greater, as the hazardous waste quantity factor value.

2.4.3 *Waste characteristics factor category value.* Determine the waste characteristics factor category value as specified in section 2.4.3.1 for all pathways and threats, except the surface water-human food chain threat and the surface water-environmental threat. Determine the waste characteristics factor category value for these latter two threats as specified in section 2.4.3.2.

2.4.3.1 *Factor category value.* For the pathway (or threat) being evaluated, multiply the toxicity or combined factor value, as appropriate, from section 2.4.1.2 and the hazardous waste quantity factor value from section 2.4.2.2, subject to a maximum product of 1×10^8. Based on this waste characteristics product assign a waste characteristics factor category value to the pathway (or threat) from Table 2–7.

TABLE 2–7.—WASTE CHARACTERISTICS FACTOR CATEGORY VALUES

Waste characteristics product	Assigned value
0	0
Greater than 0 to less than 10	1
10 to less than 1×10^2	2
1×10^2 to less than 1×10^3	3
1×10^3 to less than 1×10^4	6
1×10^4 to less than 1×10^5	10
1×10^5 to less than 1×10^6	18
1×10^6 to less than 1×10^7	32
1×10^7 to less than 1×10^8	56
1×10^8 to less than 1×10^9	100
1×10^9 to less than 1×10^{10}	180
1×10^{10} to less than 1×10^{11}	320
1×10^{11} to less than 1×10^{12}	560
1×10^{12}	1,000

2.4.3.2 *Factor category value, considering bioaccumulation potential.* For the surface water-human food chain threat and the surface water-environmental threat, multiply the toxicity or combined factor value, as appropriate, from section 2.4.1.2 and the hazardous waste quantity factor value from section 2.4.2.2, subject to:

- A maximum product of 1×10^{12}, *and*
- A maximum product exclusive of the bioaccumulation (or ecosystem bioaccumulation) potential factor of 1×10^8.

Based on the total waste characteristics product, assign a waste characteristics factor category value to these threats from Table 2–7.

2.5 *Targets.*

The types of targets evaluated include the following:

- Individual (factor name varies by pathway and threat).
- Human population.
- Resources (these vary by pathway and threat).
- Sensitive environments (included for all pathways except ground water migration).

The factor values that may be assigned to each type of target have the same range for each pathway for which that type of target is evaluated. The factor value for most types of targets depends on whether the target is subject to actual or potential contamination for the pathway and whether the actual contamination is Level I or Level II:

- Actual contamination: Target is associated either with a sampling location that meets the criteria for an observed release (or observed contamination) for the pathway or with an observed release based on direct observation for the pathway (additional criteria apply for establishing actual contamination for the human food chain threat in the surface water migration pathway, see sections 4.1.3.3 and 4.2.3.3). sections 3 through 6 specify how to determine the targets associated with a sampling location or with an observed release based on direct observation. Determine whether the actual contamination is Level I or Level II as follows:

–Level I:

– –Media-specific concentrations for the target meet the criteria for an observed release (or observed contamination) for the pathway and are at or above media-specific benchmark values. These benchmark values (see section 2.5.2) include both screening concentrations and concentrations specified in regulatory limits (such as Maximum Contaminant Level (MCL) values), or

– –For the human food chain threat in the surface water migration pathway, concentrations in tissue samples from aquatic human food chain organisms are at or above benchmark values. Such tissue samples may be used in addition to media-specific concentrations only as specified in sections 4.1.3.3 and 4.2.3.3.

–Level II:

– –Media-specific concentrations for the target meet the criteria for an observed release (or observed contamination) for the pathway, but are less than media-specific benchmarks. If none of the hazardous substances eligible to be evaluated for the sampling location has an applicable benchmark, assign Level II to the actual contamination at the sampling location, or

– –For observed releases based on direct observation, assign Level II to targets as specified in sections 3, 4, and 6, or

– –For the human food chain threat in the surface water migration pathway, concentrations in tissue samples from aquatic human food chain organisms, when applicable, are below benchmark values.

–If a target is subject to both Level I and Level II concentrations for a pathway (or threat), evaluate the target using Level I concentrations for that pathway (or threat).

- Potential contamination: Target is subject to a potential release (that is, target is not associated with actual contamination for that pathway or threat).

Assign a factor value for individual risk as follows (select the highest value that applies to the pathway or threat):

- 50 points if any individual is exposed to Level I concentrations.
- 45 points if any individual is exposed to Level II concentrations.
- Maximum of 20 points if any individual is subject to potential contamination. The value assigned is 20 multiplied by the distance or dilution weight appropriate to the pathway.

Assign factor values for population and sensitive environments as follows:

- Sum Level I targets and multiply by 10. (Level I is not used for sensitive environments in the soil exposure and air migration pathways.)
- Sum Level II targets.
- Multiply potential targets by distance or dilution weights appropriate to the pathway, sum, and divide by 10. Distance or dilution weighting accounts for diminishing exposure

with increasing distance or dilution within the different pathways.

- Sum the values for the three levels.

In addition, resource value points are assigned within all pathways for welfare-related impacts (for example, impacts to agricultural land), but do not depend on whether there is actual or potential contamination.

2.5.1 *Determination of level of actual contamination at a sampling location.* Determine whether Level I concentrations or Level II concentrations apply at a sampling location (and thus to the associated targets) as follows:

- Select the benchmarks applicable to the pathway (or threat) being evaluated.
- Compare the concentrations of hazardous substances in the sample (or comparable samples) to their benchmark concentrations for the pathway (or threat), as specified in section 2.5.2.
- Determine which level applies based on this comparison.
- If none of the hazardous substances eligible to be evaluated for the sampling location has an applicable benchmark, assign Level II to the actual contamination at that sampling location for the pathway (or threat).

In making the comparison, consider only those samples, and only those hazardous substances in the sample, that meet the criteria for an observed release (or observed contamination) for the pathway, except: tissue samples from aquatic human food chain organisms may also be used as specified in sections 4.1.3.3 and 4.2.3.3 of the surface water-human food chain threat. If any hazardous substance is present in more than one comparable sample for the sampling location, use the highest concentration of that hazardous substance from any of the comparable samples in making the comparisons.

Treat sets of samples that are not comparable separately and make a separate comparison for each such set.

2.5.2 *Comparison to benchmarks.* Use the following media-specific benchmarks for making the comparisons for the indicated pathway (or threat):

- Maximum Contaminant Level Goals (MCLGs)—ground water migration pathway and drinking water threat in surface water migration pathway. Use only MCLG values greater than 0.
- Maximum Contaminant Levels (MCLs)—ground water migration pathway and drinking water threat in surface water migration pathway.
- Food and Drug Administration Action Level (FDAAL) for fish or shellfish—human food chain threat in surface water migration pathway.
- EPA Ambient Water Quality Criteria (AWQC) for protection of aquatic life—environmental threat in surface water migration pathway.
- EPA Ambient Aquatic Life Advisory Concentrations (AALAC)—environmental threat in surface water migration pathway.
- National Ambient Air Quality Standards (NAAQS)—air migration pathway.
- National Emission Standards for Hazardous Air Pollutants (NESHAPs)—air migration pathway. Use only those NESHAPs promulgated in ambient concentration units.
- Screening concentration for cancer corresponding to that concentration that corresponds to the 10^{-6} individual cancer risk for inhalation exposures (air migration pathway) or for oral exposures (ground water migration pathway; drinking water and human food chain threats in surface water migration pathway; and soil exposure pathway).
- Screening concentration for noncancer toxicological responses corresponding to the RfD for inhalation exposures (air migration pathway) or for oral exposures (ground water migration pathway; drinking water and human food chain threats in surface water migration pathway; and soil exposure pathway).

Select the benchmark(s) applicable to the pathway (or threat) being evaluated as specified in sections 3 through 6. Compare the concentration of each hazardous substance from the sampling location to its benchmark concentration(s) for that pathway (or threat). Use only those samples and only those hazardous substances in the sample that meet the criteria for an observed release (or observed contamination) for the pathway, except: tissue samples from aquatic human food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of any applicable hazardous substance from any sample equals or exceeds its benchmark concentration, consider the sampling location to be subject to Level I concentrations for that pathway (or threat). If more than one benchmark applies to the hazardous substance, assign Level I if the concentration of the hazardous substance equals or exceeds the lowest applicable benchmark concentration.

If no hazardous substance individually equals or exceeds its benchmark concentration, but more than one hazardous substance either meets the criteria for an observed release (or observed contamination) for the sample (or comparable samples) or is eligible to be evaluated for a tissue sample (see sections 4.1.3.3 and 4.2.3.3), calculate the indices I and J specified below based on these hazardous substances.

For those hazardous substances that are carcinogens (that is, those having a carcinogen weight-of-evidence classification of A, B, or C), calculate an index I for the sample location as follows:

$$I = \sum_{i=1}^{n} \frac{C_i}{SC_i}$$

where:

C_i=Concentration of hazardous substance i in sample (or highest concentration of hazardous substance i from among comparable samples).

SC_i=Screening concentration for cancer corresponding to that concentration that corresponds to its 10^{-6} individual cancer risk for applicable exposure (inhalation or oral) for hazardous substance i.

n=Number of applicable hazardous substances in sample (or comparable samples) that are carcinogens and for which an SC_i is available.

For those hazardous substances for which an RfD is available, calculate an index J for the sample location as follows:

$$J = \sum_{j=1}^{m} \frac{C_j}{CR_j}$$

where:

C_j=Concentration of hazardous substance j in sample (or highest concentration of hazardous substance j from among comparable samples).

CR_j=Screening concentration for noncancer toxicological responses corresponding to RfD for applicable exposure (inhalation or oral) for hazardous substance j.

m=Number of applicable hazardous substances in sample (or comparable samples) for which a CR_j is available.

If either I or J equals or exceeds 1, consider the sampling location to be subject to Level I concentrations for that pathway (or threat). If both I and J are less than 1, consider the sampling location to be subject to Level II concentrations for that pathway (or threat). If, for the sampling location, there are sets of samples that are not comparable, calculate I and J separately for each such set, and use the highest calculated values of I and J to assign Level I and Level II.

See sections 7.3.1 and 7.3.2 for criteria for determining the level of contamination for radioactive substances.

3.0 Ground Water Migration Pathway

Evaluate the ground water migration pathway based on three factor categories: likelihood of release, waste characteristics, and targets. Figure 3–1 indicates the factors included within each factor category.

Determine the ground water migration pathway score (S_{gw}) in terms of the factor category values as follows:

$$S_{gw} = \frac{(LR)\,(WC)\,(T)}{SF}$$

where:

LR=Likelihood of release factor category value.

WC=Waste characteristics factor category value.

T=Targets factor category value.

SF=Scaling factor.

Table 3–1 outlines the specific calculation procedure.

Calculate a separate ground water migration pathway score for each aquifer, using the factor category values for that aquifer for likelihood of release, waste characteristics, and targets. In doing so, include both the targets using water from that aquifer and the targets using water from all overlying aquifers through which the hazardous substances would migrate to reach the aquifer being evaluated. Assign the highest ground water migration pathway score that results for any aquifer as the ground water migration pathway score for the site.

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Likelihood of Release (LR)

Observed Release

or

Potential to Release
- Containment
- Net Precipitation
- Depth to Aquifer
- Travel Time

X

Waste Characteristics (WC)

Toxicity/Mobility
- Toxicity
  - Chronic
  - Carcinogenic
  - Acute
- Mobility
  - Water Solubility
  - Distribution Coefficient (K_d)

Hazardous Waste Quantity
- Hazardous Constituent Quantity
- Hazardous Wastestream Quantity
- Volume
- Area

X

Targets (T)

Nearest Well

Population
- Level I Concentrations
- Level II Concentrations
- Potential Contamination

Resources

Wellhead Protection Area

FIGURE 3-1
OVERVIEW OF GROUND WATER MIGRATION PATHWAY

BILLING CODE 6560-50-C

TABLE 3-1.—GROUND WATER MIGRATION PATHWAY SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Likelihood of Release to an Aquifer:		
1. Observed Release	550	—
2. Potential to Release:		
2a. Containment	10	—
2b. Net Precipitation	10	—
2c. Depth to Aquifer	5	—
2d. Travel Time	35	—
2e. Potential to Release [lines 2a(2b+2c+2d)]	500	—
3. Likelihood of Release (higher of lines 1 and 2e)	550	—
Waste Characteristics:		
4. Toxicity/Mobility	(a)	—
5. Hazardous Waste Quantity	(a)	—
6. Waste Characteristics	100	—
Targets:		
7. Nearest Well	50	—
8. Population:		
8a. Level I Concentrations	(b)	—
8b. Level II Concentrations	(b)	—
8c. Potential Contamination	(b)	—
8d. Population (lines 8a+8b+8c)	(b)	—
9. Resources	5	—
10. Wellhead Protection Area	20	—
11. Targets (lines 7+8d+9+10)	(b)	—
Ground Water Migration Score for an Aquifer:		
12. Aquifer Score [(lines 3 x 6 x 11)/82,500] [c]	100	—
Ground Water Migration Pathway Score:		
13. Pathway Score (S_{gw}), (highest value from line 12 for all aquifers evaluated)[c]	100	—

[a] Maximum value applies to waste characteristics category.
[b] Maximum value not applicable.
[c] Do not round to nearest integer.

3.0.1 *General considerations*

3.0.1.1 *Ground water target distance limit.* The target distance limit defines the maximum distance from the sources at the site over which targets are evaluated. Use a target distance limit of 4 miles for the ground water migration pathway, except when aquifer discontinuities apply (see section 3.0.1.2.2). Furthermore, consider any well with an observed release from a source at the site (see section 3.1.1) to lie within the target distance limit of the site, regardless of the well's distance from the sources at the site.

For sites that consist solely of a contaminated ground water plume with no identified source, begin measuring the 4-mile target distance limit at the center of the area of observed ground water contamination. Determine the area of observed ground water contamination based on available samples that meet the criteria for an observed release.

3.0.1.2 *Aquifer boundaries.* Combine multiple aquifers into a single hydrologic unit for scoring purposes if aquifer interconnections can be established for these aquifers. In contrast, restrict aquifer boundaries if aquifer discontinuities can be established.

3.0.1.2.1 *Aquifer interconnections.* Evaluate whether aquifer interconnections occur within 2 miles of the sources at the site. If they occur within this 2-mile distance, combine the aquifers having interconnections in scoring the site. In addition, if observed ground water contamination attributable to the sources at the site extends beyond 2 miles from the sources, use any locations within the limits of this observed ground water contamination in evaluating aquifer interconnections. If data are not adequate to establish aquifer interconnections, evaluate the aquifers as separate aquifers.

3.0.1.2.2 *Aquifer discontinuities.* Evaluate whether aquifer discontinuities occur within the 4-mile target distance limit. An aquifer discontinuity occurs for scoring purposes only when a geologic, topographic, or other structure or feature entirely transects an aquifer within the 4-mile target distance limit, thereby creating a continuous boundary to ground water flow within this limit. If two or more aquifers can be combined into a single hydrologic unit for scoring purposes, an aquifer discontinuity occurs only when the structure or feature entirely transects the boundaries of this single hydrologic unit.

When an aquifer discontinuity is established within the 4-mile target distance limit, exclude that portion of the aquifer beyond the discontinuity in evaluating the ground water migration pathway. However, if hazardous substances have migrated across an apparent discontinuity within the 4-mile target distance limit, do not consider this to be a discontinuity in scoring the site.

3.0.1.3 *Karst aquifer.* Give a karst aquifer that underlies any portion of the sources at the site special consideration in the evaluation of two potential to release factors (depth to aquifer in section 3.1.2.3 and travel time in section 3.1.2.4), one waste characteristics factor (mobility in section 3.2.1.2), and two targets factors (nearest well in section 3.3.1 and potential contamination in section 3.3.2.4).

3.1 *Likelihood of release.* For an aquifer, evaluate the likelihood of release factor category in terms of an observed release factor or a potential to release factor.

3.1.1 *Observed release.* Establish an observed release to an aquifer by demonstrating that the site has released a hazardous substance to the aquifer. Base this demonstration on either:

- Direct observation—a material that contains one or more hazardous substances has been deposited into or has been observed entering the aquifer.
- Chemical analysis—an analysis of ground water samples from the aquifer indicates that the concentration of hazardous substance(s) has increased significantly above the background concentration for the site (see section 2.3). Some portion of the significant increase must be attributable to the site to establish the observed release, except: when the source itself consists of a ground water plume with no identified source, no separate attribution is required.

If an observed release can be established for the aquifer, assign the aquifer an observed release factor value of 550, enter this value in Table 3-1, and proceed to section 3.1.3. If an observed release cannot be established for the aquifer, assign an observed release factor value of 0, enter this value in Table 3-1, and proceed to section 3.1.2.

3.1.2 *Potential to release.* Evaluate potential to release only if an observed release cannot be established for the aquifer. Evaluate potential to release based on four factors: containment, net precipitation, depth to aquifer, and travel time. For sources overlying karst terrain, give any karst aquifer that underlies any portion of the sources at the site special consideration in evaluating depth to aquifer and travel time, as specified in sections 3.1.2.3 and 3.1.2.4.

3.1.2.1 *Containment.* Assign a containment factor value from Table 3-2 to each source at the site. Select the highest containment factor value assigned to those sources with a source hazardous waste quantity value of 0.5 or more (see section

2.4.2.1.5). (Do not include this minimum size requirement in evaluating any other factor of this pathway.) Assign this highest value as the containment factor value for the aquifer being evaluated. Enter this value in Table 3-1.

If no source at the site meets the minimum size requirement, then select the highest value assigned to the sources at the site and assign it as the containment factor value for the aquifer being evaluated. Enter this value in Table 3–1.

3.1.2.2 *Net precipitation.* Assign a net precipitation factor value to the site. Figure 3–2 provides computed net precipitation factor values, based on site location. Where necessary, determine the net precipitation factor value as follows:

- Determine monthly precipitation and monthly evapotranspiration:
  - –Use local measured monthly averages.
  - –When local data are not available, use monthly averages from the nearest National Oceanographic and Atmospheric Administration weather station that is in a similar geographic setting.

TABLE 3-2.—CONTAINMENT FACTOR VALUES FOR GROUND WATER MIGRATION PATHWAY

Source	Assigned value
All Sources (Except Surface Impoundments, Land Treatment, Containers, and Tanks)	
Evidence of hazardous substance migration from source area (i.e., source area includes source and any associated containment structures).	10
No liner	10
No evidence of hazardous substance migration from source area, a liner, *and*:	
(a) None of the following present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system, or (3) functioning leachate collection and removal system immediately above liner.	10
(b) Any one of the three items in (a) present	9
(c) Any two of the items in (a) present	7
(d) All three items in (a) present plus a functioning ground water monitoring system	5
(e) All items in (d) present, plus no bulk or non-containerized liquids nor materials containing free liquids deposited in source area.	3
No evidence of hazardous substance migration from source area, double liner with functioning leachate collection and removal system above and between liners, functioning ground water monitoring system, *and*:	
(f) Only one of the following deficiencies present in containment: (1) bulk or noncontainerized liquids or materials containing free liquids deposited in source area, or (2) no or nonfunctioning or nonmaintained run-on control system and runoff management system, or (3) no or nonmaintained engineered cover.	3
(g) None of the deficiencies in (f) present	0
Source area inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate is generated, liquids or materials containing free liquids not deposited in source area, and functioning and maintained run-on control present.	0
Surface Impoundment	
Evidence of hazardous substance migration from surface impoundment	10
No liner	10
Free-liquids present with either no diking, unsound diking, or diking that is not regularly inspected and maintained	10
No evidence of hazardous substance migration from surface impoundment, free liquids present, sound diking that is regularly inspected and maintained, adequate freeboard, *and*:	
(a) Liner	9
(b) Liner with functioning leachate collection and removal system below liner, and functioning ground water monitoring system.	5
(c) Double liner with functioning leachate collection and removal system between liners, and functioning ground water monitoring system.	3
No evidence of hazardous substance migration from surface impoundment and all free liquids eliminated at closure (either by removal of liquids or solidification of remaining wastes and waste residues).	Evaluate using **All sources** criteria (with no bulk or free liquid deposited).
Land Treatment	
Evidence of hazardous substance migration from land treatment zone	10
No functioning, maintained, run-on control and runoff management system	10
No evidence of hazardous substance migration from land treatment zone *and*:	
(a) Functioning and maintained run-on control and runoff management system	7
(b) Functioning and maintained run-on control and runoff management system, and vegetative cover established over entire land treatment area.	5
(c) Land treatment area maintained in compliance with 40 CFR 264.280	0

TABLE 3-2.—CONTAINMENT FACTOR VALUES FOR GROUND WATER MIGRATION PATHWAY—Continued

Source	Assigned value
Containers	
All containers buried	Evaluate using **All sources** criteria.
Evidence of hazardous substance migration from container area (i.e., container area includes containers and any associated containment structures).	10
No liner (or no essentially impervious base) under container area	10
No diking (or no similar structure) surrounding container area	10
Diking surrounding container area unsound or not regularly inspected and maintained	10
No evidence of hazardous substance migration from container area, container area surrounded by sound diking that is regularly inspected and maintained, *and*:	
(a) Liner (or essentially impervious base) under container area	9
(b) Essentially impervious base under container area with liquids collection and removal system	7
(c) Containment system includes essentially impervious base, liquids collection system, sufficient capacity to contain 10 percent of volume of all containers, and functioning and maintained run-on control; plus functioning ground water monitoring system, and spilled or leaked hazardous substances and accumulated precipitation removed in timely manner to prevent overflow of collection system, at least weekly inspection of containers, hazardous substances in leaking or deteriorating containers transferred to containers in good condition, and containers sealed except when waste is added or removed.	5
(d) Free liquids present, containment system has sufficient capacity to hold total volume of all containers and to provide adequate freeboard, single liner under container area with functioning leachate collection and removal system below liner, and functioning ground water monitoring system.	5
(e) Same as (d) except: double liner under container area with functioning leachate collection and removal system between liners.	3
Containers inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate would be generated from any unsealed or ruptured containers, liquids or materials containing free liquids not deposited in any container, and functioning and maintained run-off control present.	0
No evidence of hazardous substance migration from container area, containers leaking, and all free liquids eliminated at closure (either by removal of liquid or solidification of remaining wastes and waste residues).	Evaluate using **All sources** criteria (with no bulk or free liquid deposited).
Tank	
Below-ground tank	Evaluate using **All sources** criteria.
Evidence of hazardous substance migration from tank area (i.e., tank area includes tank, ancillary equipment such as piping, and any associated containment structures).	10
Tank and ancillary equipment not provided with secondary containment (e.g., liner under tank area, vault system, double wall).	10
No diking (or no similar structure) surrounding tank and ancillary equipment	10
Diking surrounding tank and ancillary equipment unsound or not regularly inspected and maintained	10
No evidence of hazardous substance migration from tank area, tank and ancillary equipment surrounded by sound diking that is regularly inspected and maintained, *and*:	
(a) Tank and ancillary equipment provided with secondary containment	9
(b) Tank and ancillary equipment provided with secondary containment with leak detection and collection system.	7
(c) Tank and ancillary equipment provided with secondary containment system that detects and collects spilled or leaked hazardous substances and accumulated precipitation and has sufficient capacity to contain 110 percent of volume of largest tank within containment area, spilled or leaked hazardous substances and accumulated precipitation removed in timely manner, at least weekly inspection of tank and secondary containment system, all leaking or unfit-for-use tank systems promptly responded to, and functioning ground water monitoring system.	5
(d) Containment system has sufficient capacity to hold volume of all tanks within tank containment area and to provide adequate freeboard, single liner under that containment area with functioning leachate collection and removal system below liner, and functioning ground water monitoring system.	5
(e) Same as (d) except: double liner under tank containment area with functioning leachate collection and removal system between liners.	3
Tank is above ground, and inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate would be generated from any material released from tank, liquids or materials containing free liquids not deposited in any tank, and functioning and maintained run-on control present.	0

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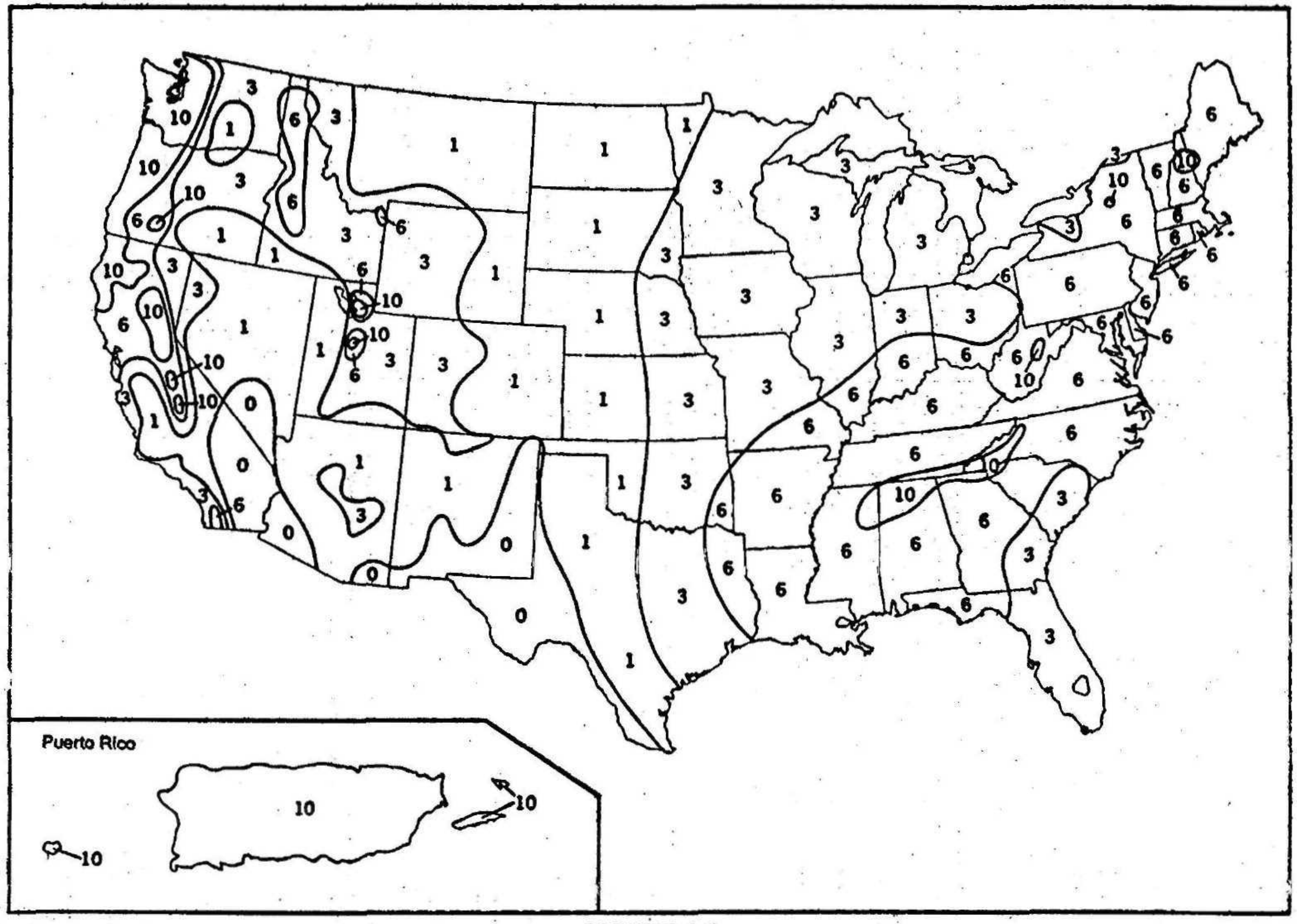

FIGURE 3-2
NET PRECIPITATION FACTOR VALUES

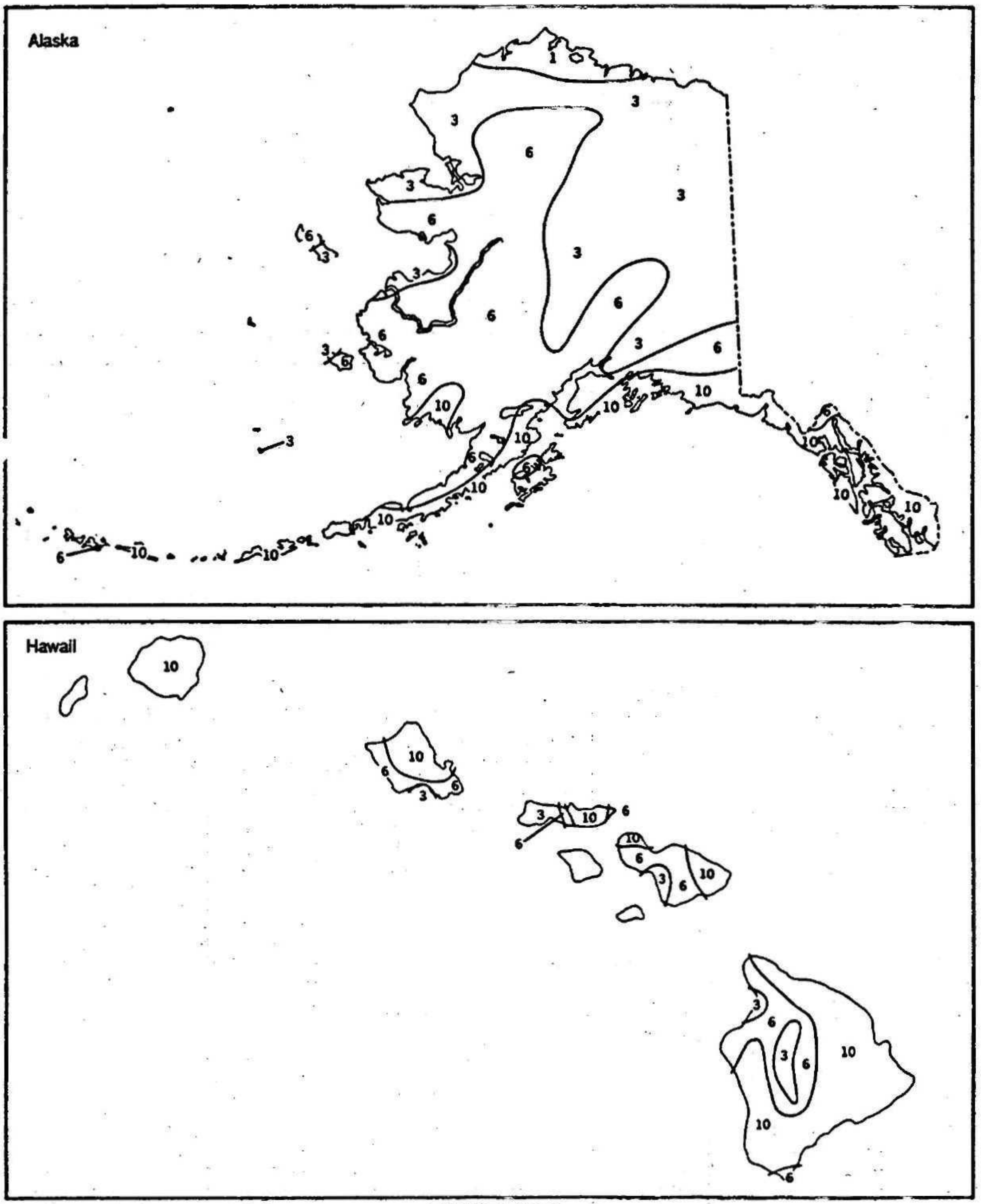

FIGURE 3-2
NET PRECIPITATION FACTOR VALUES
(CONCLUDED)

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–When measured monthly evapotranspiration is not available, calculate monthly potential evapotranspiration (E_i) as follows:

$$E_i = 0.6\, F_i\, (10\, T_i/I)^a$$

where:

E_i=Monthly potential evapotranspiration (inches) for month i.

F_i=Monthly latitude adjusting value for month i.

T_i=Mean monthly temperature (°C) for month i.

$$I = \sum_{i=1}^{12} (T_i/5)^{1.514}$$

$$a = 6.75\times10^{-7} I^3 - 7.71\times10^{-5} I^2 + 1.79\times10^{-2} I + 0.49239$$

Select the latitude adjusting value for each month from Table 3–3. For latitudes lower than 50° North or 20° South, determine the monthly latitude adjusting value by interpolation.

- Calculate monthly net precipitation by subtracting monthly evapotranspiration (or monthly potential evapotranspiration) from monthly precipitation. If evapotranspiration (or potential evapotranspiration) exceeds precipitation for a month, assign that month a net precipitation value of 0.
- Calculate the annual net precipitation by summing the monthly net precipitation values.
- Based on the annual net precipitation, assign a net precipitation factor value from Table 3–4.

Enter the value assigned from Figure 3–2 or from Table 3–4, as appropriate, in Table 3–1.

TABLE 3–3.—MONTHLY LATITUDE ADJUSTING VALUES[a]

Latitude[b] (degrees)	Month											
	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
≥50 N	0.74	0.78	1.02	1.15	1.33	1.36	1.37	1.25	1.06	0.92	0.76	0.70
45 N	0.80	0.81	1.02	1.13	1.28	1.29	1.31	1.21	1.04	0.94	0.79	0.75
40 N	0.84	0.83	1.03	1.11	1.24	1.25	1.27	1.18	1.04	0.96	0.83	0.81
35 N	0.87	0.85	1.03	1.09	1.21	1.21	1.23	1.16	1.03	0.97	0.89	0.85
30 N	0.90	0.87	1.03	1.08	1.18	1.17	1.20	1.14	1.03	0.98	0.89	0.88
20 N	0.95	0.90	1.03	1.05	1.13	1.11	1.14	1.11	1.02	1.00	0.93	0.94
10 N	1.00	0.91	1.03	1.03	1.08	1.06	1.08	1.07	1.02	1.02	0.98	0.99
0	1.04	0.94	1.04	1.01	1.04	1.01	1.04	1.04	1.01	1.04	1.01	1.04
10 S	1.08	0.97	1.05	0.99	1.00	0.96	1.00	1.02	1.00	1.06	1.05	1.09
20 S	1.14	0.99	1.05	0.97	0.96	0.91	0.95	0.99	1.00	1.08	1.09	1.15

[a] Do not round to nearest integer.

[b] For unlisted latitudes lower than 50° North or 20° South, determine the latitude adjusting value by interpolation.

TABLE 3–4.—NET PRECIPITATION FACTOR VALUES

Net precipitation (inches)	Assigned value
0	0
Greater than 0 to 5	1
Greater than 5 to 15	3
Greater than 15 to 30	6
Greater than 30	10

3.1.2.3 *Depth to aquifer.* Evaluate depth to aquifer by determining the depth from the lowest known point of hazardous substances at a site to the top of the aquifer being evaluated, considering all layers in that interval. Measure the depth to an aquifer as the distance from the surface to the top of the aquifer minus the distance from the surface to the lowest known point of hazardous substances eligible to be evaluated for that aquifer. In evaluating depth to aquifer in karst terrain, assign a thickness of 0 feet to a karst aquifer that underlies any portion of the sources at the site. Based on the calculated depth, assign a value from Table 3–5 to the depth to aquifer factor.

Determine the depth to aquifer only at locations within 2 miles of the sources at the site, except: if observed ground water contamination attributable to sources at the site extends more than 2 miles beyond these sources, use any location within the limits of this observed ground water contamination when evaluating the depth to aquifer factor for any aquifer that does not have an observed release. If the necessary geologic information is available at multiple locations, calculate the depth to aquifer at each location. Use the location having the smallest depth to assign the factor value. Enter this value in Table 3–1.

TABLE 3–5.—DEPTH TO AQUIFER FACTOR VALUES

Depth to aquifer[a] (feet)	Assigned value
Less than or equal to 25	5
Greater than 25 to 250	3
Greater than 250	1

[a] Use depth of all layers between the hazardous substances and aquifer. Assign a thickness of 0 feet to any karst aquifer that underlies any portion of the sources at the site.

3.1.2.4 *Travel time.* Evaluate the travel time factor based on the geologic materials in the interval between the lowest known point of hazardous substances at the site and the top of the aquifer being evaluated. Assign a value to the travel time factor as follows:

- If the depth to aquifer (see section 3.1.2.3) is 10 feet or less, assign a value of 35.
- If, for the interval being evaluated, all layers that underlie a portion of the sources at the site are karst, assign a value of 35.
- Otherwise:
  - –Select the lowest hydraulic conductivity layer(s) from within the above interval. Consider only layers at least 3 feet thick. However, do not consider layers or portions of layers within the first 10 feet of the depth to the aquifer.
  - –Determine hydraulic conductivities for individual layers from Table 3–6 or from in-situ or laboratory tests. Use representative, measured, hydraulic conductivity values whenever available.
  - –If more than one layer has the same lowest hydraulic conductivity, include all such layers and sum their thicknesses. Assign a thickness of 0 feet to a karst layer that underlies any portion of the sources at the site.
  - –Assign a value from Table 3–7 to the travel time factor, based on the thickness and hydraulic conductivity of the lowest hydraulic conductivity layer(s).

TABLE 3-6.—HYDRAULIC CONDUCTIVITY OF GEOLOGIC MATERIALS

Type of material	Assigned hydraulic conductivity [a] (cm/sec)
Clay; low permeability till (compact unfractured till); shale; unfractured metamorphic and igneous rocks	10^{-8}
Silt; loesses; silty clays; sediments that are predominantly silts; moderately permeable till (fine-grained, unconsolidated till, or compact till with some fractures); low permeability limestones and dolomites (no karst); low permeability sandstone; low permeability fractured igneous and metamorphic rocks	10^{-6}
Sands; sandy silts; sediments that are predominantly sand; highly permeable till (coarse-grained, unconsolidated or compact and highly fractured); peat; moderately permeable limestones and dolomites (no karst); moderately permeable sandstone; moderately permeable fractured igneous and metamorphic rocks	10^{-4}
Gravel; clean sand; highly permeable fractured igneous and metamorphic rocks; permeable basalt; karst limestones and dolomites	10^{-2}

[a] Do not round to nearest integer.

TABLE 3-7.—TRAVEL TIME FACTOR VALUES [a]

Hydraulic conductivity (cm/sec)	Thickness of lowest hydraulic conductivity layer(s) [b] (feet)			
	Greater than 3 to 5	Greater than 5 to 100	Greater than 100 to 500	Greater than 500
Greater than or equal to 10^{-3}	35	35	35	25
Less than 10^{-3} to 10^{-5}	35	25	15	15
Less than 10^{-5} to 10^{-7}	15	15	5	5
Less than 10^{-7}	5	5	1	1

[a] If depth to aquifer is 10 feet or less or if, for the interval being evaluated, all layers that underlie a portion of the sources at the site are karst, assign a value of 35.

[b] Consider only layers at least 3 feet thick. Do not consider layers or portions of layers within the first 10 feet of the depth to the aquifer.

Determine travel time only at locations within 2 miles of the sources at the site, except: if observed ground water contamination attributable to sources at the site extends more than 2 miles beyond these sources, use any location within the limits of this observed ground water contamination when evaluating the travel time factor for any aquifer that does not have an observed release. If the necessary subsurface geologic information is available at multiple locations, evaluate the travel time factor at each location. Use the location having the highest travel time factor value to assign the factor value for the aquifer. Enter this value in Table 3-1.

3.1.2.5 *Calculation of potential to release factor value.* Sum the factor values for net precipitation, depth to aquifer, and travel time, and multiply this sum by the factor value for containment. Assign this product as the potential to release factor value for the aquifer. Enter this value in Table 3-1.

3.1.3 *Calculation of likelihood of release factor category value.* If an observed release is established for an aquifer, assign the observed release factor value of 550 as the likelihood of release factor category value for that aquifer. Otherwise, assign the potential to release factor value for that aquifer as the likelihood of release value. Enter the value assigned in Table 3-1.

3.2 *Waste characteristics.* Evaluate the waste characteristics factor category for an aquifer based on two factors: toxicity/mobility and hazardous waste quantity. Evaluate only those hazardous substances available to migrate from the sources at the site to ground water. Such hazardous substances include:

- Hazardous substances that meet the criteria for an observed release to ground water.
- All hazardous substances associated with a source that has a ground water containment factor value greater than 0 (see sections 2.2.2, 2.2.3, and 3.1.2.1).

3.2.1 *Toxicity/mobility.* For each hazardous substance, assign a toxicity factor value, a mobility factor value, and a combined toxicity/mobility factor value as specified in the following sections. Select the toxicity/mobility factor value for the aquifer being evaluated as specified in section 3.2.1.3.

3.2.1.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in Section 2.4.1.1.

3.2.1.2 *Mobility.* Assign a mobility factor value to each hazardous substance for the aquifer being evaluated as follows:

- For any hazardous substance that meets the criteria for an observed release by chemical analysis to one or more aquifers underlying the sources at the site, regardless of the aquifer being evaluated, assign a mobility factor value of 1.
- For any hazardous substance that does not meet the criteria for an observed release by chemical analysis to at least one of the aquifers, assign that hazardous substance a mobility factor value from Table 3-8 for the aquifer being evaluated, based on its water solubility and distribution coefficient (K_d).
- If the hazardous substance cannot be assigned a mobility factor value because data on its water solubility or distribution coefficient are not available, use other hazardous substances for which information is available in evaluating the pathway.

TABLE 3-8.—GROUND WATER MOBILITY FACTOR VALUES [a]

Water solubility (mg/l)	Distribution coefficient (K_d) (ml/g)			
	Karst [c]	≤10	>10 to 1,000	>1,000
Present as liquid [b]	1	1	0.01	0.0001
Greater than 100	1	1	0.01	0.0001
Greater than 1 to 100	0.2	0.2	0.002	2×10^{-5}
Greater than 0.01 to 1	0.002	0.002	2×10^{-5}	2×10^{-7}
Less than or equal to 0.01	2×10^{-5}	2×10^{-5}	2×10^{-7}	2×10^{-9}

[a] Do not round to nearest integer.

[b] Use if the hazardous substance is present or deposited as a liquid.

[c] Use if the entire interval from the source to the aquifer being evaluated is karst.

- If none of the hazardous substances eligible to be evaluated can be assigned a mobility factor value, use a default value of 0.002 as the mobility factor value for all these hazardous substances.

Determine the water solubility to be used *in Table 3–8 for the hazardous substance as* follows (use this same water solubility for all aquifers):

- For any hazardous substance that does not meet the criteria for an observed release by chemical analysis, if the hazardous substance is present or deposited as a liquid, use the water solubility category "Present as Liquid" in Table 3–8 to assign the mobility factor value to that hazardous substance.
- Otherwise:
  - For any hazardous substance that is a metal (or metalloid) and that does not meet the criteria for an observed release by chemical analysis, establish a water solubility for the hazardous substance as follows:
    - Determine the overall range of water solubilities for compounds of this hazardous substance (consider all compounds for which adequate water solubility information is available, not just compounds identified as present at the site).
    - Calculate the geometric mean of the highest and the lowest water solubility in this range.
    - Use this geometric mean as the water solubility in assigning the hazardous substance a mobility factor value from Table 3–8.
  - For any other hazardous substance (either organic or inorganic) that does not meet the criteria for an observed release by chemical analysis, use the water solubility of that hazardous substance to assign a mobility factor value from Table 3–8 to the hazardous substance.

For the aquifer being evaluated, determine the distribution coefficient to be used in Table 3–8 for the hazardous substance as follows:

- For any hazardous substance that does not meet the criteria for an observed release by chemical analysis, if the entire interval from a source at the site to the aquifer being evaluated is karst, use the distribution coefficient category "Karst" in Table 3–8 in assigning the mobility factor value for that hazardous substance for that aquifer.
- Otherwise:
  - For any hazardous substance that is a metal (or metalloid) and that does not meet the criteria for an observed release by chemical analysis, use the distribution coefficient for the metal or (metalloid) to assign a mobility factor value from Table 3–8 for that hazardous substance.
  - For any other inorganic hazardous substance that does not meet the criteria for an observed release by chemical analysis, use the distribution coefficient for that inorganic hazardous substance, if available, to assign a mobility factor value from Table 3–8. If the distribution coefficient is not available, use a default value of "less than 10" as the distribution coefficient, except: for asbestos use a default value of "greater than 1,000" as the distribution coefficient.
  - For any hazardous substance that is organic and that does not meet the criteria for an observed release by chemical analysis, establish a distribution coefficient for that hazardous substance as follows:
    - Estimate the K_d range for the hazardous substance using the following equation:

$$K_d=(K_{oc})(f_s)$$

where:

K_{oc} = Soil-water partition coefficient for organic carbon for the hazardous substance.

f_s = Sorbent content (fraction of clays plus organic carbon) in the subsurface.

    - Use f_s values of 0.03 and 0.77 in the above equation to establish the upper and lower values of the K_d range for the hazardous substance.
    - Calculate the geometric mean of the upper and lower K_d range values. Use this geometric mean as the distribution coefficient in assigning the hazardous substance a mobility factor value from Table 3–8.

3.2.1.3 *Calculation of toxicity/mobility factor value.* Assign each hazardous substance a toxicity/mobility factor value from Table 3–9, based on the values assigned to the hazardous substance for the toxicity and mobility factors. Use the hazardous substance with the highest toxicity/mobility factor value for the aquifer being evaluated to assign the value to the toxicity/mobility factor for that aquifer. Enter this value in Table 3–1.

TABLE 3–9.—TOXICITY/MOBILITY FACTOR VALUES [a]

Mobility factor value	Toxicity factor value					
	10,000	1,000	100	10	1	0
1.0	10,000	1,000	100	10	1	0
0.2	2,000	200	20	2	0.2	0
0.01	100	10	1	0.1	0.01	0
0.002	20	2	0.2	0.02	0.002	0
0.0001	1	0.1	0.01	0.001	1×10^{-4}	0
2×10^{-5}	0.2	0.02	0.002	2×10^{-4}	2×10^{-5}	0
2×10^{-7}	0.002	2×10^{-4}	2×10^{-5}	2×10^{-6}	2×10^{-7}	0
2×10^{-9}	2×10^{-5}	2×10^{-6}	2×10^{-7}	2×10^{-8}	2×10^{-9}	0

[a] Do not round to nearest integer.

3.2.2 *Hazardous waste quantity.* Assign a hazardous waste quantity factor value for the ground water pathway (or aquifer) as specified in section 2.4.2. Enter this value in Table 3–1.

3.2.3 *Calculation of waste characteristics factor category value.* Multiply the toxicity/mobility and hazardous waste quantity factor values, subject to a maximum product of 1×10^8. Based on this product, assign a value from Table 2–7 (section 2.4.3.1) to the waste characteristics factor category. Enter this value in Table 3–1.

3.3 *Targets.* Evaluate the targets factor category for an aquifer based on four factors: nearest well, population, resources, and Wellhead Protection Area. Evaluate these four factors based on targets within the target distance limit specified in section 3.0.1.1 and the aquifer boundaries specified in section 3.0.1.2. Determine the targets to be included in evaluating these factors for an aquifer as specified in section 3.0.

3.3.1 *Nearest well.* In evaluating the nearest well factor, include both the drinking water wells drawing from the aquifer being evaluated and those drawing from overlying aquifers as specified in section 3.0. Include standby wells in evaluating this factor only if they are used for drinking water supply at least once every year.

If there is an observed release by direct observation for a drinking water well within the target distance limit, assign Level II concentrations to that well. However, if one or more samples meet the criteria for an observed release for that well, determine if that well is subject to Level I or Level II concentrations as specified in sections 2.5.1 and 2.5.2. Use the health-based benchmarks from Table 3–10 in determining the level of contamination.

Assign a value for the nearest well factor as follows:

- If one or more drinking water wells is subject to Level I concentrations, assign a value of 50.
- If not, but if one or more drinking water wells is subject to Level II concentrations, assign a value of 45.
- If none of the drinking water wells is subject to Level I or Level II concentrations, assign a value as follows:
  - If one of the target aquifers is a karst aquifer that underlies any portion of the sources at the site and any well draws drinking water from this karst aquifer within the target distance limit, assign a value of 20.
  - If not, determine the shortest distance to any drinking water well, as measured from any source at the site with a ground water containment factor value greater than 0. Select a value from Table 3–11 based on this distance. Assign it as the value for the nearest well factor.

Enter the value assigned to the nearest well factor in Table 3–1.

TABLE 3–10.—HEALTH-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN DRINKING WATER

- Concentration corresponding to Maximum Contaminant Level (MCL).
- Concentration corresponding to a nonzero Maximum Contaminant Level Goal (MCLG).
- Screening concentration for cancer corresponding to that concentration that corresponds to the 10^{-6} individual cancer risk for oral exposures.
- Screening concentration for noncancer toxicological responses corresponding to the Reference Dose (RfD) for oral exposures.

TABLE 3–11.—NEAREST WELL FACTOR VALUES

Distance from source (miles)	Assigned value
Level I concentrations[a]	50
Level II concentrations[a]	45
0 to ¼	20
Greater than ¼ to ½	18
Greater than ½ to 1	9
Greater than 1 to 2	5
Greater than 2 to 3	3
Greater than 3 to 4	2
Greater than 4	0

[a] Distance does not apply.

3.3.2 *Population*. In evaluating the population factor, include those persons served by drinking water wells within the target distance limit specified in section 3.0.1.1. For the aquifer being evaluated, count those persons served by wells in that aquifer and those persons served by wells in overlying aquifers as specified in section 3.0. Include residents, students, and workers who regularly use the water. Exclude transient populations such as customers and travelers passing through the area. Evaluate the population based on the location of the water supply wells, not on the location of residences, work places, etc. When a standby well is maintained on a regular basis so that water can be withdrawn, include it in evaluating the population factor.

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located.

In determining the population served by a well, if the water from the well is blended with other water (for example, water from other ground water wells or surface water intakes), apportion the total population regularly served by the blended system to the well based on the well's relative contribution to the total blended system. In estimating the well's relative contribution, assume each well and intake contributes equally and apportion the population accordingly, except: if the relative contribution of any one well or intake exceeds 40 percent based on average annual pumpage or capacity, estimate the relative contribution of the wells and intakes considering the following data, if available:

- Average annual pumpage from the ground water wells and surface water intakes in the blended system.
- Capacities of the wells and intakes in the blended system.

For systems with standby ground water wells or standby surface water intakes, apportion the total population regularly served by the blended system as described above, except:

- Exclude standby surface water intakes in apportioning the population.
- When using pumpage data for a standby ground water well, use average pumpage for the period during which the standby well is used rather than average annual pumpage.
- For that portion of the total population that could be apportioned to a standby ground water well, assign that portion of the population either to that standby well or to the other ground water well(s) and surface water intake(s) that serve that population; do not assign that portion of the population both to the standby well and to the other well(s) and intake(s) in the blended system. Use the apportioning that results in the highest population factor value. (Either include all standby well(s) or exclude some or all of the standby well(s) as appropriate to obtain this highest value.) Note that the specific standby well(s) included or excluded and, thus, the specific apportioning may vary in evaluating different aquifers and in evaluating the surface water pathway.

3.3.2.1 *Level of contamination*. Evaluate the population served by water from a point of withdrawal based on the level of contamination for that point of withdrawal. Use the applicable factor: Level I concentrations, Level II concentrations, or potential contamination.

If no samples meet the criteria for an observed release for a point of withdrawal and there is no observed release by direct observation for that point of withdrawal, evaluate that point of withdrawal using the potential contamination factor in section 3.3.2.4. If there is an observed release by direct observation, use Level II concentrations for that point of withdrawal. However, if one or more samples meet the criteria for an observed release for the point of withdrawal, determine which factor (Level I or Level II concentrations) applies to that point of withdrawal as specified in sections 2.5.1 and 2.5.2. Use the health-based benchmarks from Table 3–10 in determining the level of contamination. Evaluate the point of withdrawal using the Level I concentrations factor in section 3.3.2.2 or the Level II concentrations factor in section 3.3.2.3, as appropriate.

For the potential contamination factor, use population ranges in evaluating the factor as specified in section 3.3.2.4. For the Level I and Level II concentrations factors, use the population estimate, not population ranges, in evaluating both factors.

3.3.2.2 *Level I concentrations*. Sum the number of people served by drinking water from points of withdrawal subject to Level I concentrations. Multiply this sum by 10. Assign this product as the value for this factor. Enter this value in Table 3–1.

3.3.2.3 *Level II concentrations*. Sum the number of people served by drinking water from points of withdrawal subject to Level II concentrations. Do not include those people already counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in Table 3–1.

3.3.2.4 *Potential contamination*. Determine the number of people served by drinking water from points of withdrawal subject to potential contamination. Do not include those people already counted under the Level I and Level II concentrations factors.

Assign distance-weighted population values from Table 3–12 to this population as follows:

- Use the "Karst" portion of Table 3–12 to assign values only for that portion of the population served by points of withdrawal that draw drinking water from a karst aquifer that underlies any portion of the sources at the site.
  - For this portion of the population, determine the number of people included within each "Karst" distance category in Table 3–12.

TABLE 3-12.—DISTANCE-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FACTOR FOR GROUND WATER MIGRATION PATHWAY [a]

Distance category (miles)	Number of people within the distance category												
	0	1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,001 to 3,000,000
Other Than Karst [b]:													
0 to ¼	0	4	17	53	164	522	1,633	5,214	16,325	52,137	163,246	521,360	1,632,455
Greater than ¼ to ½	0	2	11	33	102	324	1,013	3,233	10,122	32,325	101,213	323,243	1,012,122
Greater than ½ to 1	0	1	5	17	52	167	523	1,669	5,224	16,684	52,239	166,835	522,385
Greater than 1 to 2	0	0.7	3	10	30	94	294	939	2,939	9,385	29,384	93,845	293,842
Greater than 2 to 3	0	0.5	2	7	21	68	212	678	2,122	6,778	21,222	67,777	212,219
Greater than 3 to 4	0	0.3	1	4	13	42	131	417	1,306	4,171	13,060	41,709	130,596
Karst [c]:													
0 to ¼	0	4	17	53	164	522	1,633	5,214	16,325	52,137	163,246	521,360	1,632,455
Greater than ¼ to ½	0	2	11	33	102	324	1,013	3,233	10,122	32,325	101,213	323,243	1,012,122
Greater than ½ to 1	0	2	9	26	82	261	817	2,607	8,163	26,068	81,623	260,680	816,227
Greater than 1 to 2	0	2	9	26	82	261	817	2,607	8,163	26,068	81,623	260,680	816,227
Greater than 2 to 3	0	2	9	26	82	261	817	2,607	8,163	26,068	81,623	260,680	816,227
Greater than 3 to 4	0	2	9	26	82	261	817	2,607	8,163	26,068	81,623	260,680	816,227

[a] Round the number of people present within a distance category to nearest integer. Do not round the assigned distance-weighted population value to nearest integer.

[b] Use for all aquifers, except karst aquifers underlying any portion of the sources at the site.

[c] Use only for karst aquifers underlying any portion of the sources at the site.

–Assign a distance-weighted population value for each distance category based on the number of people included within the distance category.

- Use the "Other Than Karst" portion of Table 3-12 for the remainder of the population served by points of withdrawal subject to potential contamination.

–For this portion of the population, determine the number of people included within each "Other Than Karst" distance category in Table 3-12.

–Assign a distance-weighted population value for each distance category based on the number of people included within the distance category.

Calculate the value for the potential contamination factor (PC) as follows:

$$PC = \frac{1}{10} \sum_{i=1}^{n} (W_i + K_i)$$

where:

W_i=Distance-weighted population from "Other Than Karst" portion of Table 3-12 for distance category i.

K_i=Distance-weighted population from "Karst" portion of Table 3-12 for distance category i.

n=Number of distance categories.

If PC is less than 1, do not round it to the nearest integer; if PC is 1 or more, round to the nearest integer. Enter this value in Table 3-1.

3.3.2.5 *Calculation of population factor value.* Sum the factor values for Level I concentrations, Level II concentrations, and potential contamination. Do not round this sum to the nearest integer. Assign this sum as the population factor value for the aquifer. Enter this value in Table 3-1.

3.3.3 *Resources.* To evaluate the resources factor, select the highest value specified below that applies for the aquifer being evaluated. Assign this value as the resources factor value for the aquifer. Enter this value in Table 3-1.

Assign a resources value of 5 if water drawn from any target well for the aquifer being evaluated or overlying aquifers (as specified in section 3.0) is used for one or more of the following purposes:

- Irrigation (5-acre minimum) of commercial food crops or commercial forage crops.
- Watering of commercial livestock.
- Ingredient in commercial food preparation.
- Supply for commercial aquaculture.
- Supply for a major or designated water recreation area, excluding drinking water use.

Assign a resources value of 5 if no drinking water wells are within the target distance limit, but the water in the aquifer being evaluated or any overlying aquifers (as specified in section 3.0) is usable for drinking water purposes.

Assign a resources value of 0 if none of the above applies.

3.3.4 *Wellhead Protection Area.* Evaluate the Wellhead Protection Area factor based on Wellhead Protection Areas designated according to section 1428 of the Safe Drinking Water Act, as amended. Consider only those Wellhead Protection Areas applicable to the aquifer being evaluated or overlying aquifers (as specified in section 3.0). Select the highest value below that applies. Assign it as the value for the Wellhead Protection Area factor for the aquifer being evaluated. Enter this value in Table 3-1.

Assign a value of 20 if either of the following criteria applies for the aquifer being evaluated or overlying aquifers:

- A source with a ground water containment factor value greater than 0 lies, either partially or fully, within or above the designated Wellhead Protection Area.
- Observed ground water contamination attributable to the sources at the site lies, either partially or fully, within the designated Wellhead Protection Area.

If neither criterion applies, assign a value of 5, if, within the target distance limit, there is a designated Wellhead Protection Area applicable to the aquifer being evaluated or overlying aquifers.

Assign a value of 0 if none of the above applies.

3.3.5 *Calculation of targets factor category value.* Sum the factor values for nearest well, population, resources, and Wellhead Protection Area. Do not round this sum to the nearest integer. Use this sum as the targets factor category value for the aquifer. Enter this value in Table 3-1.

3.4 *Ground water migration score for an aquifer.* For the aquifer being evaluated, multiply the factor category values for likelihood of release, waste characteristics, and targets, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum value of 100, as the ground water migration pathway score for the aquifer. Enter this score in Table 3-1.

3.5 *Calculation of ground water migration pathway score.* Calculate a ground water migration score for each aquifer underlying the sources at the site, as appropriate. Assign the highest ground water migration score for an aquifer as the ground water migration pathway score (S_{gw}) for the site. Enter this score in Table 3-1.

4.0 *Surface Water Migration Pathway.*

4.0.1 *Migration components.* Evaluate the surface water migration pathway based on two migration components:

- Overland/flood migration to surface water (see section 4.1).
- Ground water to surface water migration (see section 4.2).

Evaluate each component based on the same three threats: drinking water threat, human food chain threat, and environmental threat.

Score one or both components, considering their relative importance. If only one component is scored, assign its score as the surface water migration pathway score. If both components are scored, select the higher of the two scores and assign it as the surface water migration pathway score.

4.0.2 *Surface water categories.* For HRS purposes, classify surface water into four categories: rivers, lakes, oceans, and coastal tidal waters.

Rivers include:

- Perennially flowing waters from point of origin to the ocean or to coastal tidal waters, whichever comes first, and wetlands contiguous to these flowing waters.
- Aboveground portions of disappearing rivers.
- Man-made ditches only insofar as they perennially flow into other surface water.
- Intermittently flowing waters and contiguous intermittently flowing ditches only in arid or semiarid areas with less than 20 inches of mean annual precipitation.

Lakes include:

- Natural and man-made lakes (including impoundments) that lie along rivers, but excluding the Great Lakes.
- Isolated, but perennial, lakes, ponds, and wetlands.
- Static water channels or oxbow lakes contiguous to rivers.
- Small rivers, without diking, that merge into surrounding perennially inundated wetlands.
- Wetlands contiguous to water bodies defined here as lakes.

Ocean and ocean-like water bodies include:

- Ocean areas seaward from the baseline of the Territorial Sea. (This baseline represents the generalized coastline of the United States. It is parallel to the seaward limit of the Territorial Sea and other maritime limits such as the inner boundary of Federal fisheries jurisdiction and the limit of States jurisdiction under the Submerged Lands Act, as amended.)
- The Great Lakes.
- Wetlands contiguous to the Great Lakes.

Coastal tidal waters include:

- Embayments, harbors, sounds, estuaries, back bays, lagoons, wetlands, etc. seaward from mouths of rivers and landward from the baseline of the Territorial Sea.

4.1 *Overland/flood migration component.* Use the overland/flood migration component to evaluate surface water threats that result from overland migration of hazardous substances from a source at the site to surface water. Evaluate three types of threats for this component: drinking water threat, human food chain threat, and environmental threat.

4.1.1 *General considerations.*

4.1.1.1 *Definition of hazardous substance migration path for overland/flood migration component.* The hazardous substance migration path includes both the overland segment and the in-water segment that hazardous substances would take as they migrate away from sources at the site:

- Begin the overland segment at a source and proceed downgradient to the probable point of entry to surface water.
- Begin the in-water segment at this probable point of entry.
  - For rivers, continue the in-water segment in the direction of flow (including any tidal flows) for the distance established by the target distance limit (see section 4.1.1.2).
  - For lakes, oceans, coastal tidal waters, or Great Lakes, do not consider flow direction. Instead apply the target distance limit as an arc.
  - If the in-water segment includes both rivers and lakes (or oceans, coastal tidal waters, or Great Lakes), apply the target distance limit to their combined in-water segments.

For sites that consist of contaminated sediments with no identified source, the hazardous substance migration path consists solely of the in-water segment specified in section 4.1.1.2.

Consider a site to be in two or more watersheds for this component if two or more hazardous substance migration paths from the sources at the site do not reach a common point within the target distance limit. If the site is in more than one watershed, define a separate hazardous substance migration path for each watershed. Evaluate the overland/flood migration component for each watershed separately as specified in section 4.1.1.3.

4.1.1.2 *Target distance limit.* The target distance limit defines the maximum distance over which targets are considered in evaluating the site. Determine a separate target distance limit for each watershed as follows:

- If there is no observed release to surface water in the watershed or if there is an observed release only by direct observation (see section 4.1.2.1.1), begin measuring the target distance limit for the watershed at the probable point of entry to surface water and extend it for 15 miles along the surface water from that point.
- If there is an observed release from the site to the surface water in the watershed that is based on sampling, begin measuring the target distance limit for the watershed at the probable point of entry; extend the target distance limit either for 15 miles along the surface water or to the most distant sample point that meets the criteria for an observed release to that watershed, whichever is greater.

In evaluating the site, include only surface water targets (for example, intakes, fisheries, sensitive environments) that are within or contiguous to the hazardous substance migration path and located, partially or wholly, at or between the probable point of entry and the target distance limit applicable to the watershed:

- If flow within the hazardous substance migration path is reversed by tides, evaluate upstream targets only if there is documentation that the tidal run could carry substances from the site as far as those upstream targets.
- Determine whether targets within or contiguous to the hazardous substance migration path are subject to actual or potential contamination as follows:
  - If a target is located, partially or wholly, either at or between the probable point of entry and any sampling point that meets the criteria for an observed release to the watershed or at a point that meets the criteria for an observed release by direct observation, evaluate that target as subject to actual contamination, except as otherwise specified for fisheries in section 4.1.3.3 and for wetlands in section 4.1.4.3.1.1. If the actual contamination is based on direct observation, assign Level II to the actual contamination. However, if the actual contamination is based on samples, determine whether the actual contamination is at Level I or Level II concentrations as specified in sections 4.1.2.3, 4.1.3.3, and 4.1.4.3.1.
  - If a target is located, partially or wholly, within the target distance limit for the watershed, but not at or between the probable point of entry and any sampling point that meets the criteria for an observed release to the watershed, nor at a point that meets the criteria for an observed release by direct observation, evaluate it as subject to potential contamination.

For sites consisting solely of contaminated sediments with no identified source, determine the target distance limit as follows:

- If there is a clearly defined direction of flow for the surface water body (or bodies) containing the contaminated sediments, begin measuring the target distance limit at the point of observed sediment contamination that is farthest upstream (that is, at the location of the farthest available upstream sediment sample that meets the criteria for an observed release); extend the target distance limit either for 15 miles along the surface water or to the most distant downstream sample point that meets the criteria for an observed release to that watershed, whichever is greater.
- If there is no clearly defined direction of flow, begin measuring the target distance limit at the center of the area of observed sediment contamination. Extend the target distance limit as an arc either for 15 miles along the surface water or to the most distant sample point that meets the criteria for an observed release to that watershed, whichever is greater. Determine the area of observed sediment contamination based on available samples that meet the criteria for an observed release.

Note that the hazardous substance migration path for these contaminated sediment sites consists solely of the in-water segment defined by the target distance limit; there is no overland segment.

For these contaminated sediment sites, include only those targets (for example, intakes, fisheries, sensitive environments) that are within or contiguous to the hazardous substance migration path and located, wholly or partially, within the target distance limit for the site. Determine whether these targets are subject to actual or potential contamination as follows:

- If a target is located, partially or wholly, within the area of observed sediment contamination, evaluate it as subject to actual contamination, except as otherwise specified for fisheries in section 4.1.3.3 and wetlands in section 4.1.4.3.1.1.
  - If a drinking water target is subject to actual contamination, evaluate it using Level II concentrations.

–If a human food chain target or environmental target is subject to actual contamination, evaluate it using Level I or Level II concentrations, as appropriate (see sections 4.1.3.3 and 4.1.4.3.1).

- If a target is located, partially or wholly, within the target distance limit for the watershed, but not within the area of observed sediment contamination, evaluate it as subject to potential contamination.

4.1.1.3 *Evaluation of overland/flood migration component.* Evaluate the drinking water threat, human food chain threat, and environmental threat for each watershed for this component based on three factor categories: likelihood of release, waste characteristics, and targets. Figure 4–1 indicates the factors included within each factor category for each type of threat.

Determine the overland/flood migration component score (S_{of}) for a watershed in terms of the factor category values as follows:

$$S_{of}=\sum_{i=1}^{3}\frac{(LR_i)(WC_i)(T_i)}{SF}$$

where:

LR_i=Likelihood of release factor category value for threat i (that is, drinking water, human food chain, or environmental threat).
WC_i=Waste characteristics factor category value for threat i.
T_i=Targets factor category value for threat i.
SF=Scaling factor.
Table 4–1 outlines the specific calculation procedure.

If the site is in only one watershed, assign the overland/flood migration score for that watershed as the overland/flood migration component score for the site.

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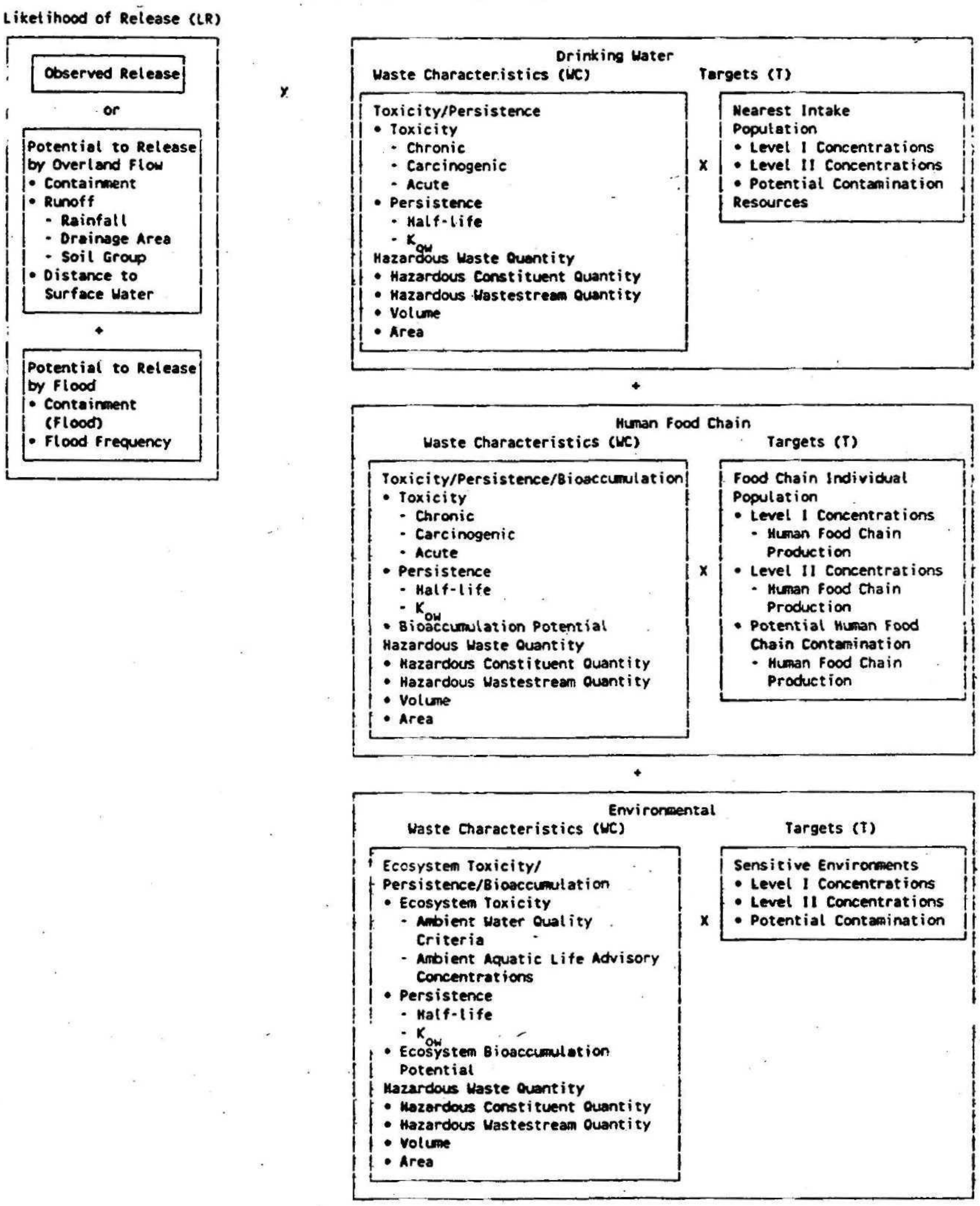

FIGURE 4-1
OVERVIEW OF SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT

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TABLE 4-1.—SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Drinking Water Threat		
Likelihood of Release:		
1. Observed Release	550	___
2. Potential to Release by Overland Flow:		
2a. Containment	10	___
2b. Runoff	25	___
2c. Distance to Surface Water	25	___
2d. Potential to Release by Overland Flow (lines 2a[2b+2c])	500	___
3. Potential to Release by Flood:		
3a. Containment (Flood)	10	___
3b. Flood Frequency	50	___
3c. Potential to Release by Flood (lines 3a×3b)	500	___
4. Potential to Release (lines 2d+3c, subject to a maximum of 500)	500	___
5. Likelihood of Release (higher of lines 1 and 4)	550	___
Waste Characteristics:		
6. Toxicity/Persistence	(a)	___
7. Hazardous Waste Quantity	(a)	___
8. Waste Characteristics	100	___
Targets:		
9. Nearest Intake	50	___
10. Population		
10a. Level I Concentrations	(b)	___
10b. Level II Concentrations	(b)	___
10c. Potential Contamination	(b)	___
10d. Population (lines 10a+10b+10c)	(b)	___
11. Resources	5	___
12. Targets (lines 9+10d+11)	(b)	___
Drinking Water Threat Score:		
13. Drinking Water Threat Score ([lines 5×8×12]/82,500, subject to a maximum of 100)	100	___
Human Food Chain Threat		
Likelihood of Release:		
14. Likelihood of Release (same value as line 5)	550	___
Waste Characteristics:		
15. Toxicity/Persistence/Bioaccumulation	(a)	___
16. Hazardous Waste Quantity	(a)	___
17. Waste Characteristics	1,000	___
Targets:		
18. Food Chain Individual	50	___
19. Population		
19a. Level I Concentrations	(b)	___
19b. Level II Concentrations	(b)	___
19c. Potential Human Food Chain Contamination	(b)	___
19d. Population (lines 19a+19b+19c)	(b)	___
20. Targets (lines 18+19d)	(b)	___
Human Food Chain Threat Score:		
21. Human Food Chain Threat Score ([lines 14×17×20]/82,500, subject to a maximum of 100)	100	___
Environmental Threat		
Likelihood of Release:		
22. Likelihood of Release (same value as line 5)	550	___
Waste Characteristics:		
23. Ecosystem Toxicity/Persistence/Bioaccumulation	(a)	___
24. Hazardous Waste Quantity	(a)	___
25. Waste Characteristics	1,000	
Targets:		
26. Sensitive Environments		
26a. Level I Concentrations	(b)	___
26b. Level II Concentrations	(b)	___
26c. Potential Contamination	(b)	___
26d. Sensitive Environments (lines 26a+26b+26c)	(b)	
27. Targets (value from line 26d)	(b)	
Environmental Threat Score:		
28. Environmental Threat Score ([lines 22×25×27]/82,500, subject to a maximum of 60)	60	___
Surface Water Overland/Flood Migration Component Score for a Watershed		
29. Watershed Score [c] (lines 13+21+28, subject to a maximum of 100)	100	___
Surface Water Overland/Flood Migration Component Score		
30. Component Score (S_{of}) [c] (highest score from line 29 for all watersheds evaluated, subject to a maximum of 100)	100	___

[a] Maximum value applies to waste characteristics category.

[b] Maximum value not applicable.

[c] Do not round to nearest integer.

If the site is in more than one watershed:

- Calculate a separate overland/flood migration component score for each watershed, using likelihood of release, waste characteristics, and targets applicable to each watershed.
- Select the highest overland/flood migration component score from the watersheds evaluated and assign it as the overland/flood migration component score for the site.

4.1.2 *Drinking water threat.* Evaluate the drinking water threat for each watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.1.2.1 *Drinking water threat—likelihood of release.* Evaluate the likelihood of release factor category for each watershed in terms of an observed release factor or a potential to release factor.

4.1.2.1.1 *Observed release.* Establish an observed release to surface water for a watershed by demonstrating that the site has released a hazardous substance to the surface water in the watershed. Base this demonstration on either:

- Direct observation:
  - A material that contains one or more hazardous substances has been seen entering surface water through migration or is known to have entered surface water through direct deposition, or
  - A source area has been flooded at a time that hazardous substances were present, and one or more hazardous substances were in contact with the flood waters, or
  - When evidence supports the inference of a release of a material that contains one or more hazardous substances by the site to surface water, demonstrated adverse effects associated with that release may also be used to establish an observed release.
- Chemical analysis:
  - Analysis of surface water, benthic, or sediment samples indicates that the concentration of hazardous substance(s) has increased significantly above the background concentration for the site for that type of sample (see section 2.3).
    - Limit comparisons to similar types of samples and background concentrations—for example, compare surface water samples to surface water background concentrations.
    - For benthic samples, limit comparisons to essentially sessile organisms.
  - Some portion of the significant increase must be attributable to the site to establish the observed release, except: when the site itself consists of contaminated sediments with no identified source, no separate attribution is required.

If an observed release can be established for a watershed, assign an observed release factor value of 550 to that watershed, enter this value in Table 4–1, and proceed to section 4.1.2.1.3. If no observed release can be established for the watershed, assign an observed release factor value of 0 to that watershed, enter this value in Table 4–1, and proceed to section 4.1.2.1.2.

4.1.2.1.2 *Potential to release.* Evaluate potential to release only if an observed release cannot be established for the watershed. Evaluate potential to release based on two components: potential to release by overland flow (see section 4.1.2.1.2.1) and potential to release by flood (see section 4.1.2.1.2.2). Sum the values for these two components to obtain the potential to release factor value for the watershed, subject to a maximum value of 500.

4.1.2.1.2.1 *Potential to release by overland flow.* Evaluate potential to release by overland flow for the watershed based on three factors: containment, runoff, and distance to surface water.

Assign potential to release by overland flow a value of 0 for the watershed if:

- No overland segment of the hazardous substance migration path can be defined for the watershed, or
- The overland segment of the hazardous substance migration path for the watershed exceeds 2 miles before surface water is encountered.

If either condition applies, enter a value of 0 in Table 4–1 and proceed to section 4.1.2.1.2.2 to evaluate potential to release by flood. If neither applies, proceed to section 4.1.2.1.2.1.1 to evaluate potential to release by overland flow.

4.1.2.1.2.1.1 *Containment.* Determine the containment factor value for the watershed as follows:

- If one or more sources is located in surface water in the watershed (for example, intact sealed drums in surface water), assign the containment factor a value of 10 for the watershed. Enter this value in Table 4–1.
- If none of the sources is located in surface water in the watershed, assign a containment factor value from Table 4–2 to each source at the site that can potentially release hazardous substances to the hazardous substance migration path for this watershed. Assign the containment factor value for the watershed as follows:
  - Select the highest containment factor value assigned to those sources that meet the minimum size requirement described below. Assign this highest value as the containment factor value for the watershed. Enter this value in Table 4–1.
  - If, for this watershed, no source at the site meets the minimum size requirement, then select the highest containment factor value assigned to the sources at the site eligible to be evaluated for this watershed and assign it as the containment factor value for the watershed. Enter this value in Table 4–1.

A source meets the minimum size requirement if its source hazardous waste quantity value (see section 2.4.2.1.5) is 0.5 or more. Do not include the minimum size requirement in evaluating any other factor of this surface water migration component, except potential to release by flood as specified in section 4.1.2.1.2.2.3.

4.1.2.1.2.1.2 *Runoff.* Evaluate runoff based on three components: rainfall, drainage area, and soil group.

TABLE 4–2.—CONTAINMENT FACTOR VALUES FOR SURFACE WATER MIGRATION PATHWAY

Source	Assigned value
All Sources (Except Surface Impoundments, Land Treatment, Containers, and Tanks)	
Evidence of hazardous substance migration from source area (i.e., source area includes source and any associated containment structures)	10
No evidence of hazardous substance migration from source area *and:*	
(a) Neither of the following present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system.	10
(b) Any one of the two items in (a) present	9
(c) Any two of the following present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system, or (3) liner with functioning leachate collection and removal system immediately above liner.	7
(d) All items in (c) present	5
(e) All items in (c) present, plus no bulk or non-containerized liquids nor materials containing free liquids deposited in source area	3
No evidence of hazardous substance migration from source area, double liner with functioning leachate collection and removal system above and between liners, *and:*	
(f) Only one of the following deficiencies present in containment: (1) bulk or noncontainerized liquids or materials containing free liquids deposited in source area, or (2) no or nonfunctioning or nonmaintained run-on control system and runoff management system, or (3) no or nonmaintained engineered cover.	3
(g) None of the deficiencies in (f) present	0
Source area inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate is generated, liquids or materials containing free liquids not deposited in source area, and functioning and maintained run-on control present.	

TABLE 4-2.—CONTAINMENT FACTOR VALUES FOR SURFACE WATER MIGRATION PATHWAY—Concluded

Source	Assigned value
Surface Impoundment	
Evidence of hazardous substance migration from surface impoundment	10
Free liquids present with either no diking, unsound diking, or diking that is not regularly inspected and maintained	10
No evidence of hazardous substance migration from surface impoundment, free liquids present, sound diking that is regularly inspected and maintained, adequate freeboard, *and:*	
(a) No liner	9
(b) Liner	7
(c) Liner with functioning leachate collection and removal system below liner	5
(d) Double liner with functioning leachate collection and removal system between liners	3
No evidence of hazardous substance migration from surface impoundment and all free liquids eliminated at closure (either by removal of liquids or solidification of remaining wastes and waste residues).	Evaluate using All Sources criteria (with no bulk or free liquids deposited).
Land Treatment	
Evidence of hazardous substance migration from land treatment zone	10
No functioning and maintained run-on control and runoff management system	10
No evidence of hazardous substance migration from land treatment zone *and:*	
(a) Functioning and maintained run-on control and runoff management system	7
(b) Functioning and maintained run-on control and runoff management system, and vegetative cover established over entire land treatment area.	5
(c) Land treatment area maintained in compliance with 40 CFR 264.280	0
Containers	
All containers buried	Evaluate using All Sources criteria.
Evidence of hazardous substance migration from container area (i.e., container area includes containers and any associated containment structures).	10
No diking (or no similar structure) surrounding container area	10
Diking surrounding container area unsound or not regularly inspected and maintained	10
No evidence of hazardous substance migration from container area and container area surrounded by sound diking that is regularly inspected and maintained.	9
No evidence of hazardous substance migration from container area, container area surrounded by sound diking that is regularly inspected and maintained, *and:*	9
(a) Essentially impervious base under container area with liquids collection and removal system	7
(b) Containment system includes essentially impervious base, liquids collection system, sufficient capacity to contain 10 percent of volume of all containers, and functioning and maintained run-on control; and spilled or leaked hazardous substances and accumulated precipitation removed in timely manner to prevent overflow of collection system, at least weekly inspection of containers, hazardous substances in leaking or deteriorating containers transferred to containers in good condition, and containers sealed except when waste is added or removed.	5
(c) Free liquids present, containment system has sufficient capacity to hold total volume of all containers and to provide adequate freeboard, and single liner under container area with functioning leachate collection and removal system below liner.	5
(d) Same as (c) except: double liner under container area with functioning leachate collection and removal system between liners	3
Containers inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate would be generated from any unsealed or ruptured containers, liquids or materials containing free liquids not deposited in any container, and functioning and maintained run-on control present.	0
No evidence of hazardous substance migration from container area, containers leaking, and all free liquids eliminated at closure (either by removal of liquids or solidification of remaining wastes and waste residues).	Evaluate using All Sources criteria (with no bulk or free liquids deposited).
Tank	
Below-ground tank	Evaluate using All Sources criteria
Evidence of hazardous substance migration from tank area (i.e., tank area includes tank, ancillary equipment such as piping, and any associated containment structures).	10
No diking (or no similar structure) surrounding tank and ancillary equipment	10
Diking surrounding tank and ancillary equipment unsound or not regularly inspected and maintained	10
No evidence of hazardous substance migration from tank area and tank and ancillary equipment surrounded by sound diking that is regularly inspected and maintained.	9
No evidence of hazardous substance migration from tank area, tank and ancillary equipment surrounded by sound diking that is regularly inspected and maintained, *and:*	
(a) Tank and ancillary equipment provided with secondary containment (e.g., liner under tank area, vault system, double-wall) with leak detection and collection system.	7
(b) Tank and ancillary equipment provided with secondary containment system that detects and collects spilled or leaked hazardous substances and accumulated precipitation and has sufficient capacity to contain 110 percent of volume of largest tank within containment area, spilled or leaked hazardous substances and accumulated precipitation removed in a timely manner, at least weekly inspection of tank and secondary containment system, and all leaking or unfit-for-use tank systems promptly responded to.	5
(c) Containment system has sufficient capacity to hold total volume of all tanks within the tank containment area and to provide adequate freeboard, and single liner under tank containment area with functioning leachate collection and removal system below liner.	5
(d) Same as (c) except: double liner under tank containment area with functioning leachate collection and removal system between liners.	3
Tank is above ground, and inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate would be generated from any material released from tank, liquids or materials containing free liquids not deposited in any tank, and functioning and maintained run-on control present.	0

Rainfall. Determine the 2-year, 24-hour rainfall for the site. Use site-specific, 2-year, 24-hour rainfall data if records are available for at least 20 years. If such site-specific data are not available, estimate the 2-year, 24-hour rainfall for the site from a rainfall-frequency map. Do not round the rainfall value to the nearest integer.

Drainage area. Determine the drainage area for the sources at the site. Include in this drainage area both the source areas and the area upgradient of the sources, but exclude any portion of this drainage area for which runoff is diverted from entering the sources by storm sewers or run-on control and/or runoff management systems. Assign a drainage area value for the watershed from Table 4-3.

Soil group. Based on the predominant soil group within the drainage area described above, assign a soil group designation for the watershed from Table 4-4 as follows:

- Select the predominant soil group as that type which comprises the largest total area within the applicable drainage area.
- If a predominant soil group cannot be delineated, select that soil group in the drainage area that yields the highest value for the runoff factor.

Calculation of runoff factor value. Assign a combined rainfall/runoff value for the watershed from Table 4-5, based on the 2-year, 24-hour rainfall and the soil group designation. Determine the runoff factor value for the watershed from Table 4-6, based on the rainfall/runoff and drainage area values. Enter the runoff factor value in Table 4-1.

TABLE 4-3.—DRAINAGE AREA VALUES

Drainage area (acres)	Assigned value
Less than 50	1
50 to 250	2
Greater than 250 to 1,000	3
Greater than 1,000	4

TABLE 4-4.—SOIL GROUP DESIGNATIONS

Surface soil description	Soil group designation
Coarse-textured soils with high infiltration rates (for example, sands, loamy sands).	A
Medium-textured soils with moderate infiltration rates (for example, sandy loams, loams).	B
Moderately fine-textured soils with low infiltration rates (for example, silty loams, silts, sandy clay loams).	C
Fine-textured soils with very low infiltration rates (for example, clays, sandy clays, silty clay loams, clay loams, silty clays); or impermeable surfaces (for example, pavement).	D

TABLE 4-5.—RAINFALL/RUNOFF VALUES

2-Year, 24-hour rainfall (inches)	Soil group designation			
	A	B	C	D
Less than 1.0	0	0	2	3
1.0 to less than 1.5	0	1	2	3
1.5 to less than 2.0	0	2	3	4
2.0 to less than 2.5	1	2	3	4
2.5 to less than 3.0	2	3	4	4
3.0 to less than 3.5	2	3	4	5
3.5 or greater	3	4	5	6

TABLE 4-6.—RUNOFF FACTOR VALUES

Drainage area value	Rainfall/runoff value						
	0	1	2	3	4	5	6
1	0	0	0	1	1	1	1
2	0	0	1	1	2	3	4
3	0	0	1	3	7	11	15
4	0	1	2	7	17	25	25

4.1.2.1.2.1.3 *Distance to surface water.* Evaluate the distance to surface water as the shortest distance, along the overland segment, from any source with a surface water containment factor value greater than 0 to either the mean high water level for tidal waters or the mean water level for other surface waters. Based on this distance, assign a value from Table 4-7 to the distance to surface water factor for the watershed. Enter this value in Table 4-1.

4.1.2.1.2.1.4 *Calculation of factor value for potential to release by overland flow.* Sum the factor values for runoff and distance to surface water for the watershed and multiply this sum by the factor value for containment. Assign the resulting product as the factor value for potential to release by overland flow for the watershed. Enter this value in Table 4-1.

4.1.2.1.2.2 *Potential to release by flood.* Evaluate potential to release by flood for each watershed as the product of two factors: containment (flood) and flood frequency. Evaluate potential to release by flood separately for each source that is within the watershed. Furthermore, for each source, evaluate potential to release by flood separately for each category of floodplain in which the source lies. (See section 4.1.2.1.2.2.2 for the applicable floodplain categories.) Calculate the value for the potential to release by flood factor as specified in 4.1.2.1.2.2.3.

4.1.2.1.2.2.1 *Containment (flood).* For each source within the watershed, separately evaluate the containment (flood) factor for each category of floodplain in which the source is partially or wholly located. Assign a containment (flood) factor value from Table 4-8 to each floodplain category applicable to that source. Assign a containment (flood) factor value of 0 to each floodplain category in which the source does not lie.

4.1.2.1.2.2.2 *Flood frequency.* For each source within the watershed, separately evaluate the flood frequency factor for each category of floodplain in which the source is partially or wholly located. Assign a flood frequency factor value from Table 4-9 to each floodplain category in which the source is located.

4.1.2.1.2.2.3 *Calculation of factor value for potential to release by flood.* For each source within the watershed and for each category of floodplain in which the source is partially or wholly located, calculate a separate potential to release by flood factor value. Calculate this value as the product of the containment (flood) value and the flood frequency value applicable to the source for the floodplain category. Select the highest value calculated for those sources that meet the minimum size requirement specified in section 4.1.2.1.2.1.1 and assign it as the value for the potential to release by flood factor for the watershed. However, if, for this watershed, no source at the site meets the minimum size requirement, select the highest value calculated for the sources at the site eligible to be evaluated for this watershed and assign it as the value for this factor.

TABLE 4-7.—DISTANCE TO SURFACE WATER FACTOR VALUES

Distance	Assigned value
Less than 100 feet	25
100 feet to 500 feet	20
Greater than 500 feet to 1,000 feet	16
Greater than 1,000 feet to 2,500 feet	9
Greater than 2,500 feet to 1.5 miles	6
Greater than 1.5 miles to 2 miles	3

TABLE 4-8.—CONTAINMENT (FLOOD) FACTOR VALUES

Containment criteria	Assigned value
Documentation that containment at the source is designed, constructed, operated, and maintained to prevent a washout of hazardous substances by the flood being evaluated.	0
Other	10

TABLE 4-9.—FLOOD FREQUENCY FACTOR VALUES

Floodplain category	Assigned value
Source floods annually	50
Source in 10-year floodplain	50
Source in 100-year floodplain	25
Source in 500-year floodplain	7
None of above	0

Enter this highest potential to release by flood factor value for the watershed in Table 4-1, as well as the values for containment (flood) and flood frequency that yield this highest value.

4.1.2.1.2.3 *Calculation of potential to release factor value.* Sum the factor values assigned to the watershed for potential to release by overland flow and potential to release by flood. Assign this sum as the potential to release factor value for the watershed, subject to a maximum value of 500. Enter this value in Table 4-1.

4.1.2.1.3 *Calculation of drinking water threat-likelihood of release factor category value.* If an observed release is established for the watershed, assign the observed release factor value of 550 as the likelihood of release factor category value for that watershed. Otherwise, assign the potential to release factor value for that watershed as the likelihood of release factor category value for that watershed. Enter the value assigned in Table 4-1.

4.1.2.2 *Drinking water threat-waste characteristics.* Evaluate the waste characteristics factor category for each watershed based on two factors: toxicity/persistence and hazardous waste quantity. Evaluate only those hazardous substances that are available to migrate from the sources at the site to surface water in the watershed via the overland/flood hazardous substance migration path for the watershed (see section 4.1.1.1). Such hazardous substances include:

- Hazardous substances that meet the criteria for an observed release to surface water in the watershed.
- All hazardous substances associated with a source that has a surface water containment factor value greater than 0 for the watershed (see sections 2.2.2, 2.2.3, 4.1.2.1.2.1.1, and 4.1.2.1.2.2.1).

4.1.2.2.1 *Toxicity/persistence.* For each hazardous substance, assign a toxicity factor value, a persistence factor value, and a combined toxicity/persistence factor value as specified in sections 4.1.2.2.1.1 through 4.1.2.2.1.3. Select the toxicity/persistence factor value for the watershed as specified in section 4.1.2.2.1.3.

4.1.2.2.1.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

4.1.2.2.1.2 *Persistence.* Assign a persistence factor value to each hazardous substance. In assigning this value, evaluate persistence based primarily on the half-life of the hazardous substance in surface water and secondarily on the sorption of the hazardous substance to sediments. The half-life in surface water is defined for HRS purposes as the time required to reduce the initial concentration in surface water by one-half as a result of the combined decay processes of biodegradation, hydrolysis, photolysis, and volatilization. Sorption to sediments is evaluated for the HRS based on the logarithm of the n-octanol-water partition coefficient (log K_{ow}) of the hazardous substance.

Estimate the half-life ($t_{1/2}$) of a hazardous substance as follows:

$$t_{1/2}=\frac{1}{\frac{1}{h}+\frac{1}{b}+\frac{1}{p}+\frac{1}{v}}$$

where:

h = Hydrolysis half-life.
b = Biodegradation half-life.
p = Photolysis half-life.
v = Volatilization half-life.

If one or more of these four component half-lives cannot be estimated for the hazardous substance from available data, delete that component half-life from the above equation. If none of these four component half-lives can be estimated for the hazardous substance from available data, use the default procedure indicated below. Estimate a half-life for the hazardous substance for lakes or for rivers, oceans, coastal tidal waters, and Great Lakes, as appropriate.

If a half-life can be estimated for a hazardous substance:

- Assign that hazardous substance a persistence factor value from the appropriate portion of Table 4-10 (that is lakes; or rivers, oceans, coastal tidal waters, and Great Lakes).
- Select the appropriate portion of Table 4-10 as follows:
  - If there is one or more drinking water intakes along the hazardous substance migration path for the watershed, select the nearest drinking water intake as measured from the probable point of entry. If the in-water segment between the probable point of entry and this selected intake includes both lakes and other water bodies, use the lakes portion of Table 4-10 only if more than half the distance to this selected intake lies in lake(s). Otherwise, use the rivers, oceans, coastal tidal waters, and Great Lakes portion of Table 4-10. For contaminated sediments with no identified source, use the point where measurement begins (see section 4.1.1.2) rather than the probable point of entry.
  - If there are no drinking water intakes but there are intakes or points of use for any of the resource types listed in section 4.1.2.3.3, select the nearest such intake or point of use. Select the portion of Table 4-10 based on this intake or point of use in the manner specified for drinking water intakes.
  - If there are no drinking water intakes and no specified resource intakes and points of use, but there is another type of resource listed in section 4.1.2.3.3 (for example, the water is usable for drinking water purposes even though not used), select the portion of Table 4-10 based on the nearest point of this resource in the manner specified for drinking water intakes.

TABLE 4-10.—PERSISTENCE FACTOR VALUES—HALF-LIFE

Surface water category	Substance half-life (days)	Assigned value [a]
Rivers, oceans, coastal tidal waters, and Great Lakes	Less than or equal to 0.2	0.0007
	Greater than 0.2 to 0.5	0.07
	Greater than 0.5 to 1.5	0.4
	Greater than 1.5	1
Lakes	Less than or equal to 0.02	0.0007
	Greater than 0.02 to 2	0.07
	Greater than 2 to 20	0.4
	Greater than 20	1

[a] Do not round to nearest integer.

If a half-life cannot be estimated for a hazardous substance from available data, use the following default procedure to assign a persistence factor value to that hazardous substance:

- For those hazardous substances that are metals (or metalloids), assign a persistence factor value of 1 as a default for all surface water bodies.
- For other hazardous substances (both organic and inorganic), assign a persistence factor value of 0.4 as a default for rivers, oceans, coastal tidal waters, and Great Lakes, and a persistence factor value of 0.07 as a default for lakes. Select the appropriate value in the same manner specified for using Table 4-10.

Use the persistence factor value assigned based on half-life or the default procedure unless the hazardous substance can be assigned a higher factor value from Table 4-11, based on its Log K_{ow}. If a higher value can be assigned from Table 4-11, assign this higher value as the persistence factor value for the hazardous substance.

TABLE 4-11.—PERSISTENCE FACTOR VALUES—LOG K_{ow}

Log K_{ow}	Assigned value [a]
Less than 3.5	0.0007
3.5 to less than 4.0	0.07
4.0 to 4.5	0.4
Greater than 4.5	1

[a] Use for lakes, rivers, oceans, coastal tidal waters, and Great Lakes. Do not round to nearest integer.

4.1.2.2.1.3 *Calculation of toxicity/persistence factor value.* Assign each hazardous substance a toxicity/persistence factor value from Table 4-12, based on the values assigned to the hazardous substance for the toxicity and persistence factors. Use the hazardous substance with the highest toxicity/persistence factor value for the watershed to assign the toxicity/persistence factor value for the drinking water threat for the watershed. Enter this value in Table 4-1.

4.1.2.2.2 *Hazardous waste quantity.* Assign a hazardous waste quantity factor value for the watershed as specified in section 2.4.2. Enter this value in Table 4-1.

4.1.2.2.3 *Calculation of drinking water threat-waste characteristics factor category value.* Multiply the toxicity/persistence and hazardous waste quantity factor values for the watershed, subject to a maximum product of 1 x 10^8. Based on this product, assign a value from Table 2-7 (section 2.4.3.1) to the drinking water threat-waste characteristics factor category for the watershed. Enter this value in Table 4-1.

TABLE 4-12.—TOXICITY/PERSISTENCE FACTOR VALUES [a]

Persistence factor value	Toxicity factor value					
	10,000	1,000	100	10	1	0
1.0	10,000	1,000	100	10	1	0
0.4	4,000	400	40	4	0.4	0
0.07	700	70	7	0.7	0.07	0
0.0007	7	0.7	0.07	0.007	0.0007	0

[a] Do not round to nearest integer.

4.1.2.3 *Drinking water threat-targets.* Evaluate the targets factor category for each watershed based on three factors: nearest intake, population, and resources.

To evaluate the nearest intake and population factors, determine whether the target surface water intakes are subject to actual or potential contamination as specified in section 4.1.1.2. Use either an observed release based on direct observation at the intake or the exposure concentrations from samples (or comparable samples) taken at or beyond the intake to make this determination (see section 4.1.2.1.1). The exposure concentrations for a sample (that is, surface water, benthic, or sediment sample) consist of the concentrations of those hazardous substances present that are significantly above background levels and attributable at least in part to the site (that is, those hazardous substance concentrations that meet the criteria for an observed release).

When an intake is subject to actual contamination, evaluate it using Level I concentrations or Level II concentrations. If the actual contamination is based on an observed release by direct observation, use Level II concentrations for that intake. However, if the actual contamination is based on an observed release from samples, determine which level applies for the intake by comparing the exposure concentrations from samples (or comparable samples) to health-based benchmarks as specified in sections 2.5.1 and 2.5.2. Use the health-based benchmarks from Table 3-10 (section 3.3.1) in determining the level of contamination from samples. For contaminated sediments with no identified source, evaluate the actual contamination using Level II concentrations (see section 4.1.1.2).

4.1.2.3.1 *Nearest intake.* Evaluate the nearest intake factor based on the drinking water intakes along the overland/flood hazardous substance migration path for the watershed. Include standby intakes in evaluating this factor only if they are used for supply at least once a year.

Assign the nearest intake factor a value as follows and enter the value in Table 4-1:

- If one or more of these drinking water intakes is subject to Level I concentrations as specified in section 4.1.2.3, assign a factor value of 50.
- If not, but if one or more of these drinking water intakes is subject to Level II concentrations, assign a factor value of 45.
- If none of these drinking water intakes is subject to Level I or Level II concentrations, determine the nearest of these drinking water intakes, as measured from the probable point of entry (or from the point where measurement begins for contaminated sediments with no identified source). Assign a dilution weight from Table 4-13 to this intake, based on the type of surface water body in which it is located. Multiply this dilution weight by 20, round the product to the nearest integer, and assign it as the factor value.

Assign the dilution weight from Table 4-13 as follows:

TABLE 4-13.—SURFACE WATER DILUTION WEIGHTS

Type of surface water body [a]		Assigned dilution weight [b]
Descriptor	Flow characteristics	
Minimal stream	Less than 10 cfs [c]	1
Small to moderate stream	10 to 100 cfs	0.1
Moderate to large stream	Greater than 100 to 1,000 cfs	0.01
Large stream to river	Greater than 1,000 to 10,000 cfs	0.001
Large river	Greater than 10,000 to 100,000 cfs	0.0001
Very large river	Greater than 100,000 cfs	0.00001
Coastal tidal waters [d]	Flow not applicable, depth not applicable	0.0001
Shallow ocean zone [e] or Great Lake	Flow not applicable, depth less than 20 feet	0.0001
Moderate depth ocean zone [e] or Great Lake	Flow not applicable, depth 20 to 200 feet	0.00001
Deep ocean zone [e] or Great Lake	Flow not applicable, depth greater than 200 feet	0.000005
3-mile mixing zone in quiet flowing river	10 cfs or greater	0.5

[a] Treat each lake as a separate type of water body and assign a dilution weight as specified in text.

[b] Do not round to nearest integer.

[c] cfs = cubic feet per second.

[d] Embayments, harbors, sounds, estuaries, back bays, lagoons, wetlands, etc., seaward from mouths of rivers and landward from baseline of Territorial Sea.

[e] Seaward from baseline of Territorial Sea. This baseline represents the generalized U.S. coastline. It is parallel to the seaward limit of the Territorial Sea and other maritime limits such as the inner boundary of the Federal fisheries jurisdiction and the limit of States jurisdiction under the Submerged Lands Act, as amended.

- For a river (that is, surface water body types specified in Table 4-13 as minimal stream through very large river), assign a dilution weight based on the average annual flow in the river at the intake. If available, use the average annual discharge as defined in the U.S. Geological Survey Water Resources Data Annual Report. Otherwise, estimate the average annual flow.
- For a lake, assign a dilution weight as follows:
  - For a lake that has surface water flow entering the lake, assign a dilution weight based on the sum of the

  average annual flows for the surface water bodies entering the lake up to the point of the intake.
  - –For a lake that has no surface water flow entering, but that does have surface water flow leaving, assign a dilution weight based on the sum of the average annual flows for the surface water bodies leaving the lake.
  - –For a closed lake (that is, a lake without surface water flow entering or leaving), assign a dilution weight based on the average annual ground water flow into the lake, if available, using the dilution weight for the corresponding river flow rate in Table 4–13. If not available, assign a default dilution weight of 1.

- For the ocean and the Great Lakes, assign a dilution weight based on depth.
- For coastal tidal waters, assign a dilution weight of 0.0001; do not consider depth or flow.
- For a quiet-flowing river that has average annual flow of 10 cubic feet per second (cfs) or greater and that contains the probable point of entry to surface water, apply a zone of mixing in assigning the dilution weight:
  - –Start the zone of mixing at the probable point of entry and extend it for 3 miles from the probable point of entry, except: if the surface water characteristics change to turbulent within this 3-mile distance, extend the zone of mixing only to the point at which the change occurs.
  - –Assign a dilution weight of 0.5 to any intake that lies within this zone of mixing.
  - –Beyond this zone of mixing, assign a dilution weight the same as for any other river (that is, assign the dilution weight based on average annual flow).
  - –Treat a quiet-flowing river with an average annual flow of less than 10 cfs the same as any other river (that is, assign it a dilution weight of 1).

In those cases where water flows from a surface water body with a lower assigned dilution weight (from Table 4–13) to a surface water body with a higher assigned dilution weight (that is, water flows from a surface water body with more dilution to one with less dilution), use the lower assigned dilution weight as the dilution weight for the latter surface water body.

4.1.2.3.2 *Population.* In evaluating the population factor, include only persons served by drinking water drawn from intakes that are along the overland/flood hazardous substance migration path for the watershed and that are within the target distance limit specified in section 4.1.1.2. Include residents, students, and workers who regularly use the water. Exclude transient populations such as customers and travelers passing through the area. When a standby intake is maintained on a regular basis so that water can be withdrawn, include it in evaluating the population factor.

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located.

In estimating the population served by an intake, if the water from the intake is blended with other water (for example, water from other surface water intakes or ground water wells), apportion the total population regularly served by the blended system to the intake based on the intake's relative contribution to the total blended system. In estimating the intake's relative contribution, assume each well or intake contributes equally and apportion the population accordingly, except: if the relative contribution of any one intake or well exceeds 40 percent based on average annual pumpage or capacity, estimate the relative contribution of the wells and intakes considering the following data, if available:

- Average annual pumpage from the ground water wells and surface water intakes in the blended system.
- Capacities of the wells and intakes in the blended system.

For systems with standby surface water intakes or standby ground water wells, apportion the total population regularly served by the blended system as described above, except:

- Exclude standby ground water wells in apportioning the population.
- When using pumpage data for a standby surface water intake, use average pumpage for the period during which the standby intake is used rather than average annual pumpage.
- For that portion of the total population that could be apportioned to a standby surface water intake, assign that portion of the population either to that standby intake or to the other surface water intake(s) and ground water well(s) that serve that population; do not assign that portion of the population both to the standby intake and to the other intake(s) and well(s) in the blended system. Use the apportioning that results in the highest population factor value. (Either include all standby intake(s) or exclude some or all of the standby intake(s) as appropriate to obtain this highest value.) Note that the specific standby intake(s) included or excluded and, thus, the specific apportioning may vary in evaluating different watersheds and in evaluating the ground water pathway.

4.1.2.3.2.1 *Level of contamination.* Evaluate the population factor based on three factors: Level I concentrations, Level II concentrations, and potential contamination. Determine which factor applies for an intake as specified in section 4.1.2.3. Evaluate intakes subject to Level I concentration as specified in section 4.1.2.3.2.2, intakes subject to Level II concentration as specified in section 4.1.2.3.2.3, and intakes subject to potential contamination as specified in section 4.1.2.3.2.4.

For the potential contamination factor, use population ranges in evaluating the factor as specified in section 4.1.2.3.2.4. For the Level I and Level II concentrations factors, use the population estimate, not population ranges, in evaluating both factors.

4.1.2.3.2.2 *Level I concentrations.* Sum the number of people served by drinking water from intakes subject to Level I concentrations. Multiply this sum by 10. Assign this product as the value for this factor. Enter this value in Table 4–1.

4.1.2.3.2.3 *Level II concentrations.* Sum the number of people served by drinking water from intakes subject to Level II concentrations. Do not include people already counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in Table 4–1.

4.1.2.3.2.4 *Potential contamination.* For each applicable type of surface water body in Table 4–14, first determine the number of people served by drinking water from intakes subject to potential contamination in that type of surface water body. Do not include those people already counted under the Level I and Level II concentrations factors.

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TABLE 4-14
DILUTION-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FACTOR FOR SURFACE WATER MIGRATION PATHWAY[a]

Type of Surface Water Body[b]	Number of People								
	0	1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000
Minimal stream (< 10 cfs)	0	4	17	53	164	522	1,633	5,214	16,325
Small to moderate stream (10 to 100 cfs)	0	0.4	2	5	16	52	163	521	1,633
Moderate to large stream (> 100 to 1,000 cfs)	0	0.04	0.2	0.5	2	5	16	52	163
Large stream to river (> 1,000 to 10,000 cfs)	0	0.004	0.02	0.05	0.2	0.5	2	5	16
Large river (> 10,000 to 100,000 cfs)	0	0	0.002	0.005	0.02	0.05	0.2	0.5	2
Very large river (> 100,000 cfs)	0	0	0	0.001	0.002	0.005	0.02	0.05	0.2
Shallow ocean zone or Great Lake (depth < 20 feet)	0	0	0.002	0.005	0.02	0.05	0.2	0.5	2
Moderate ocean zone or Great Lake (depth 20 to 200 feet)	0	0	0	0.001	0.002	0.005	0.02	0.05	0.2
Deep ocean zone or Great Lakes (depth > 200 feet)	0	0	0	0	0.001	0.003	0.008	0.03	0.08
3-mile mixing zone in quiet flowing river (≥ 10 cfs)	0	2	9	26	82	261	817	2,607	8,163

TABLE 4-14 (Concluded)

	Number of People				
Type of Surface Water Body[b]	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,001 to 3,000,000	3,000,001 to 10,000,000
Minimal stream (< 10 cfs)	52,137	163,246	521,360	1,632,455	5,213,590
Small to moderate stream (10 to 100 cfs)	5,214	16,325	52,136	163,245	521,359
Moderate to large stream (> 100 to 1,000 cfs)	521	1,633	5,214	16,325	52,136
Large stream to river (> 1,000 to 10,000 cfs)	52	163	521	1,632	5,214
Large river (> 10,000 to 100,000 cfs)	5	16	52	163	521
Very large river (> 100,000 cfs)	0.5	2	5	16	52
Shallow ocean zone or Great Lake (depth < 20 feet)	5	16	52	163	521
Moderate ocean zone or Great Lake (depth 20 to 200 feet)	0.5	2	5	16	52
Deep zone or Great Lake (depth > 200 feet)	0.3	1	3	8	26
3-mile mixing zone in quiet flowing river (≥ 10 cfs)	26,068	81,623	260,680	816,227	2,606,795

[a] Round the number of people to nearest integer. Do not round the assigned dilution-weighted population value to nearest integer.

[b] Treat each lake as a separate type of water body and assign it a dilution-weighted population value using the surface water body type with the same dilution weight from Table 4-13 as the lake. If drinking water is withdrawn from coastal tidal water or the ocean, assign a dilution-weighted population value to it using the surface water body type with the same dilution weight from Table 4-13 as the coastal tidal water or the ocean zone.

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For each type of surface water body, assign a dilution-weighted population value from Table 4-14, based on the number of people included for that type of surface water body. (Note that the dilution-weighted population values in Table 4-14 incorporate the dilution weights from Table 4-13. Do not multiply the values from Table 4-14 by these dilution weights.)

Calculate the value for the potential contamination factor (PC) for the watershed as follows:

$$PC = \frac{1}{10} \sum_{i=1}^{n} W_i$$

where:

W_i=Dilution-weighted population from Table 4-14 for surface water body type i.

n=Number of different surface water body types in the watershed.

If PC is less than 1, do not round it to the nearest integer; if PC is 1 or more, round to the nearest integer. Enter this value for the potential contamination factor in Table 4-1.

4.1.2.3.2.5 *Calculation of population factor value.* Sum the factor values for Level I concentrations, Level II concentrations, and potential contamination. Do not round this sum to the nearest integer. Assign this sum as the population factor value for the watershed. Enter this value in Table 4-1.

4.1.2.3.3 *Resources.* To evaluate the resources factor for the watershed, select the highest value below that applies to the watershed. Assign this value as the resources factor value for the watershed. Enter this value in Table 4-1.

Assign a value of 5 if, within the in-water segment of the hazardous substance migration path for the watershed, the surface water is used for one or more of the following purposes:

- Irrigation (5 acre minimum) of commercial food crops or commercial forage crops.
- Watering of commercial livestock.
- Ingredient in commercial food preparation.
- Major or designated water recreation area, excluding drinking water use.

Assign a value of 5 if, within the in-water segment of the hazardous substance migration path for the watershed, the surface water is not used for drinking water, but either of the following applies:

- Any portion of the surface water is designated by a State for drinking water use under section 305(a) of the Clean Water Act, as amended.
- Any portion of the surface water is usable for drinking water purposes.

Assign a value of 0 if none of the above applies.

4.1.2.3.4 *Calculation of drinking water threat-targets factor category value.* Sum the nearest intake, population, and resources factor values for the watershed. Do not round this sum to the nearest integer. Assign this sum as the drinking water threat-targets factor category value for the watershed. Enter this value in Table 4-1.

4.1.2.4 *Calculation of the drinking water threat score for a watershed.* Multiply the drinking water threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 100, as the drinking water threat score for the watershed. Enter this value in Table 4-1.

4.1.3 *Human food chain threat.* Evaluate the human food chain threat for each watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.1.3.1 *Human food chain threat-likelihood of release.* Assign the same likelihood of release factor category value for the human food chain threat for the watershed as would be assigned in section 4.1.2.1.3 for the drinking water threat. Enter this value in Table 4-1.

4.1.3.2 *Human food chain threat-waste characteristics.* Evaluate the waste characteristics factor category for each watershed based on two factors: toxicity/persistence/bioaccumulation and hazardous waste quantity.

4.1.3.2.1 *Toxicity/persistence/bioaccumulation.* Evaluate all those hazardous substances eligible to be evaluated for toxicity/persistence in the drinking water threat for the watershed (see section 4.1.2.2).

4.1.3.2.1.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

4.1.3.2.1.2 *Persistence.* Assign a persistence factor value to each hazardous substance as specified for the drinking water threat (see section 4.1.2.2.1.2), except: use the predominant water category (that is, lakes; or rivers, oceans, coastal tidal waters, or Great Lakes) between the probable point of entry and the nearest fishery (not the nearest drinking water or resources intake) along the hazardous substance migration path for the watershed to determine which portion of Table 4-10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.2.1.2. For contaminated sediments with no identified source, use the point where measurement begins rather than the probable point of entry.

4.1.3.2.1.3 *Bioaccumulation potential.* Use the following data hierarchy to assign a bioaccumulation potential factor value to each hazardous substance:

- Bioconcentration factor (BCF) data.
- Logarithm of the n-octanol-water partition coefficient (log K_{ow}) data.
- Water solubility data.

Assign a bioaccumulation potential factor value to each hazardous substance from Table 4-15.

If BCF data are available for any aquatic human food chain organism for the substance being evaluated, assign the bioaccumulation potential factor value to the hazardous substance as follows:

- If BCF data are available for both fresh water and salt water for the hazardous substance, use the BCF data that correspond to the type of water body (that is, fresh water or salt water) in which the fisheries are located to assign the bioaccumulation potential factor value to the hazardous substance.
- If, however, some of the fisheries being evaluated are in fresh water and some are in salt water, or if any are in brackish water, use the BCF data that yield the higher factor value to assign the bioaccumulation potential factor value to the hazardous substance.
- If BCF data are available for either fresh water or salt water, but not for both, use the available BCF data to assign the bioaccumulation potential factor value to the hazardous substance.

If BCF data are not available for the hazardous substance, use log K_{ow} data to assign a bioaccumulation potential factor value to organic substances, but not to inorganic substances. If BCF data are not available, and if either log K_{ow} data are not available, the log K_{ow} is available but exceeds 6.0, or the substance is an inorganic substance, use water solubility data to assign a bioaccumulation potential factor value.

TABLE 4-15.—BIOACCUMULATION POTENTIAL FACTOR VALUES [a]

If bioconcentration factor (BCF) data are available for any aquatic human food chain organism, assign a value as follows: [b]

BCF	Assigned value
Greater than or equal to 10,000	50,000
1,000 to less than 10,000	5,000
100 to less than 1,000	500
10 to less than 100	50
1 to less than 10	5
Less than 1	0.5

If BCF data are not available, and log K_{ow} data are available and do not exceed 6.0, assign a value to an organic hazardous substance as follows (for inorganic hazardous substances, skip this step and proceed to the next):

Log K_{ow}	Assigned value
5.5 to 6.0	50,000
4.5 to less than 5.5	5,000
3.2 to less than 4.5	500
2.0 to less than 3.2	50
0.8 to less than 2.0	5
Less than 0.8	0.5

If BCF data are not available, and if either Log K_{ow} data are not available, a log K_{ow} is available but exceeds 6.0, or the substance is an inorganic substance, assign a value as follows:

TABLE 4-15.—BIOACCUMULATION POTENTIAL FACTOR VALUES [a]—Concluded

Water solubility (mg/l)	Assigned value
Less than 25	50,000
25 to 500	5,000
Greater than 500 to 1,500	500
Greater than 1,500	0.5

If none of these data are available, assign a value of 0.5.

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[a] Do not round to nearest integer.

[b] See text for use of freshwater and saltwater BCF data.

Do not distinguish between fresh water and salt water in assigning the bioaccumulation potential factor value based on log K_{ow} or water solubility data.

If none of these data are available, assign the hazardous substance a bioaccumulation potential factor value of 0.5.

4.1.3.2.1.4 *Calculation of toxicity/persistence/bioaccumulation factor value.* Assign each hazardous substance a toxicity/persistence factor value from Table 4-12, based on the values assigned to the hazardous substance for the toxicity and persistence factors. Then assign each hazardous substance a toxicity/persistence/bioaccumulation factor value from Table 4-16, based on the values assigned for the toxicity/persistence and bioaccumulation potential factors. Use the hazardous substance with the highest toxicity/persistence/bioaccumulation factor value for the watershed to assign the value to this factor. Enter this value in Table 4-1.

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TABLE 4-16
TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES[a]

Toxicity/ Persistence Factor Value	Bioaccumulation Potential Factor Value					
	50,000	5,000	500	50	5	0.5
10,000	5×10^8	5×10^7	5×10^6	5×10^5	5×10^4	5,000
4,000	2×10^8	2×10^7	2×10^6	2×10^5	2×10^4	2,000
1,000	5×10^7	5×10^6	5×10^5	5×10^4	5,000	500
700	3.5×10^7	3.5×10^6	3.5×10^5	3.5×10^4	3,500	350
400	2×10^7	2×10^6	2×10^5	2×10^4	2,000	200
100	5×10^6	5×10^5	5×10^4	5,000	500	50
70	3.5×10^6	3.5×10^5	3.5×10^4	3,500	350	35
40	2×10^6	2×10^5	2×10^4	2,000	200	20
10	5×10^5	5×10^4	5,000	500	50	5
7	3.5×10^5	3.5×10^4	3,500	350	35	3.5
4	2×10^5	2×10^4	2,000	200	20	2
1	5×10^4	5,000	500	50	5	0.5
0.7	3.5×10^4	3,500	350	35	3.5	0.35
0.4	2×10^4	2,000	200	20	2	0.2
0.07	3,500	350	35	3.5	0.35	0.035
0.007	350	35	3.5	0.35	0.035	0.0035
0.0007	35	3.5	0.35	0.035	0.0035	0.00035
0	0	0	0	0	0	0

[a] Do not round to nearest integer.

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4.1.3.2.2 *Hazardous waste quantity.* Assign the same factor value for hazardous waste quantity for the watershed as would be assigned in section 4.1.2.2.2 for the drinking water threat. Enter this value in Table 4–1.

4.1.3.2.3 *Calculation of human food chain threat-waste characteristics factor category value.* For the hazardous substance selected for the watershed in section 4.1.3.2.1.4, use its toxicity/persistence factor value and bioaccumulation potential factor value as follows to assign a value to the waste characteristics factor category. First, multiply the toxicity/persistence factor value and the hazardous waste quantity factor value for the watershed, subject to a maximum product of 1×10^{8}. Then multiply this product by the bioaccumulation potential factor value for this hazardous substance, subject to a maximum product of 1×10^{12}. Based on this second product, assign a value from Table 2–7 (section 2.4.3.1) to the human food chain threat-waste characteristics factor category for the watershed. Enter this value in Table 4–1.

4.1.3.3 *Human food chain threat-targets.* Evaluate two target factors for each watershed: food chain individual and population. For both factors, determine whether the target fisheries are subject to actual or potential human food chain contamination.

Consider a fishery (or portion of a fishery) within the target distance limit of the watershed to be subject to actual human food chain contamination if any of the following apply:

- A hazardous substance having a bioaccumulation potential factor value of 500 or greater is present either in an observed release by direct observation to the watershed or in a surface water or sediment sample from the watershed at a level that meets the criteria for an observed release to the watershed from the site, and at least a portion of the fishery is within the boundaries of the observed release (that is, it is located either at the point of direct observation or at or between the probable point of entry and the most distant sampling point establishing the observed release).
- The fishery is closed, and a hazardous substance for which the fishery has been closed has been documented in an observed release to the watershed from the site, and at least a portion of the fishery is within the boundaries of the observed release.
- A hazardous substance is present in a tissue sample from an essentially sessile, benthic, human food chain organism from the watershed at a level that meets the criteria for an observed release to the watershed from the site, and at least a portion of the fishery is within the boundaries of the observed release.

For a fishery that meets any of these three criteria, but that is not wholly within the boundaries of the observed release, consider only the portion of the fishery that is within the boundaries of the observed release to be subject to actual human food chain contamination. Consider the remainder of the fishery within the target distance limit to be subject to potential food chain contamination.

In addition, consider all other fisheries that are partially or wholly within the target distance limit for the watershed, including fisheries partially or wholly within the boundaries of an observed release for the watershed that do not meet any of the three criteria listed above, to be subject to potential human food chain contamination. If only a portion of the fishery is within the target distance limit for the watershed, include only that portion in evaluating the targets factor category.

When a fishery (or portion of a fishery) is subject to actual food chain contamination, determine the part of the fishery subject to Level I concentrations and the part subject to Level II concentrations. If the actual food chain contamination is based on direct observation, evaluate it using Level II concentrations. However, if the actual food chain contamination is based on samples from the watershed, use these samples and, if *available, additional tissue samples from* aquatic human food chain organisms as specified below, to determine the part subject to Level I concentrations and the part subject to Level II concentrations:

- Determine the level of actual contamination from samples (including tissue samples from essentially sessile, benthic organisms) that meet the criteria for actual food chain contamination by comparing the exposure concentrations (see section 4.1.2.3) from these samples (or comparable samples) to the health-based benchmarks from Table 4–17, as described in section 2.5.1 and 2.5.2. Use only the exposure concentrations for those hazardous substances in the sample (or comparable samples) that meet the criteria for actual contamination of the fishery.
- In addition, determine the level of actual contamination from other tissue samples by comparing the concentrations of hazardous substances in the tissue samples (or comparable tissue samples) to the health-based benchmarks from Table 4–17, as described in sections 2.5.1 and 2.5.2. Use only those additional tissue samples and only those hazardous substances in the tissue samples that meet all the following criteria:
  - –The tissue sample is from a location that is within the boundaries of the actual food chain contamination for the site (that is, either at the point of direct observation or at or between the probable point of entry and the most distant sample point meeting the criteria for actual food chain contamination).
  - –The tissue sample is from a species of aquatic human food chain organism that spends extended periods of time within the boundaries of the actual food chain contamination for the site and that is not an essentially sessile, benthic organism.
  - –The hazardous substance is a substance that is also present in a surface water, benthic, or sediment sample from within the target distance limit for the watershed and, for such a sample, meets the criteria for actual food chain contamination.

TABLE 4–17.—HEALTH-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN HUMAN FOOD CHAIN

- Concentration corresponding to Food and Drug Administration Action Level (FDAAL) for fish or shellfish.
- Screening concentration for cancer corresponding to that concentration that corresponds to the 10^{-6} individual cancer risk for oral exposures.
- Screening concentration for noncancer toxicological responses corresponding to the Reference Dose (RfD) for oral exposures.

4.1.3.3.1 *Food chain individual.* Evaluate the food chain individual factor based on the fisheries (or portions of fisheries) within the target distance limit for the watershed. Assign this factor a value as follows:

- *If any fishery (or portion of a fishery) is* subject to Level I concentrations, assign a value of 50.
- If not, but if any fishery (or portion of a fishery) is subject to Level II concentrations, assign a value of 45.
- If not, but if there is an observed release of a hazardous substance having a bioaccumulation potential factor value of 500 or greater to surface water in the watershed and there is a fishery (or portion of a fishery) present anywhere within the target distance limit, assign a value of 20.
- If there is no observed release to surface water in the watershed or there is no observed release of a hazardous substance having a bioaccumulation potential factor value of 500 or greater, but there is a fishery (or portion of a fishery) present anywhere within the target distance limit, assign a value as follows:
  - –Using Table 4–13, determine the highest dilution weight (that is, lowest amount of dilution) applicable to the fisheries (or portions of fisheries) within the target distance limit. Multiply this dilution weight by 20 and round to the nearest integer.
  - –Assign this calculated value as the factor value.
- If there are no fisheries (or portions of fisheries) within the target distance limit of the watershed, assign a value of 0.

Enter the value assigned in Table 4–1.

4.1.3.3.2 *Population.* Evaluate the population factor for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential human food chain contamination. Determine which factor applies for a fishery (or portion of a fishery) as specified in section 4.1.3.3.

4.1.3.3.2.1 *Level I concentrations.* Determine those fisheries (or portions of fisheries) within the watershed that are subject to Level I concentrations.

Estimate the human food chain population value for each fishery (or portion of a fishery) as follows:

- Estimate human food chain production for the fishery based on the estimated annual production (in pounds) of human food chain organisms (for example, fish, shellfish) for that fishery, except: if the fishery is closed and a hazardous substance for which the fishery has been closed has been documented in an observed release to the fishery from a source at the site, use the estimated annual production for the period prior to closure of the fishery or use the estimated annual production from comparable fisheries that are not closed.

- Assign the fishery a value for human food chain population from Table 4–18, based on the estimated human food production for the fishery.
- Set boundaries between fisheries at those points where human food chain production changes or where the surface water dilution weight changes.

Sum the human food chain population value for each fishery (and portion of a fishery). Multiply this sum by 10. If the product is less than 1, do not round it to the nearest integer; if 1 or more, round to the nearest integer. Assign the resulting value as the Level I concentrations factor value. Enter this value in Table 4–1.

4.1.3.3.2.2 *Level II concentrations.* Determine those fisheries (or portions of fisheries) within the watershed that are subject to Level II concentrations. Do not include any fisheries (or portions of fisheries) already counted under the Level I concentrations factor.

Assign each fishery (or portion of a fishery) a value for human food chain population from Table 4–18, based on the estimated human food production for the fishery. Estimate the human food chain production for the fishery as specified in section 4.1.3.3.2.1.

Sum the human food chain population value for each fishery (and portion of a fishery). If this sum is less than 1, do not round it to the nearest integer; if 1 or more, round to the nearest integer. Assign the resulting value as the Level II concentrations factor value. Enter this value in Table 4–1.

TABLE 4–18.—HUMAN FOOD CHAIN POPULATION VALUES [a]

Human food chain production (pounds per year)	Assigned human food chain population value
0	0
Greater than 0 to 100	0.03
Greater than 100 to 1,000	0.3
Greater than 1,000 to 10,000	3
Greater than 10,000 to 100,000	31
Greater than 100,000 to 1,000,000	310
Greater than 10^6 to 10^7	3,100
Greater than 10^7 to 10^8	31,000
Greater than 10^8 to 10^9	310,000
Greater than 10^9	3,100,000

[a] Do not round to nearest integer.

4.1.3.3.2.3 *Potential human food chain contamination.* Determine those fisheries (or portions of fisheries) within the watershed that are subject to potential human food chain contamination. Do not include those fisheries (or portion of fisheries) already counted under the Level I or Level II concentrations factors.

Calculate the value for the potential human food chain contamination factor (PF) for the watershed as follows:

$$PF = \frac{1}{10} \sum_{i=1}^{n} P_i D_i$$

where:

P_i = Human food chain population value for fishery i.

D_i = Dilution weight from Table 4–13 for fishery i.

n = Number of fisheries subject to potential human food chain contamination.

In calculating PF:

- Estimate the human food chain population value (P_i) for a fishery (or portion of a fishery) as specified in section 4.1.3.3.2.1.
- Assign the fishery (or portion of a fishery) a dilution weight as indicated in Table 4–13 (section 4.1.2.3.1), except: do not assign a dilution weight of 0.5 for a "3-mile mixing zone in quiet flowing river"; instead assign a dilution weight based on the average annual flow.

If PF is less than 1, do not round it to the nearest integer; if PF is 1 or more, round to the nearest integer. Enter the value assigned in Table 4–1.

4.1.3.3.2.4 *Calculation of population factor value.* Sum the values for the Level I concentrations, Level II concentrations, and potential human food chain contamination factors for the watershed. Do not round this sum to the nearest integer. Assign it as the population factor value for the watershed. Enter this value in Table 4–1.

4.1.3.3.3 *Calculation of human food chain threat-targets factor category value.* Sum the food chain individual and population factor values for the watershed. Do not round this sum to the nearest integer. Assign it as the human food chain threat-targets factor category value for the watershed. Enter this value in Table 4–1.

4.1.3.4 *Calculation of human food chain threat score for a watershed.* Multiply the human food chain threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 100, as the human food chain threat score for the watershed. Enter this score in Table 4–1.

4.1.4 *Environmental threat.* Evaluate the environmental threat for the watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.1.4.1 *Environmental threat-likelihood of release.* Assign the same likelihood of release factor category value for the environmental threat for the watershed as would be assigned in section 4.1.2.1.3 for the drinking water threat. Enter this value in Table 4–1.

4.1.4.2 *Environmental threat-waste characteristics.* Evaluate the waste characteristics factor category for each watershed based on two factors: ecosystem toxicity/persistence/bioaccumulation and hazardous waste quantity.

4.1.4.2.1 *Ecosystem toxicity/persistence/bioaccumulation.* Evaluate all those hazardous substances eligible to be evaluated for toxicity/persistence in the drinking water threat for the watershed (see section 4.1.2.2).

4.1.4.2.1.1 *Ecosystem toxicity.* Assign an ecosystem toxicity factor value from Table 4–19 to each hazardous substance on the basis of the following data hierarchy:

- EPA chronic Ambient Water Quality Criterion (AWQC) for the substance.
- EPA chronic Ambient Aquatic Life Advisory Concentrations (AALAC) for the substance.
- EPA acute AWQC for the substance.
- EPA acute AALAC for the substance.
- Lowest LC_{50} value for the substance.

In assigning the ecosystem toxicity factor value to the hazardous substance:

- If either an EPA chronic AWQC or AALAC is available for the hazardous substance, use it to assign the ecosystem toxicity factor value. Use the chronic AWQC in preference to the chronic AALAC when both are available.
- If neither is available, use the EPA acute AWQC or AALAC to assign the ecosystem toxicity factor value. Use the acute AWQC in preference to the acute AALAC.
- If none of the chronic and acute AWQCs and AALACs is available, use the lowest LC_{50} value to assign the ecosystem toxicity factor value.
- If an LC_{50} value is also not available, assign an ecosystem toxicity factor value of 0 to the hazardous substance and use other hazardous substances for which data are available in evaluating the pathway.

If an ecosystem toxicity factor value of 0 is assigned to all hazardous substances eligible to be evaluated for the watershed (that is, insufficient data are available for evaluating all the substances), use a default value of 100 as the ecosystem toxicity factor value for all these hazardous substances.

With regard to the AWQC, AALAC, or LC_{50} selected for assigning the ecosystem toxicity factor value to the hazardous substance:

- If values for the selected AWQC, AALAC, or LC_{50} are available for both fresh water and marine water for the hazardous substance, use the value that corresponds to the type of water body (that is, fresh water or salt water) in which the sensitive environments are located to assign the ecosystem toxicity factor value to the hazardous substance.
- If, however, some of the sensitive environments being evaluated are in fresh water and some are in salt water, or if any are in brackish water, use the value (fresh water or marine) that yields the higher factor value to assign the ecosystem toxicity factor value to the hazardous substance.
- If a value for the selected AWQC, AALAC, or LC_{50} is available for either fresh water or marine water, but not for both, use the available one to assign an ecosystem toxicity factor value to the hazardous substance.

TABLE 4-19.—ECOSYSTEM TOXICITY FACTOR VALUES

If an EPA chronic AWQC[a] or AALAC[b] is available, assign a value as follows:[c]

EPA chronic AWQC or AALAC	Assigned value
Less than 1 $\mu g/l$	10,000
1 to 10 $\mu g/l$	1,000
Greater than 10 to 100 $\mu g/l$	100
Greater than 100 to 1,000 $\mu g/l$	10
Greater than 1,000 $\mu g/l$	1

If neither an EPA chronic AWQC nor EPA chronic AALAC is available, assign a value based on the EPA acute AWQC or AALAC as follows:[c]

EPA acute AWQC or AALAC	Assigned value
Less than 100 $\mu g/l$	10,000
100 to 1,000 $\mu g/l$	1,000
Greater than 1,000 to 10,000 $\mu g/l$	100
Greater than 10,000 to 100,000 $\mu g/l$	10
Greater than 100,000 $\mu g/l$	1

TABLE 4-19. ECOSYSTEM TOXICITY FACTOR VALUES—Concluded

If neither an EPA chronic or acute AWQC nor EPA chronic or acute AALAC is available, assign a value from the LC_{50} as follows:

EPA acute AWQC or AALAC

LC_{50}	Assigned value
Less than 100 $\mu g/l$	10,000
100 to 1,000 $\mu g/l$	1,000
Greater than 1,000 to 10,000 $\mu g/l$	100
Greater than 10,000 to 100,000 $\mu g/l$	10
Greater than 100,000 $\mu g/l$	1

If none of the AWQCs and AALACs nor the LC_{50} is available, assign a value of 0.

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[a] AWQC—Ambient Water Quality Criteria.

[b] AALAC—Ambient Aquatic Life Advisory Concentrations.

[c] Use the AWQC value in preference to the AALAC when both are available. See text for use of freshwater and marine values.

4.1.4.2.1.2 *Persistence.* Assign a persistence factor value to each hazardous substance as specified in section 4.1.2.2.1.2, except: use the predominant water category (that is lakes; or rivers, oceans, coastal tidal waters, or Great Lakes) between the probable point of entry and the nearest sensitive environment (not the nearest drinking water or resources intake) along the hazardous substance migration path for the watershed to determine which portion of Table 4-10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.2.1.2. For contaminated sediments with no identified source, use the point where measurement begins rather than the probable point of entry.

4.1.4.2.1.3 *Ecosystem bioaccumulation potential.* Assign an ecosystem bioaccumulation potential factor value to each hazardous substance in the same manner specified for the bioaccumulation potential factor in section 4.1.3.2.1.3, except:

- Use BCF data for all aquatic organisms, not just for aquatic human food chain organisms.
- Use the BCF data that corresponds to the type of water body (that is, fresh water or salt water) in which the sensitive environments (not fisheries) are located.

4.1.4.2.1.4 *Calculation of ecosystem toxicity/persistence/bioaccumulation factor value.* Assign each hazardous substance an ecosystem toxicity/persistence factor value from Table 4-20, based on the values assigned to the hazardous substance for the ecosystem toxicity and persistence factors. Then assign each hazardous substance an ecosystem toxicity/persistence/bioaccumulation factor value from Table 4-21, based on the values assigned for the ecosystem toxicity/persistence and ecosystem bioaccumulation potential factors. Select the hazardous substance with the highest ecosystem toxicity/persistence/bioaccumulation factor value for the watershed and use it to assign the value to this factor. Enter this value in Table 4-1.

TABLE 4-20.—ECOSYSTEM TOXICITY/PERSISTENCE FACTOR VALUES[a]

Persistence factor value	Ecosystem toxicity factor value					
	10,000	1,000	100	10	1	0
1.0	10,000	1,000	100	10	1	0
0.4	4,000	400	40	4	0.4	0
0.07	700	70	7	0.7	0.07	0
0.0007	7	0.7	0.07	0.007	0.0007	0

[a] Do not round to nearest integer.

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TABLE 4-21
ECOSYSTEM TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES[a]

Ecosystem Toxicity/ Persistence Factor Value	Ecosystem Bioaccumulation Potential Factor Value					
	50,000	5,000	500	50	5	0.5
10,000	5×10^8	5×10^7	5×10^6	5×10^5	5×10^4	5,000
4,000	2×10^8	2×10^7	2×10^6	2×10^5	2×10^4	2,000
1,000	5×10^7	5×10^6	5×10^5	5×10^4	5,000	500
700	3.5×10^7	3.5×10^6	3.5×10^5	3.5×10^4	3,500	350
400	2×10^7	2×10^6	2×10^5	2×10^4	2,000	200
100	5×10^6	5×10^5	5×10^4	5,000	500	50
70	3.5×10^6	3.5×10^5	3.5×10^4	3,500	350	35
40	2×10^6	2×10^5	2×10^4	2,000	200	20
10	5×10^5	5×10^4	5,000	500	50	5
7	3.5×10^5	3.5×10^4	3,500	350	35	3.5
4	2×10^5	2×10^4	2,000	200	20	2
1	5×10^4	5,000	500	50	5	0.5
0.7	3.5×10^4	3,500	350	35	3.5	0.35
0.4	2×10^4	2,000	200	20	2	0.2
0.07	3,500	350	35	3.5	0.35	0.035
0.007	350	35	3.5	0.35	0.035	0.0035
0.0007	35	3.5	0.35	0.035	0.0035	0.00035
0	0	0	0	0	0	0

[a] Do not round to nearest integer.

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4.1.4.2.2 *Hazardous waste quantity.* Assign the same factor value for hazardous waste quantity for the watershed as would be assigned in section 4.1.2.2.2 for the drinking water threat. Enter this value in Table 4-1.

4.1.4.2.3 *Calculation of environmental threat-waste characteristics factor category value.* For the hazardous substance selected for the watershed in section 4.1.4.2.1.4, use its ecosystem toxicity/persistence factor value and ecosystem bioaccumulation potential factor value as follows to assign a value to the waste characteristics factor category. First, multiply the ecosystem toxicity/persistence factor value and the hazardous waste quantity factor value for the watershed, subject to a maximum product of 1×10^8. Then multiply this product by the ecosystem bioaccumulation potential factor value for this hazardous substance, subject to a maximum product of 1×10^{12}. Based on this second product, assign a value from Table 2-7 (section 2.4.3.1) to the environmental threat-waste characteristics factor category for the watershed. Enter this value in Table 4-1.

TABLE 4-22.—ECOLOGICAL-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN SURFACE WATER

- Concentration corresponding to EPA Ambient Water Quality Criteria (AWQC) for protection of aquatic life (fresh water or marine).
- Concentration corresponding to EPA Ambient Aquatic Life Advisory Concentrations (AALAC).
- Select the appropriate AWQC and AALAC as follows:
  - –Use chronic value, if available; otherwise use acute value.
  - –If the sensitive environment being evaluated is in fresh water, use fresh water value, except: if no fresh water value is available, use marine value if available.
  - –If the sensitive environment being evaluated is in salt water, use marine value, except: if no marine value is available, use fresh water value if available.
  - –If the sensitive environment being evaluated is in both fresh water and salt water, or is in brackish water, use lower of fresh water or marine values.

TABLE 4-23.—SENSITIVE ENVIRONMENTS RATING VALUES

Sensitive environment	Assigned value
Critical habitat [a] for Federal designated endangered or threatened species	100
Marine Sanctuary	
National Park	
Designated Federal Wilderness Area	
Areas identified under Coastal Zone Management Act [b]	
Sensitive areas identified under National Estuary Program [c] or Near Coastal Waters Program [d]	
Critical areas identified under the Clean Lakes Program [e]	
National Monument [f]	
National Seashore Recreational Area	
National Lakeshore Recreational Area	
Habitat known to be used by Federal designated or proposed endangered or threatened species	75
National Preserve	
National or State Wildlife Refuge	
Unit of Coastal Barrier Resources System	
Coastal Barrier (undeveloped)	
Federal land designated for protection of natural ecosystems	
Administratively Proposed Federal Wilderness Area	
Spawning areas critical [g] for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters	
Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which the fish spend extended periods of time	
Terrestrial areas utilized for breeding by large or dense aggregations of animals [h]	
National river reach designated as Recreational	
Habitat known to be used by State designated endangered or threatened species	50
Habitat known to be used by species under review as to its Federal endangered or threatened status	
Coastal Barrier (partially developed)	
Federal designated Scenic or Wild River	
State land designated for wildlife or game management	25
State designated Scenic or Wild River	
State designated Natural Areas	
Particular areas, relatively small in size, important to maintenance of unique biotic communities	
State designated areas for protection or maintenance of aquatic life [i]	5

[a] Critical habitat as defined in 50 CFR 424.02.

[b] Areas identified in State Coastal Zone Management plans as requiring protection because of ecological value.

[c] National Estuary Program study areas (subareas within estuaries) identified in Comprehensive Conservation and Management Plans as requiring protection because they support critical life stages of key estuarine species (Section 320 of Clean Water Act, as amended).

[d] Near Coastal Waters as defined in Sections 104(b)(3), 304(1), 319, and 320 of Clean Water Act, as amended.

[e] Clean Lakes Program critical areas (subareas within lakes, or in some cases entire small lakes) identified by State Clean Lake Plans as critical habitat (Section 314 of Clean Water Act, as amended).

[f] Use only for air migration pathway.

[g] Limit to areas described as being used for intense or concentrated spawning by a given species.

[h] For the air migration pathway, limit to terrestrial vertebrate species. For the surface water migration pathway, limit to terrestrial vertebrate species with aquatic or semiaquatic foraging habits.

[i] Areas designated under Section 305(a) of Clean Water Act, as amended.

TABLE 4-24.—WETLANDS RATING VALUES FOR SURFACE WATER MIGRATION PATHWAY

Total length of wetlands [a] (miles)	Assigned value
Less than 0.1	0
0.1 to 1	25
Greater than 1 to 2	50
Greater than 2 to 3	75
Greater than 3 to 4	100
Greater than 4 to 8	150
Greater than 8 to 12	250
Greater than 12 to 16	350
Greater than 16 to 20	450
Greater than 20	500

[a] Wetlands as defined in 40 CFR Section 230.3.

4.1.4.3 *Environmental threat-targets.* Evaluate the environmental threat-targets factor category for a watershed using one factor: sensitive environments.

4.1.4.3.1 *Sensitive environments.* Evaluate sensitive environments along the hazardous substance migration path for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential contamination.

Determine which factor applies to each sensitive environment as specified in section 4.1.2.3, except: use ecological-based benchmarks (Table 4-22) rather than health-based benchmarks (Table 3-10) in determining the level of contamination from samples. In determining the level of actual contamination, use a point of direct observation anywhere within the sensitive environment or samples (that is, surface water, benthic, or sediment samples) taken anywhere within or beyond the sensitive environment (or anywhere adjacent to or beyond the sensitive environment if it is contiguous to the migration path).

4.1.4.3.1.1 *Level I concentrations.* Assign value(s) from Table 4-23 to each sensitive environment subject to Level I concentrations.

For those sensitive environments that are wetlands, assign an additional value from Table 4-24. In assigning a value from Table 4-24, include only those portions of wetlands located along the hazardous substance migration path in the area of Level I concentrations. If a wetland is located partially along the area of Level I concentrations and partially along the area of Level II concentrations and/or potential contamination, then solely for purposes of Table 4-24, count the portion(s) along the areas of Level II concentrations or potential contamination under the Level II concentrations factor (section 4.1.4.3.1.2) or potential contamination factor (section 4.1.4.3.1.3), as appropriate.

Estimate the total length of wetlands along the hazardous substance migration path (that is, wetland frontage) in the area of Level I concentrations and assign a value from Table 4-24 based on this total length. Estimate this length as follows:

- For an isolated wetland or for a wetland where the probable point of entry to surface water is in the wetland, use the perimeter of that portion of the wetland subject to Level I concentrations as the length.
- For rivers, use the length of the wetlands contiguous to the in-water segment of the hazardous substance migration path (that is, wetland frontage).
- For lakes, oceans, coastal tidal waters, and Great Lakes, use the length of the wetlands along the shoreline within the target distance limit (that is, wetland frontage along the shoreline).

Calculate the Level I concentrations factor value (SH) for the watershed as follows:

$$SH=10(WH+\sum_{i=1}^{n} S_i)$$

where:

WH=Value assigned from Table 4-24 to wetlands along the area of Level I concentrations.

S_i=Value(s) assigned from Table 4-23 to sensitive environment i.

n=Number of sensitive environments from Table 4-23 subject to Level I concentrations.

Enter the value assigned in Table 4-1.

4.1.4.3.1.2 *Level II concentrations.* Assign value(s) from Table 4-23 to each sensitive environment subject to Level II concentrations. Do not include sensitive environments already counted for Table 4-23 under the Level I concentrations factor for this watershed.

For those sensitive environments that are wetlands, assign an additional value from Table 4-24. In assigning a value from Table 4-24, include only those portions of wetlands located along the hazardous substance migration path in the area of Level II concentrations, as specified in section 4.1.4.3.1.1.

Estimate the total length of wetlands along the hazardous substance migration path (that is, wetland frontage) in the area of Level II concentrations and assign a value from Table 4-24 based on this total length. Estimate this length as specified in section 4.1.4.3.1.1, except: for an isolated wetland or for a wetland where the probable point of entry to surface water is in the wetland, use the perimeter of that portion of the wetland subject to Level II (not Level I) concentrations as the length.

Calculate the Level II concentrations value (SL) for the watershed as follows:

$$SL=WL+\sum_{i=1}^{n} S_i$$

where:

WL=Value assigned from Table 4-24 to wetlands along the area of Level II concentrations.

S_i=Value(s) assigned from Table 4-23 to sensitive environment i.

n=Number of sensitive environments from Table 4-23 subject to Level II concentrations.

Enter the value assigned in Table 4-1.

4.1.4.3.1.3 *Potential contamination.* Assign value(s) from Table 4-23 to each sensitive environment subject to potential contamination. Do not include sensitive environments already counted for Table 4-23 under the Level I or Level II concentrations factors.

For each type of surface water body in Table 4-13 (section 4.1.2.3.1), sum the value(s) assigned from Table 4-23 to the sensitive environments along that type of surface water body, except: do not use the surface water body type "3-mile mixing zone in quiet flowing river." If a sensitive environment is along two or more types of surface water bodies (for example, Wildlife Refuge contiguous to both a moderate stream and a large river), assign the sensitive environment only to that surface water body type having the highest dilution weight value from Table 4-13.

For those sensitive environments that are wetlands, assign an additional value from Table 4-24. In assigning a value from Table 4-24, include only those portions of wetlands located along the hazardous substance migration path in the area of potential contamination, as specified in section 4.1.4.3.1.1. Aggregate these wetlands by type of surface water body, except: do not use the surface water body type "3-mile mixing zone in quiet flowing river." Treat the wetlands aggregated within each type of surface water body as separate sensitive environments solely for purposes of applying Table 4-24. Estimate the total length of the wetlands within each surface water body type as specified in section 4.1.4.3.1.1, except: for an isolated wetland or for a wetland where the probable point of entry to surface water is in the wetland, use the perimeter of that portion of the wetland subject to potential contamination (or the portion of that perimeter that is within the target distance limit) as the length. Assign a separate value from Table 4-24 for each type of surface water body in the watershed.

Calculate the potential contamination factor value (SP) for the watershed as follows:

$$SP=\frac{1}{10}\sum_{j=1}^{m}([W_j+S_j]D_j)$$

where:

$$S_j=\sum_{i=1}^{n} S_{ij}$$

S_{ij}=Value(s) assigned from Table 4-23 to sensitive environment i in surface water body type j.

n=Number of sensitive environments from Table 4-23 subject to potential contamination.

W_j=Value assigned from Table 4-24 for wetlands along the area of potential contamination in surface water body type j.

D_j=Dilution weight from Table 4-13 for surface water body type j.

m=Number of different surface water body types from Table 4-13 in the watershed.

If SP is less than 1, do not round it to the nearest integer; if SP is 1 or more, round to the nearest integer. Enter this value for the potential contamination factor in Table 4-1.

4.1.4.3.1.4 *Calculation of environmental threat-targets factor category value.* Sum the values for the Level I concentrations, Level II concentrations, and potential contamination factors for the watershed. Do not round this sum to the nearest integer. Assign this sum as the environmental threat-targets factor category value for the watershed. Enter this value in Table 4–1.

4.1.4.4 *Calculation of environmental threat score for a watershed.* Multiply the environmental threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 60, as the environmental threat score for the watershed. Enter this score in Table 4–1.

4.1.5 *Calculation of overland/flood migration component score for a watershed.* Sum the scores for the three threats for the watershed (that is, drinking water, human food chain, and environmental threats). Assign the resulting score, subject to a maximum value of 100, as the surface water overland/flood migration component score for the watershed. Enter this score in Table 4–1.

4.1.6 *Calculation of overland/flood migration component score.* Select the highest surface water overland/flood migration component score from the watersheds evaluated. Assign this score as the surface water overland/flood migration component score for the site, subject to a maximum score of 100. Enter this score in Table 4–1.

4.2 *Ground water to surface water migration component.* Use the ground water to surface water migration component to evaluate surface water threats that result from migration of hazardous substances from a source at the site to surface water via ground water. Evaluate three types of threats for this component: drinking water threat, human food chain threat, and environmental threat.

4.2.1 *General considerations.*

4.2.1.1 *Eligible surface waters.* Calculate ground water to surface water migration component scores only for surface waters (see section 4.0.2) for which all the following conditions are met:

- A portion of the surface water is within 1 mile of one or more sources at the site having a containment factor value greater than 0 (see section 4.2.2.1.2).
- No aquifer discontinuity is established between the source and the portion of the surface water within 1 mile of the source (see section 3.0.1.2.2). However, if hazardous substances have migrated across an apparent discontinuity within this 1 mile distance, do not consider a discontinuity present in scoring the site.
- The top of the uppermost aquifer is at or above the bottom of the surface water.

Do not evaluate this component for sites consisting solely of contaminated sediments with no identified source.

4.2.1.2 *Definition of hazardous substance migration path for ground water to surface water migration component.* The hazardous substance migration path includes both the ground water segment and the surface water in-water segment that hazardous substances would take as they migrate away from sources at the site:

- Restrict the ground water segment to migration via the uppermost aquifer between a source and the surface water.
- Begin the surface water in-water segment at the probable point of entry from the uppermost aquifer to the surface water. Identify the probable point of entry as that point of the surface water that yields the shortest straight-line distance, within the aquifer boundary (see section 3.0.1.2), from the sources at the site with a containment factor value greater than 0 to the surface water.
  - –For rivers, continue the in-water segment in the direction of flow (including any tidal flows) for the distance established by the target distance limit (see section 4.2.1.4).
  - –For lakes, oceans, coastal tidal waters, or Great Lakes, do not consider flow direction. Instead apply the target distance limit as an arc.
  - –If the in-water segment includes both rivers and lakes (or oceans, coastal tidal waters, or Great Lakes), apply the target distance limit to their combined in-water segments.

Consider a site to be in two or more watersheds for this component if two or more hazardous substance migration paths from the sources at the site do not reach a common point within the target distance limit. If the site is in more than one watershed, define a separate hazardous substance migration path for each watershed. Evaluate the ground water to surface water migration component for each watershed separately as specified in section 4.2.1.5.

4.2.1.3 *Observed release of a specific hazardous substance to surface water in-water segment.* Section 4.2.2.1.1 specifies the criteria for assigning values to the observed release factor for the ground water to surface water migration component. With regard to an individual hazardous substance, consider an observed release of that hazardous substance to be established for the surface water in-water segment of the ground water to surface water migration component only when the hazardous substance meets the criteria both for an observed release both to ground water (see section 4.2.2.1.1) and for an observed release by chemical analysis to surface water (see section 4.1.2.1.1).

If the hazardous substance meets the section 4.1.2.1.1 criteria for an observed release by chemical analysis to surface water but does not also meet the criteria for an observed release to ground water, do not use any samples of that hazardous substance from the surface water in-water segment in evaluating the factors of this component (for example, do not use the hazardous substance in establishing targets subject to actual contamination or in determining the level of actual contamination for a target).

4.2.1.4 *Target distance limit.* Determine the target distance limit for each watershed as specified in section 4.1.1.2, except: do not extend the target distance limit to a sample location beyond 15 miles unless at least one hazardous substance in a sample from that location meets the criteria in section 4.2.1.3 for an observed release to the surface water in-water segment.

Determine the targets eligible to be evaluated for each watershed and establish whether these targets are subject to actual or potential contamination as specified in section 4.1.1.2, except: do not establish actual contamination based on a sample location unless at least one hazardous substance in a sample from that location meets the criteria in section 4.2.1.3 for an observed release to the surface water in-water segment.

4.2.1.5 *Evaluation of ground water to surface water migration component.* Evaluate the drinking water threat, human food chain threat, and environmental threat for each watershed for this component based on three factor categories: likelihood of release, waste characteristics, and targets. Figure 4–2 indicates the factors included within each factor category for each type of threat.

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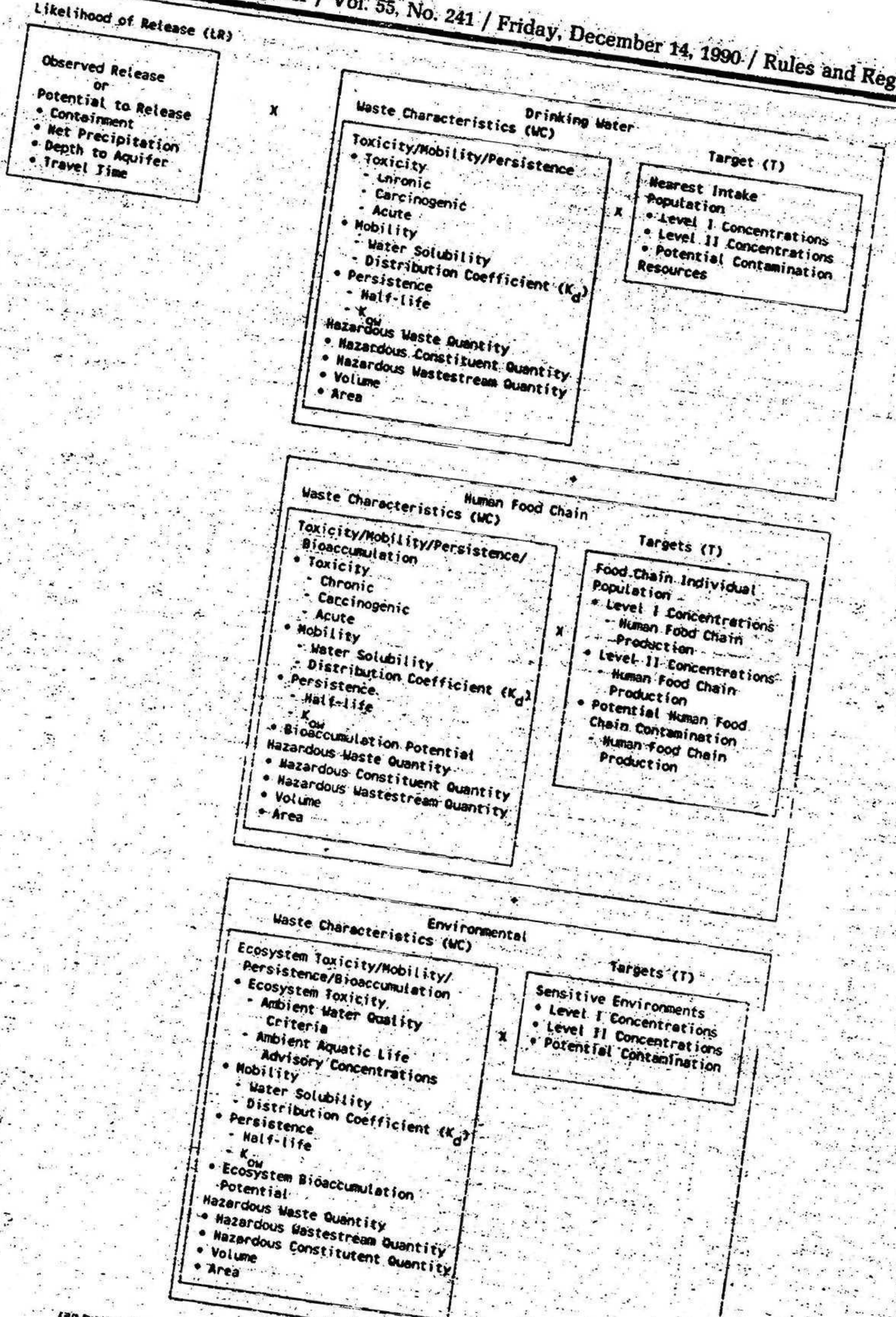

Figure 4-2
OVERVIEW OF GROUND WATER TO SURFACE WATER MIGRATION COMPONENT

Determine the ground water to surface water migration component score (S_{gs}) for a watershed in terms of the factor category values as follows:

$$S_{gs} = \frac{\sum_{i=1}^{3} (LR_i)(WC_i)(T_i)}{SF}$$

where:

LR_i=Likelihood of release factor category value for threat i (that is, drinking water, human food chain, or environmental threat).

WC_i=Waste characteristics factor category value for threat i.

T_i=Targets factor category value for threat i.

SF=Scaling factor.

Table 4–25 outlines the specific calculation procedure.

If the site is in only one watershed, assign the ground water to surface water migration component score for that watershed as the ground water to surface water migration component score for the site.

If the site is in more than one watershed:

- Calculate a separate ground water to surface water migration component score for each watershed, using likelihood of release, waste characteristics, and targets applicable to each watershed.
- Select the highest ground water to surface water migration component score from the watersheds evaluated and assign it as the ground water to surface water migration component score for the site.

TABLE 4–25.—GROUND WATER TO SURFACE WATER MIGRATION COMPONENT SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Drinking Water Threat		
Likelihood of Release to Aquifer:		
1. Observed Release	550	____
2. Potential to Release:		
2a. Containment	10	____
2b. Net Precipitation	10	____
2c. Depth to Aquifer	5	____
2d. Travel Time	35	____
2e. Potential to Release (lines 2a[2b+2c+2d])	500	____
3. Likelihood of Release (higher of lines 1 and 2e)	550	
Waste Characteristics:		
4. Toxicity/Mobility/Persistence	(a)	____
5. Hazardous Waste Quantity	(a)	____
6. Waste Characteristics	100	____
Targets:		
7. Nearest Intake	50	____
8. Population		
8a. Level I Concentrations	(b)	____
8b. Level II Concentrations	(b)	____
8c. Potential Contamination	(b)	____
8d. Population (lines 8a + 8b + 8c)		____
9. Resources	5	____
10. Targets (lines 7 + 8d + 9)	(b)	____
Drinking Water Threat Score:		
11. Drinking Water Threat Score ([lines 3 x 6 x 10]/82,500, subject to a maximum of 100)	100	____
Human Food Chain Threat		
Likelihood of Release:		
12. Likelihood of Release (same value as line 3)	550	____
Waste Characteristics:		
13. Toxicity/Mobility/Persistence/Bioaccumulation	(a)	____
14. Hazardous Waste Quantity	(a)	____
15. Waste Characteristics	1,000	____
Targets:		
16. Food Chain Individual	50	____
17. Population:		
17a. Level I Concentrations	(b)	____
17b. Level II Concentrations	(b)	____
17c. Potential Human Food Chain Contamination	(b)	____
17d. Population (lines 17a + 17b + 17c)	(b)	____
18. Targets (Lines 16 + 17d)	(b)	____
Human Food Chain Threat Score:		
19. Human Food Chain Threat Score ([lines 12 x 15 x 18]/82,500, subject to a maximum of 100)	100	____
Environmental Threat		
Likelihood of Release:		
20. Likelihood of Release (same value as line 3)	550	____
Waste Characteristics:		
21. Ecosystem Toxicity/Mobility/Persistence/Bioaccumulation	(a)	____
22. Hazardous Waste Quantity	(a)	____
23. Waste Characteristics	1,000	____
Targets:		
24. Sensitive Environments:		
24a. Level I Concentrations	(b)	____
24b. Level II Concentrations	(b)	____
24c. Potential Contamination	(b)	____
24d. Sensitive Environments (lines 24a + 24b + 24c)	(b)	____
25. Targets (value from line 24d)	(b)	____

TABLE 4–25.—GROUND WATER TO SURFACE WATER MIGRATION COMPONENT SCORESHEET—Continued

Factor categories and factors	Maximum value	Value assigned
Environmental Threat Score:		
26. Environmental Threat Score ([lines 20 x 23 x 25]/82,500, subject to a maximum of 60)	60	———
Ground Water to Surface Water Migration Component Score for a Watershed		
27. Watershed Score [c] (lines 11 + 19 + 26, subject to a maximum of 100)	100	———
28. Component Score (S_{gs}) [c] (highest score from Line 27 for all watersheds evaluated, subject to a maximum of 100)	100	———

[a] Maximum value applies to waste characteristics category.
[b] Maximum value not applicable.
[c] Do not round to nearest integer.

4.2.2 *Drinking water threat.* Evaluate the drinking water threat for each watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.2.2.1 *Drinking water threat-likelihood of release.* Evaluate the likelihood of release factor category for each watershed in terms of an observed release factor or a potential to release factor.

4.2.2.1.1 *Observed release.* Establish an observed release to the uppermost aquifer as specified in section 3.1.1. If an observed release can be established for the uppermost aquifer, assign an observed release factor value of 550 to that watershed, enter this value in Table 4–25, and proceed to section 4.2.2.1.3. If no observed release can be established, assign an observed release factor value of 0, enter this value in Table 4–25, and proceed to section 4.2.2.1.2.

4.2.2.1.2 *Potential to release.* Evaluate potential to release only if an observed release cannot be established for the uppermost aquifer. Calculate a potential to release value for the uppermost aquifer as specified in section 3.1.2 and sections 3.1.2.1 through 3.1.2.5. Assign the potential to release value for the uppermost aquifer as the potential to release factor value for the watershed. Enter this value in Table 4–25.

4.2.2.1.3 *Calculation of drinking-water threat-likelihood of release factor category value.* If an observed release is established for the uppermost aquifer, assign the observed release factor value of 550 as the likelihood of release factor category value for the watershed. Otherwise, assign the potential to release factor value as the likelihood of release factor category value for the watershed. Enter the value assigned in Table 4–25.

4.2.2.2 *Drinking water threat-waste characteristics.* Evaluate the waste characteristics factor category for each watershed based on two factors: toxicity/mobility/persistence and hazardous waste quantity. Evaluate only those hazardous substances available to migrate from the sources at the site to the uppermost aquifer (see section 3.2). Such hazardous substances include:

- Hazardous substances that meet the criteria for an observed release to ground water.
- All hazardous substances associated with a source that has a ground water containment factor value greater than 0 (see sections 2.2.2, 2.2.3, and 3.1.2.1).

4.2.2.2.1 *Toxicity/mobility/persistence.* For each hazardous substance, assign a toxicity factor value, a mobility factor value, a persistence factor value, and a combined toxicity/mobility/persistence factor value as specified in sections 4.2.2.2.1.1 through 4.2.2.2.1.4.

4.2.2.2.1.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

4.2.2.2.1.2 *Mobility.* Assign a ground water mobility factor value to each hazardous substance as specified in section 3.2.1.2.

4.2.2.2.1.3 *Persistence.* Assign a surface water persistence factor value to each hazardous substance as specified in section 4.1.2.2.1.2.

4.2.2.2.1.4 *Calculation of toxicity/mobility/persistence factor value.* First, assign each hazardous substance a toxicity/mobility factor value from Table 3–9 (section 3.2.1.3), based on the values assigned to the hazardous substance for the toxicity and mobility factors. Then assign each hazardous substance a toxicity/mobility/persistence factor value from Table 4–26, based on the values assigned for the toxicity/mobility and persistence factors. Use the substance with the highest toxicity/mobility/persistence factor value for the watershed to assign the value to this factor. Enter this value in Table 4–25.

4.2.2.2.2 *Hazardous waste quantity.* Assign the same factor value for hazardous waste quantity for the watershed as would be assigned for the uppermost aquifer in section 3.2.2. Enter this value in Table 4–25.

4.2.2.2.3 *Calculation of drinking water threat-waste characteristics factor category value.* Multiply the toxicity/mobility/persistence and hazardous waste quantity factor values for the watershed, subject to a maximum product of 1×10^{8}. Based on this product, assign a value from Table 2–7 (section 2.4.3.1) to the drinking water threat-waste characteristics factor category for the watershed. Enter this value in Table 4–25.

4.2.2.3 *Drinking water threat-targets.* Evaluate the targets factor category for each watershed based on three factors: nearest intake, population, and resources.

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TABLE 4-26
TOXICITY/MOBILITY/PERSISTENCE FACTOR VALUES[a]

Toxicity/Mobility Factor Value	Persistence Factor Value			
	1.0	0.4	0.07	0.0007
10,000	10,000	4,000	700	7
2,000	2,000	800	140	1.4
1,000	1,000	400	70	0.7
200	200	80	14	0.14
100	100	40	7	0.07
20	20	8	1.4	0.014
10	10	4	0.7	0.007
2	2	0.8	0.14	0.0014
1	1	0.4	0.07	7×10^{-4}
0.2	0.2	0.08	0.014	1.4×10^{-4}
0.1	0.1	0.04	0.007	7×10^{-5}
0.02	0.02	0.008	0.0014	1.4×10^{-5}
0.01	0.01	0.004	7×10^{-4}	7×10^{-6}
0.002	0.002	8×10^{-4}	1.4×10^{-4}	1.4×10^{-6}
0.001	0.001	4×10^{-4}	7×10^{-5}	7×10^{-7}
2×10^{-4}	2×10^{-4}	8×10^{-5}	1.4×10^{-5}	1.4×10^{-7}
1×10^{-4}	1×10^{-4}	4×10^{-5}	7×10^{-6}	7×10^{-8}
2×10^{-5}	2×10^{-5}	8×10^{-6}	1.4×10^{-6}	1.4×10^{-8}
2×10^{-6}	2×10^{-6}	8×10^{-7}	1.4×10^{-7}	1.4×10^{-9}
2×10^{-7}	2×10^{-7}	8×10^{-8}	1.4×10^{-8}	1.4×10^{-10}
2×10^{-8}	2×10^{-8}	8×10^{-9}	1.4×10^{-9}	1.4×10^{11}
2×10^{-9}	2×10^{-9}	8×10^{-10}	1.4×10^{-10}	1.4×10^{-12}
0	0	0	0	0

[a] Do not round to nearest integer.

For the nearest intake and population factors, determine whether the target surface water intakes are subject to actual or potential contamination as specified in section 4.1.1.2, subject to the restrictions specified in sections 4.2.1.3 and 4.2.1.4.

When the intake is subject to actual contamination, evaluate it using Level I concentrations or Level II concentrations. Determine which level applies for the intake by comparing the exposure concentrations from a sample (or comparable samples) to health-based benchmarks as specified in section 4.1.2.3, except use only those samples from the surface water in-water segment and only those hazardous substances in such samples that meet the conditions in sections 4.2.1.3 and 4.2.1.4.

4.2.2.3.1 *Nearest intake.* Assign a value to the nearest intake factor as specified in section 4.1.2.3.1 with the following modification. For the intake being evaluated, multiply its dilution weight from Table 4–13 (section 4.1.2.3.1) by a value selected from Table 4–27. Use the resulting product, not the value from Table 4–13, as the dilution weight for the intake for the ground water to surface water component. Do not round this product to the nearest integer.

Select the value from Table 4–27 based on the angle Θ, the angle defined by the sources at the site and either the two points at the intersection of the surface water body and the 1-mile distance ring of any two other points of the surface water body within the 1-mile distance ring, whichever results in the largest angle. (See Figure 4–3 for an example of how to determine Θ.) If the surface water body does not extend to the 1-mile ring at one or both ends, define Θ using the surface water endpoint(s) within the 1-mile ring or any two other points of the surface water body within the 1-mile distance ring, whichever results in the largest angle.

TABLE 4–27.—DILUTION WEIGHT ADJUSTMENTS

Angle Θ (degrees)	Assigned value [a]
0	0
Greater than 0 to 18	0.05
Greater than 18 to 54	0.1
Greater than 54 to 90	0.2
Greater than 90 to 126	0.3
Greater than 126 to 162	0.4
Greater than 162 to 198	0.5
Greater than 198 to 234	0.6
Greater than 234 to 270	0.7
Greater than 270 to 306	0.8
Greater than 306 to 342	0.9
Greater than 342 to 360	1.0

[a] Do not round to nearest integer.

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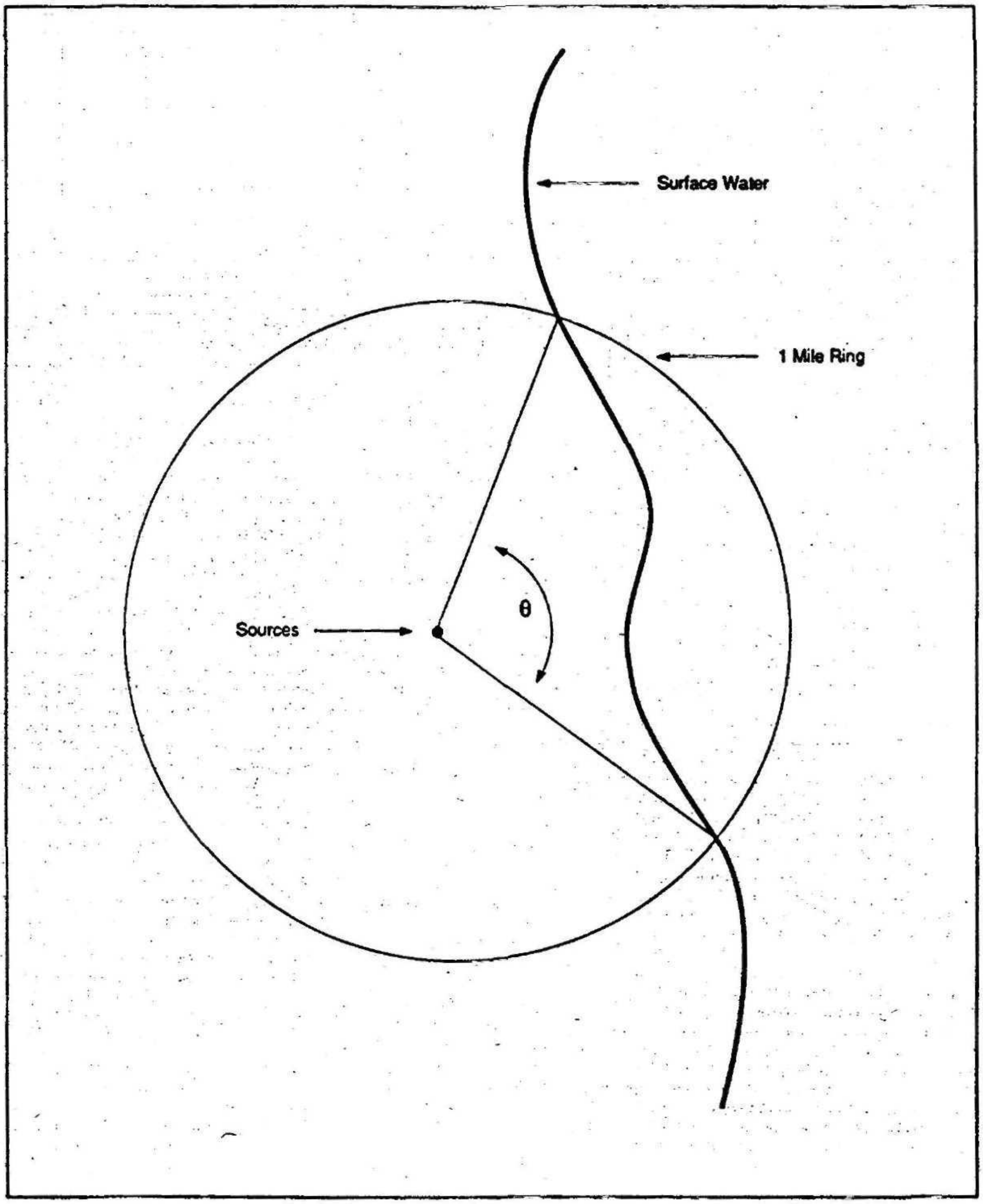

FIGURE 4-3
SAMPLE DETERMINATION OF GROUND WATER TO SURFACE WATER ANGLE

TABLE 4-28

TOXICITY/MOBILITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES[a]

Toxicity/ Mobility/ Persistence Factor Value	Bioaccumulation Potential Factor Value					
	50,000	5,000	500	50	5	0.5
10,000	5×10^8	5×10^7	5×10^6	5×10^5	5×10^4	5,000
4,000	2×10^8	2×10^7	2×10^6	2×10^5	2×10^4	2,000
2,000	1×10^8	1×10^7	1×10^6	1×10^5	1×10^4	1,000
1,000	5×10^7	5×10^6	5×10^5	5×10^4	5,000	500
800	4×10^7	4×10^6	4×10^5	4×10^4	4,000	400
700	3.5×10^7	3.5×10^6	3.5×10^5	3.5×10^4	3,500	350
400	2×10^7	2×10^6	2×10^5	2×10^4	2,000	200
200	1×10^7	1×10^6	1×10^5	1×10^4	1,000	100
140	7×10^6	7×10^5	7×10^4	7,000	700	70
100	5×10^6	5×10^5	5×10^4	5,000	500	50
80	4×10^6	4×10^5	4×10^4	4,000	400	40
70	3.5×10^6	3.5×10^5	3.5×10^4	3,500	350	35
40	2×10^6	2×10^5	2×10^4	2,000	200	20
20	1×10^6	1×10^5	1×10^4	1,000	100	10
14	7×10^5	7×10^4	7,000	700	70	7
10	5×10^5	5×10^4	5,000	500	50	5
8	4×10^5	4×10^4	4,000	400	40	4
7	3.5×10^5	3.5×10^4	3,500	350	35	3.5
4	2×10^5	2×10^4	2,000	200	20	2
2	1×10^5	1×10^4	1,000	100	10	1
1.4	7×10^4	7,000	700	70	7	0.7

TABLE 4-28 (Continued)

Toxicity/ Mobility/ Persistence Factor Value	Bioaccumulation Potential Factor Value					
	50,000	5,000	500	50	5	0.5
1.0	5×10^4	5,000	500	50	5	0.5
0.8	4×10^4	4,000	400	40	4	0.4
0.7	3.5×10^4	3,500	350	35	3.5	0.35
0.4	2×10^4	2,000	200	20	2	0.2
0.2	1×10^4	1,000	100	10	1	0.1
0.14	7,000	700	70	7	0.7	0.07
0.1	5,000	500	50	5	0.5	0.05
0.08	4,000	400	40	4	0.4	0.04
0.07	3,500	350	35	3.5	0.35	0.035
0.04	2,000	200	20	2	0.2	0.02
0.02	1,000	100	10	1	0.[illegible]	0.01
0.014	700	70	7	0.7	0.07	0.007
0.01	500	50	5	0.5	0.05	0.005
0.008	400	40	4	0.4	0.04	0.004
0.007	350	35	3.5	0.35	0.035	0.0035
0.004	200	20	2	0.2	0.02	0.002
0.002	100	10	1	0.1	0.01	0.001
0.0014	70	7	0.7	0.07	0.007	7×10^{-4}
0.001	50	5	0.5	0.05	0.005	5×10^{-4}
8×10^{-4}	40	4	0.4	0.04	0.004	4×10^{-4}
7×10^{-4}	35	3.5	0.35	0.035	0.0035	3.5×10^{-4}
4×10^{-4}	20	2	0.2	0.02	0.002	2×10^{-4}

TABLE 4-28 (Continued)

Toxicity/ Mobility/ Persistence Factor Value	Bioaccumulation Potential Factor Value					
	50,000	5,000	500	50	5	0.5
2×10^{-4}	10	1	0.1	0.01	0.001	1×10^{-4}
1.4×10^{-4}	7	0.7	0.07	0.007	7×10^{-4}	7×10^{-5}
1×10^{-4}	5	0.5	0.05	0.005	5×10^{-4}	5×10^{-5}
8×10^{-5}	4	0.4	0.04	0.004	4×10^{-4}	4×10^{-5}
7×10^{-5}	3.5	0.35	0.035	0.0035	3.5×10^{-4}	3.5×10^{-5}
4×10^{-5}	2	0.2	0.02	0.002	2×10^{-4}	2×10^{-5}
2×10^{-5}	1	0.1	0.01	0.001	1×10^{-4}	1×10^{-5}
1.4×10^{-5}	0.7	0.07	0.007	7×10^{-4}	7×10^{-5}	7×10^{-6}
8×10^{-6}	0.4	0.04	0.004	4×10^{-4}	4×10^{-5}	4×10^{-6}
7×10^{-6}	0.35	0.035	0.0035	3.5×10^{-4}	3.5×10^{-5}	3.5×10^{-6}
2×10^{-6}	0.1	0.01	0.001	1×10^{-4}	1×10^{-5}	1×10^{-6}
1.4×10^{-6}	0.07	0.007	7×10^{-4}	7×10^{-5}	7×10^{-6}	7×10^{-7}
8×10^{-7}	0.04	0.004	4×10^{-4}	4×10^{-5}	4×10^{-6}	4×10^{-7}
7×10^{-7}	0.035	0.0035	3.5×10^{-4}	3.5×10^{-5}	3.5×10^{-6}	3.5×10^{-7}
2×10^{-7}	0.01	0.001	1×10^{-4}	1×10^{-5}	1×10^{-6}	1×10^{-7}
1.4×10^{-7}	0.007	7×10^{-4}	7×10^{-5}	7×10^{-6}	7×10^{-7}	7×10^{-8}
8×10^{-8}	0.004	4×10^{-4}	4×10^{-5}	4×10^{-6}	4×10^{-7}	4×10^{-8}
7×10^{-8}	0.0035	3.5×10^{-4}	3.5×10^{-5}	3.5×10^{-6}	3.5×10^{-7}	3.5×10^{-8}
2×10^{-8}	0.001	1×10^{-4}	1×10^{-5}	1×10^{-6}	1×10^{-7}	1×10^{-8}
1.4×10^{-8}	7×10^{-4}	7×10^{-5}	7×10^{-6}	7×10^{-7}	7×10^{-8}	7×10^{-9}

TABLE 4-28 (Concluded)

Toxicity/ Mobility/ Persistence Factor Value	Bioaccumulation Potential Factor Value					
	50,000	5,000	500	50	5	0.5
8×10^{-9}	4×10^{-4}	4×10^{-5}	4×10^{-6}	4×10^{-7}	4×10^{-8}	4×10^{-9}
2×10^{-9}	1×10^{-4}	1×10^{-5}	1×10^{-6}	1×10^{-7}	1×10^{-8}	1×10^{-9}
1.4×10^{-9}	7×10^{-5}	7×10^{-6}	7×10^{-7}	7×10^{-8}	7×10^{-9}	7×10^{-10}
8×10^{-10}	4×10^{-5}	4×10^{-6}	4×10^{-7}	4×10^{-8}	4×10^{-9}	4×10^{-10}
1.4×10^{-10}	7×10^{-6}	7×10^{-7}	7×10^{-8}	7×10^{-9}	7×10^{-10}	4×10^{-11}
1.4×10^{-11}	7×10^{-7}	7×10^{-8}	7×10^{-9}	7×10^{-10}	7×10^{-11}	7×10^{-12}
1.4×10^{-12}	7×10^{-8}	7×10^{-9}	7×10^{-10}	7×10^{-11}	7×10^{-12}	7×10^{-13}
0	0	0	0	0	0	0

[a] Do not round to nearest integer.

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4.2.2.3.2 *Population.* Evaluate the population factor for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential contamination. Determine which factor applies to an intake as specified in section 4.2.2.3. Determine the population to be counted for that intake as specified in section 4.1.2.3.2, using the target distance limits in section 4.2.1.4 and the hazardous substance migration path in section 4.2.1.2.

4.2.2.3.2.1 *Level I concentrations.* Assign a value to this factor as specified in section 4.1.2.3.2.2.

4.2.2.3.2.2 *Level II concentrations.* Assign a value to this factor as specified in section 4.1.2.3.2.3.

4.2.2.3.2.3 *Potential contamination.* For each applicable type of surface water body in Table 4–14, determine the dilution-weighted population value as specified in section 4.1.2.3.2.4. Select the appropriate dilution weight adjustment value from Table 4–27 as specified in section 4.2.2.3.1.

Calculate the value for the potential contamination factor (PC) for the watershed as follows:

$$PC=\frac{A}{10}\sum_{i=1}^{n} W_i$$

where:

A=Dilution weight adjustment value from Table 4–27.

W_i=Dilution-weighted population from Table 4–14 for surface water body type i.

n=Number of different surface water body types in the watershed.

If PC is less than 1, do not round it to the nearest integer; if PC is 1 or more, round to the nearest integer. Enter the value in Table 4–25.

4.2.2.3.2.4 *Calculation of population factor value.* Sum the factor values for Level I concentrations, Level II concentrations, and potential contamination. Do not round this sum to the nearest integer. Assign this sum as the population factor value for the watershed. Enter this value in Table 4–25.

4.2.2.3.3 *Resources.* Assign a value to the resources factor as specified in section 4.1.2.3.3.

4.2.2.3.4 *Calculation of drinking water threat-targets factor category value.* Sum the nearest intake, population, and resources factor values for the watershed. Do not round this sum to the nearest integer. Assign this sum as the drinking water threat-targets factor category value for the watershed. Enter this value in Table 4–25.

4.2.2.4 *Calculation of drinking water threat score for a watershed.* Multiply the drinking water threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 100, as the drinking water threat score for the watershed. Enter this score in Table 4–25.

4.2.3 *Human food chain threat.* Evaluate the human food chain threat for a watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.2.3.1 *Human food chain threat-likelihood of release.* Assign the same likelihood of release factor category value for the human food chain threat for the watershed as would be assigned in section 4.2.2.1.3 for the drinking water threat. Enter this value in Table 4–25.

4.2.3.2 *Human food chain threat-waste characteristics.* Evaluate the waste characteristics factor category for each watershed based on two factors: toxicity/mobility/persistence/bioaccumulation and hazardous waste quantity.

4.2.3.2.1 *Toxicity/mobility/persistence/bioaccumulation.* Evaluate all those hazardous substances eligible to be evaluated for toxicity/mobility/persistence in the drinking water threat for the watershed (see section 4.2.2.2.1).

4.2.3.2.1.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

4.2.3.2.1.2 *Mobility.* Assign a ground water mobility factor value to each hazardous substance as specified for the drinking water threat (see section 4.2.2.2.1.2).

4.2.3.2.1.3 *Persistence.* Assign a surface water persistence factor value to each hazardous substance as specified for the drinking water threat (see section 4.2.2.2.1.3), except: use the predominant water category (that is, lakes; or rivers, oceans, coastal tidal waters, or Great Lakes) between the probable point of entry and the nearest fishery (not the nearest drinking water or resources intake) along the hazardous substance migration path for the watershed to determine which portion of Table 4–10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.2.1.2.

4.2.3.2.1.4 *Bioaccumulation potential.* Assign a bioaccumulation potential factor value to each hazardous substance as specified in section 4.1.3.2.1.3.

4.2.3.2.1.5 *Calculation of toxicity/mobility/persistence/ bioaccumulation factor value.* Assign each hazardous substance a toxicity/mobility factor value from Table 3–9 (section 3.2.1.3), based on the values assigned to the hazardous substance for the toxicity and mobility factors. Then assign each hazardous substance a toxicity/mobility/persistence factor value from Table 4–26, based on the values assigned for the toxicity/mobility and persistence factors. Then assign each hazardous substance a toxicity/mobility/persistence/bioaccumulation factor value from Table 4–28. Use the substance with the highest toxicity/mobility/persistence/bioaccumulation factor value for the watershed to assign the value to this factor for the watershed. Enter this value in Table 4–25.

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4.2.3.2.2 *Hazardous waste quantity.* Assign the same factor value for hazardous waste quantity for the watershed as would be assigned in section 4.2.2.2.2 for the drinking water threat. Enter this value in Table 4–25.

4.2.3.2.3 *Calculation of human food chain threat-waste characteristics factor category value.* For the hazardous substance selected for the watershed in section 4.2.3.2.1.5, use its toxicity/mobility/persistence factor value and bioaccumulation potential factor value as follows to assign a value to the waste characteristics factor category. First, multiply the toxicity/mobility/persistence factor value and the hazardous waste quantity factor value for the watershed, subject to a maximum product of 1×10^8. Then multiply this product by the bioaccumulation potential factor value for this hazardous substance, subject to a maximum product of 1×10^{12}. Based on this second product, assign a value from Table 2–7 (section 2.4.3.1) to the human food chain threat-waste characteristics factor category for the watershed. Enter this value in Table 4–25.

4.2.3.3 *Human food chain threat-targets.* Evaluate two target factors for the watershed: food chain individual and population.

For both factors, determine whether the target fisheries are subject to Level I concentrations, Level II concentrations, or potential human food chain contamination. Determine which applies to each fishery (or portion of a fishery) as specified in section 4.1.3.3, subject to the restrictions specified in sections 4.2.1.3 and 4.2.1.4.

4.2.3.3.1 *Food chain individual.* Assign a value to the food chain individual factor as specified in section 4.1.3.3.1 with the following modification. When a dilution weight is used, multiply the appropriate dilution weight from Table 4–13 by the adjustment value selected from Table 4–27, as specified in section 4.2.2.3.1. Use the resulting product, not the value from Table 4–13, as the dilution weight in assigning the factor value. Do not round this product to the nearest integer. Enter the value assigned in Table 4–25.

4.2.3.3.2 *Population.* Evaluate the population factor for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential human food chain contamination. Determine which of these factors is to be applied to each fishery as specified in section 4.2.3.3.

4.2.3.3.2.1 *Level I concentrations.* Assign a value to this factor as specified in section 4.1.3.3.2.1. Enter this value in Table 4–25.

4.2.3.3.2.2 *Level II concentrations.* Assign a value to this factor as specified in section 4.1.3.3.2.2. Enter this value in Table 4–25.

4.2.3.3.2.3 *Potential human food chain contamination.* Assign a value to this factor as specified in section 4.1.3.3.2.3 with the following modification. For each fishery being evaluated, multiply the appropriate dilution weight for that fishery from Table 4–13 by the adjustment value selected from Table 4–27, as specified in section 4.2.2.3.1. Use the resulting product, not the value from Table 4–13, as the dilution weight for the fishery. Do not round this product to the nearest integer. Enter the value assigned in Table 4–25.

4.2.3.3.2.4 *Calculation of population factor value.* Sum the factor values for Level I concentrations, Level II concentrations, and potential human food chain contamination for the watershed. Do not round this sum to the nearest integer. Assign this sum as the population factor value for the watershed. Enter this value in Table 4–25.

4.2.3.3.3 *Calculation of human food chain threat-targets factor category value.* Sum the food chain individual and population factor values for the watershed. Do not round this sum to the nearest integer. Assign this sum as the human food chain threat-targets factor category value for the watershed. Enter this value in Table 4–25.

4.2.3.4 *Calculation of human food chain threat score for a watershed.* Multiply the human food chain threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 100, as the human food chain threat score for the watershed. Enter this score in Table 4–25.

4.2.4 *Environmental threat.* Evaluate the environmental threat for the watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.2.4.1 *Environmental threat-likelihood of release.* Assign the same likelihood of release factor category value for the environmental threat for the watershed as would be assigned in section 4.2.2.1.3 for the drinking water threat. Enter this value in Table 4–25.

4.2.4.2 *Environmental threat-waste characteristics.* Evaluate the waste characteristics factor category for each watershed based on two factors: ecosystem toxicity/mobility/persistence/bioaccumulation and hazardous waste quantity.

4.2.4.2.1 *Ecosystem toxicity/mobility/persistence/bioaccumulation.* Evaluate all those hazardous substances eligible to be evaluated for toxicity/mobility/persistence in the drinking water threat for the watershed (see section 4.2.2.2.1).

4.2.4.2.1.1 *Ecosystem toxicity.* Assign an ecosystem toxicity factor value to each hazardous substance as specified in section 4.1.4.2.1.1.

4.2.4.2.1.2 *Mobility.* Assign a ground water mobility factor value to each hazardous substance as specified in section 4.2.2.2.1.2 for the drinking water threat.

4.2.4.2.1.3 *Persistence.* Assign a surface water persistence factor value to each hazardous substance as specified in section 4.2.2.2.1.3 for the drinking water threat, except: use the predominant water category (that is, lakes; or rivers, oceans, coastal tidal waters, or Great Lakes) between the probable point of entry and the nearest sensitive environment (not the nearest drinking water or resources intake) along the hazardous substance migration path for the watershed to determine which portion of Table 4–10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.2.1.2.

4.2.4.2.1.4 *Ecosystem bioaccumulation potential.* Assign an ecosystem bioaccumulation potential factor value to each hazardous substance as specified in section 4.1.4.2.1.3.

4.2.4.2.1.5 *Calculation of ecosystem toxicity/mobility/persistence/bioaccumulation factor value.* Assign each hazardous substance an ecosystem toxicity/mobility factor value from Table 3–9 (section 3.2.1.3), based on the values assigned to the hazardous substance for the ecosystem toxicity and mobility factors. Then assign each hazardous substance an ecosystem toxicity/mobility/persistence factor value from Table 4–29, based on the values assigned for the ecosystem toxicity/mobility and persistence factors. Then assign each hazardous substance an ecosystem toxicity/mobility/persistence/bioaccumulation factor value from Table 4–30, based on the values assigned for the ecosystem toxicity/mobility/persistence and ecosystem bioaccumulation potential factors. Select the substance with the highest ecosystem toxicity/mobility/persistence/bioaccumulation factor value for the watershed and use it to assign the value to this factor for the watershed. Enter this value in Table 4–25.

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TABLE 4-29
ECOSYSTEM TOXICITY/MOBILITY/PERSISTENCE FACTOR VALUES[a]

Ecosystem Toxicity/Mobility Factor Value	Persistence Factor Value			
	1.0	0.4	0.07	0.0007
10,000	10,000	4,000	700	7
2,000	2,000	800	140	1.4
1,000	1,000	400	70	0.7
200	200	80	14	0.14
100	100	40	7	0.07
20	20	8	1.4	0.014
10	10	4	0.7	0.007
2	2	0.8	0.14	0.0014
1	1	0.4	0.07	7×10^{-4}
0.2	0.2	0.08	0.014	1.4×10^{-4}
0.1	0.1	0.04	0.007	7×10^{-5}
0.02	0.02	0.008	0.0014	1.4×10^{-5}
0.01	0.01	0.004	7×10^{-4}	7×10^{-6}
0.002	0.002	8×10^{-4}	1.4×10^{-4}	1.4×10^{-6}
0.001	0.001	4×10^{-4}	7×10^{-5}	7×10^{-7}
2×10^{-4}	2×10^{-4}	8×10^{-5}	1.4×10^{-5}	1.4×10^{-7}
1×10^{-4}	1×10^{-4}	4×10^{-5}	7×10^{-6}	7×10^{-8}
2×10^{-5}	2×10^{-5}	8×10^{-6}	1.4×10^{-6}	1.4×10^{-8}
2×10^{-6}	2×10^{-6}	8×10^{-7}	1.4×10^{-7}	1.4×10^{-9}
2×10^{-7}	2×10^{-7}	8×10^{-8}	1.4×10^{-8}	1.4×10^{-10}
2×10^{-8}	2×10^{-8}	8×10^{-9}	1.4×10^{-9}	1.4×10^{-11}
2×10^{-9}	2×10^{-9}	8×10^{-10}	1.4×10^{-10}	1.4×10^{-12}
0	0	0	0	0

[a] Do not round to nearest integer.

TABLE 4-30

ECOSYSTEM TOXICITY/MOBILITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES[a]

Ecosystem Toxicity/ Mobility/ Persistence Factor Value	Ecosystem Bioaccumulation Potential Factor Value					
	50,000	5,000	500	50	5	0.5
10,000	5×10^8	5×10^7	5×10^6	5×10^5	5×10^4	5,000
4,000	2×10^8	2×10^7	2×10^6	2×10^5	2×10^4	2,000
2,000	1×10^8	1×10^7	1×10^6	1×10^5	1×10^4	1,000
1,000	5×10^7	5×10^6	5×10^5	5×10^4	5,000	500
800	4×10^7	4×10^6	4×10^5	4×10^4	4,000	400
700	3.5×10^7	3.5×10^6	3.5×10^5	3.5×10^4	3,500	350
400	2×10^7	2×10^6	2×10^5	2×10^4	2,000	200
200	1×10^7	1×10^6	1×10^5	1×10^4	1,000	100
140	7×10^6	7×10^5	7×10^4	7,000	700	70
100	5×10^6	5×10^5	5×10^4	5,000	500	50
80	4×10^6	4×10^5	4×10^4	4,000	400	40
70	3.5×10^6	3.5×10^5	3.5×10^4	3,500	350	35
40	2×10^6	2×10^5	2×10^4	2,000	200	20
20	1×10^6	1×10^5	1×10^4	1,000	100	10
14	7×10^5	7×10^4	7,000	700	70	7
10	5×10^5	5×10^4	5,000	500	50	5
8	4×10^5	4×10^4	4,000	400	40	4
7	3.5×10^5	3.5×10^4	3,500	350	35	3.5
4	2×10^5	2×10^4	2,000	200	20	2
2	1×10^5	1×10^4	1,000	100	10	1
1.4	7×10^4	7,000	700	70	7	0.7

TABLE 4-30 (Continued)

Ecosystem Toxicity/ Mobility/ Persistence Factor Value	Esosystem Bioaccumulation Potential Factor Value					
	50,000	5,000	500	50	5	0.5
1.0	5×10^4	5,000	500	50	5	0.5
0.8	4×10^4	4,000	400	40	4	0.4
0.7	3.5×10^4	3,500	350	35	3.5	0.35
0.4	2×10^4	2,000	200	20	2	0.2
0.2	1×10^4	1,000	100	10	1	0.1
0.14	7,000	700	70	7	0.7	0.07
0.1	5,000	500	50	5	0.5	0.05
0.08	4,000	400	40	4	0.4	0.04
0.07	3,500	350	35	3.5	0.35	0.035
0.04	2,000	200	20	2	0.2	0.02
0.02	1,000	100	10	1	0.1	0.01
0.014	700	70	7	0.7	0.07	0.007
0.01	500	50	5	0.5	0.05	0.005
0.008	400	40	4	0.4	0.04	0.004
0.007	350	35	3.5	0.35	0.035	0.0035
0.004	200	20	2	0.2	0.02	0.002
0.002	100	10	1	0.1	0.01	0.001
0.0014	70	7	0.7	0.07	0.007	7×10^{-4}
0.001	50	5	0.5	0.05	0.005	5×10^{-4}
8×10^{-4}	40	4	0.4	0.04	0.004	4×10^{-4}
7×10^{-4}	35	3.5	0.35	0.035	0.0035	3.5×10^{-4}
4×10^{-4}	20	2	0.2	0.02	0.002	2×10^{-4}

TABLE 4-30 (Continued)

Ecosystem Toxicity/ Mobility/ Persistence Factor Value	Ecosystem Bioaccumulation Potential Factor Value					
	50,000	5,000	500	50	5	0.5
2×10^{-4}	10	1	0.1	0.01	0.001	1×10^{-4}
1.4×10^{-4}	7	0.7	0.07	0.007	7×10^{-4}	7×10^{-5}
1×10^{-4}	5	0.5	0.05	0.005	5×10^{-4}	5×10^{-5}
8×10^{-5}	4	0.4	0.04	0.004	4×10^{-4}	4×10^{-5}
7×10^{-5}	3.5	0.35	0.035	0.0035	3.5×10^{-4}	3.5×10^{-5}
4×10^{-5}	2	0.2	0.02	0.002	2×10^{-4}	2×10^{-5}
2×10^{-5}	1	0.1	0.01	0.001	1×10^{-4}	1×10^{-5}
1.4×10^{-5}	0.7	0.07	0.007	7×10^{-4}	7×10^{-5}	7×10^{-6}
8×10^{-6}	0.4	0.04	0.004	4×10^{-4}	4×10^{-5}	4×10^{-6}
7×10^{-6}	0.35	0.035	0.0035	3.5×10^{-4}	3.5×10^{-5}	3.5×10^{-6}
2×10^{-6}	0.1	0.01	0.001	1×10^{-4}	1×10^{-5}	1×10^{-6}
1.4×10^{-6}	0.07	0.007	7×10^{-4}	7×10^{-5}	7×10^{-6}	7×10^{-7}
8×10^{-7}	0.04	0.004	4×10^{-4}	4×10^{-5}	4×10^{-6}	4×10^{-7}
7×10^{-7}	0.035	0.0035	3.5×10^{-4}	3.5×10^{-5}	3.5×10^{-6}	3.5×10^{-7}
2×10^{-7}	0.01	0.001	1×10^{-4}	1×10^{-5}	1×10^{-6}	1×10^{-7}
1.4×10^{-7}	0.007	7×10^{-4}	7×10^{-5}	7×10^{-6}	7×10^{-7}	7×10^{-8}
8×10^{-8}	0.004	4×10^{-4}	4×10^{-5}	4×10^{-6}	4×10^{-7}	4×10^{-8}
7×10^{-8}	0.0035	3.5×10^{-4}	3.5×10^{-5}	3.5×10^{-6}	3.5×10^{-7}	3.5×10^{-8}
2×10^{-8}	0.001	1×10^{-4}	1×10^{-5}	1×10^{-6}	1×10^{-7}	1×10^{-8}
1.4×10^{-8}	7×10^{-4}	7×10^{-5}	7×10^{-6}	7×10^{-7}	7×10^{-8}	7×10^{-9}

TABLE 4-30 (Concluded)

Ecosystem Toxicity/ Mobility/ Persistence Factor Value	Ecosystem Bioaccumulation Potential Factor Value					
	50.000	5,000	500	50	5	0.5
8×10^{-9}	4×10^{-4}	4×10^{-5}	4×10^{-6}	4×10^{-7}	4×10^{-8}	4×10^{-9}
2×10^{-9}	1×10^{-4}	1×10^{-5}	1×10^{-6}	1×10^{-7}	1×10^{-8}	1×10^{-9}
1.4×10^{-9}	7×10^{-5}	7×10^{-6}	7×10^{-7}	7×10^{-8}	7×10^{-9}	7×10^{-10}
8×10^{-10}	4×10^{-5}	4×10^{-6}	4×10^{-7}	4×10^{-8}	4×10^{-9}	4×10^{-10}
1.4×10^{-10}	7×10^{-6}	7×10^{-7}	7×10^{-8}	7×10^{-9}	7×10^{-10}	4×10^{-11}
1.4×10^{-11}	7×10^{-7}	7×10^{-8}	7×10^{-9}	7×10^{-10}	7×10^{-11}	7×10^{-12}
1.4×10^{-12}	7×10^{-8}	7×10^{-9}	7×10^{-10}	7×10^{-11}	7×10^{-12}	7×10^{-13}
0	0	0	0	0	0	0

[a] Do not round to nearest integer.

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4.2.4.2.2 *Hazardous waste quantity.* Assign the same factor value for hazardous waste quantity for the watershed as would be assigned in section 4.2.2.2.2 for the drinking water threat. Enter this value in Table 4–25.

4.2.4.2.3 *Calculation of environmental threat-waste characteristics factor category value.* For the hazardous substance selected for the watershed in section 4.2.4.2.1.5, use its ecosystem toxicity/mobility/persistence factor value and ecosystem bioaccumulation potential factor value as follows to assign a value to the waste characteristics factor category. First, multiply the ecosystem toxicity/mobility/persistence factor value and the hazardous waste quantity factor value for the watershed, subject to a maximum product of 1×10^{8}. Then multiply this product by the ecosystem bioaccumulation potential factor value for this hazardous substance, subject to a maximum product of 1×10^{12}. Based on this product, assign a value from Table 2–7 (section 2.4.3.1) to the environmental threat-waste characteristics category for the watershed. Enter the value in Table 4–25.

4.2.4.3 *Environmental threat-targets.* Evaluate the environmental threat-targets factor category for a watershed using one factor: sensitive environments.

4.2.4.3.1 *Sensitive environments.* Evaluate sensitive environments for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential contamination. Determine which applies to each sensitive environment as specified in section 4.1.4.3.1, except: use only those samples from the surface water in-water segment and only those hazardous substances in such samples that meet the conditions in sections 4.2.1.3 and 4.2.1.4.

4.2.4.3.1.1 *Level I concentrations.* Assign a value to this factor as specified in section 4.1.4.3.1.1. Enter this value in Table 4–25.

4.2.4.3.1.2 *Level II concentrations.* Assign a value to this factor as specified in section 4.1.4.3.1.2. Enter this value in Table 4–25.

4.2.4.3.1.3 *Potential contamination.* Assign a value to this factor as specified in section 4.1.4.3.1.3 with the following modification. Multiply the appropriate dilution weight from Table 4–13 for the sensitive environments in each type of surface water body by the adjustment value selected from Table 4–27, as specified in section 4.2.2.3.1. Use the resulting product, not the value from Table 4–13, as the dilution weight for the sensitive environments in that type of surface water body. Do not round this product to the nearest integer. Enter the value assigned in Table 4–25.

4.2.4.3.1.4 *Calculation of environmental threat-targets factor category value.* Sum the values for Level I concentrations, Level II concentrations, and potential contamination for the watershed. Do not round this sum to the nearest integer. Assign this sum as the environmental threat targets factor category value for the watershed. Enter this value in Table 4–25.

4.2.4.4 *Calculation of environmental threat score for a watershed.* Multiply the environmental threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 60, as the environmental threat score for the watershed. Enter this score in Table 4–25.

4.2.5 *Calculation of ground water to surface water migration component score for a watershed.* Sum the scores for the three threats for the watershed (that is, drinking water, human food chain, and environmental threats). Assign the resulting score, subject to a maximum value of 100, as the ground water to surface water migration component score for the watershed. Enter this score in Table 4–25.

4.2.6 *Calculation of ground water to surface water migration component score.* Select the highest ground water to surface water migration component score from the watersheds evaluated. Assign this score as the ground water to surface water migration component score for the site, subject to a maximum score of 100. Enter this score in Table 4–25.

4.3 *Calculation of surface water migration pathway score.* Determine the surface water migration pathway score as follows:

- If only one of the two surface water migration components (overland/flood or ground water to surface water) is scored, assign the score of that component as the surface water migration pathway score.
- If both components are scored, select the higher of the two component scores from sections 4.1.6 and 4.2.6. Assign that score as the surface water migration pathway score.

5.0 Soil Exposure Pathway

Evaluate the soil exposure pathway based on two threats: Resident population threat and nearby population threat. Evaluate both threats based on three factor categories: Likelihood of exposure, waste characteristics, and targets. Figure 5–1 indicates the factors included within each factor category for each type of threat.

Determine the soil exposure pathway score (S_s) in terms of the factor category values as follows:

$$S_s = \frac{\sum_{i=1}^{2} (LE_i)(WC_i)(T_i)}{SF}$$

where:

LE_i = Likelihood of exposure factor category value for threat i (that is, resident population threat or nearby population threat).

WC_i = Waste characteristics factor category value for threat i.

T_i = Targets factor category value for threat i.

SF = Scaling factor.

Table 5–1 outlines the specific calculation procedure.

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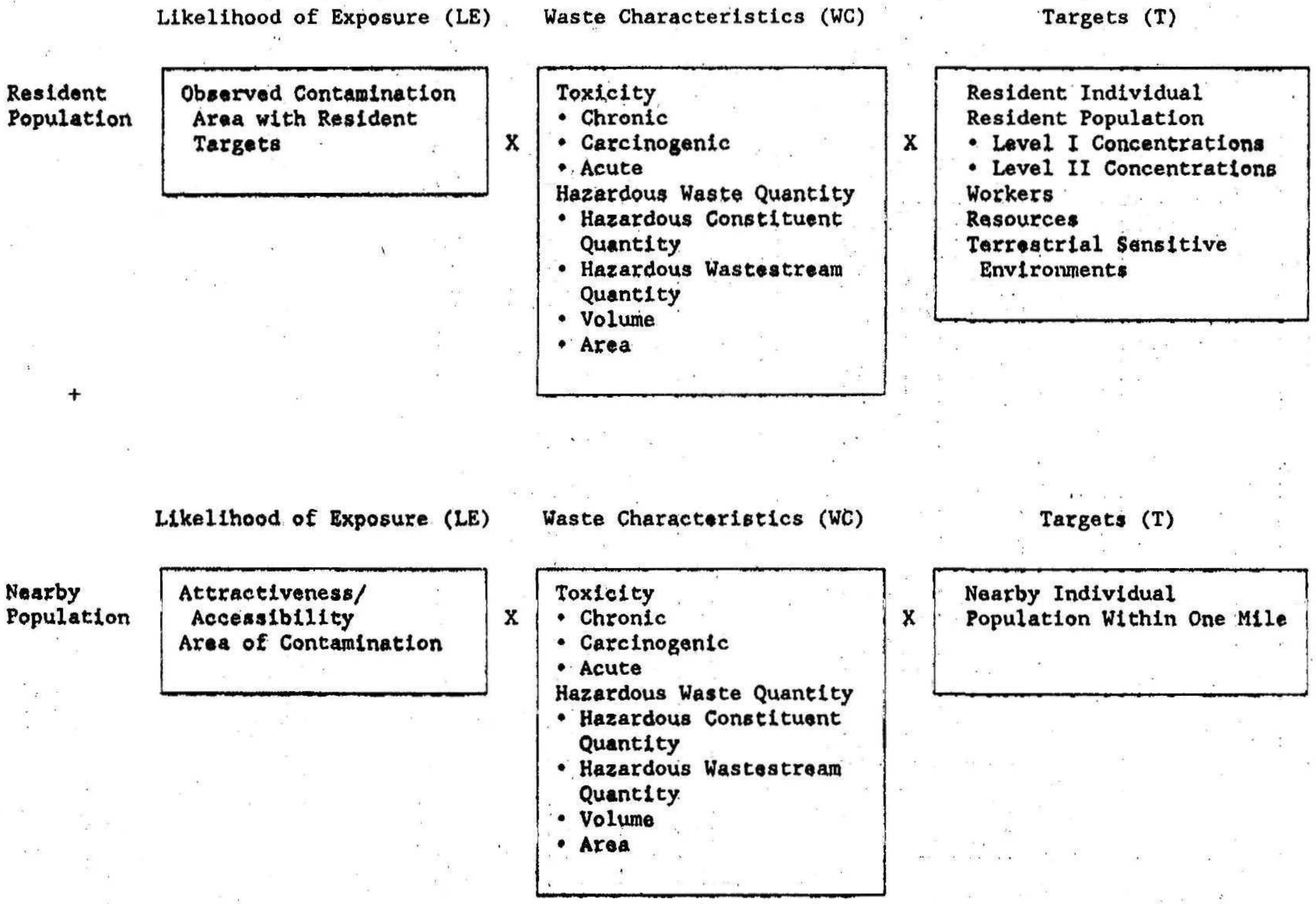

Figure 5-1
OVERVIEW OF SOIL EXPOSURE PATHWAY

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TABLE 5-1.—SOIL EXPOSURE PATHWAY SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Resident Population Threat		
Likelihood of Exposure		
1. Likelihood of Exposure	550	___
Waste Characteristics		
2. Toxicity	(a)	___
3. Hazardous Waste Quantity	(a)	___
4. Waste Characteristics	100	___
Targets		
5. Resident Individual	50	___
6 Resident Population:		
6a. Level I Concentrations	(b)	___
6b. Level II Concentrations	(b)	___
6c. Resident Population (lines 6a + 6b)	(b)	___
7. Workers	15	___
8. Resources	5	___
9. Terrestrial Sensitive Environments	(c)	___
10. Targets (lines 5 + 6c + 7 + 8 + 9)	(b)	___
Resident Population Threat Score		
11. Resident Population Threat (lines 1 × 4 × 10)	(b)	___
Nearby Population Threat		
Likelihood of Exposure		
12. Attractiveness/Accessibility	100	___
13. Area of Contamination	100	___
14. Likelihood of Exposure	500	___
Waste Characteristics		
15. Toxicity	(a)	___
16. Hazardous Waste Quantity	(a)	___
17. Waste Characteristics	100	___
Targets		
18. Nearby Individual	1	___
19. Population Within 1 Mile	(b)	___
20. Targets (lines 18 + 19)	(b)	___
Nearby Population Threat Score		
21. Nearby Population Threat (lines 14 × 17 × 20)	(b)	___
Soil Exposure Pathway Score		
22. Soil Exposure Pathway Score [d] (S_s), (lines [11+21] / 82,500, subject to a maximum of 100)	100	___

[a] Maximum value applies to waste characteristics category.
[b] Maximum value not applicable.
[c] No specific maximum value applies to factor. However, pathway score based solely on terrestrial sensitive environments is limited to maximum of 60
[d] Do not round to nearest integer.

5.0.1 *General considerations.* Evaluate the soil exposure pathway based on areas of observed contamination:

- Consider observed contamination to be present at sampling locations where analytic evidence indicates that:
  - –A hazardous substance attributable to the site is present at a concentration significantly above background levels for the site (see Table 2–3 in section 2.3 for the criteria for determining analytical significance), *and*
  - –This hazardous substance, if not present at the surface, is covered by 2 feet or less of cover material (for example, soil).
- Establish areas of observed contamination based on sampling locations at which there is observed contamination as follows:
  - –For all sources except contaminated soil, if observed contamination from the site is present at any sampling location within the source, consider that entire source to be an area of observed contamination.
  - –For contaminated soil, consider both the sampling location(s) with observed contamination from the site and the area lying between such locations to be an area of observed contamination, unless available information indicates otherwise.
- If an area of observed contamination (or portion of such an area) is covered by a permanent, or otherwise maintained, essentially impenetrable material (for example, asphalt) that is not more than 2 feet thick, exclude that area (or portion of the area) in evaluating the soil exposure pathway.
- For an area of observed contamination, consider only those hazardous substances that meet the criteria for observed contamination for that area to be associated with that area in evaluating the soil exposure pathway (see section 2.2.2).

If there is observed contamination, assign scores for the resident population threat and the nearby population threat, as specified in sections 5.1 and 5.2. If there is no observed contamination, assign the soil exposure pathway a score of 0.

5.1 *Resident Population Threat.* Evaluate the resident population threat only if there is an area of observed contamination in one or more of the following locations:

- Within the property boundary of a residence, school, or day care center *and* within 200 feet of the respective residence, school, or day care center, or
- Within a workplace property boundary *and* within 200 feet of a workplace area, or
- Within the boundaries of a resource specified in section 5.1.3.4, or
- Within the boundaries of a terrestrial sensitive environment specified in section 5.1.3.5.

If not, assign the resident population threat a value of 0, enter this value in Table 5–1, and proceed to the nearby population threat (section 5.2).

5.1.1 *Likelihood of exposure.* Assign a value of 550 to the likelihood of exposure factor category for the resident population threat if there is an area of observed contamination in one or more locations listed in section 5.1. Enter this value in Table 5–1.

5.1.2 *Waste characteristics.* Evaluate waste characteristics based on two factors: toxicity and hazardous waste quantity. Evaluate only those hazardous substances that meet the criteria for observed contamination at the site (see section 5.0.1).

5.1.2.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1. Use the hazardous substance with the highest toxicity factor value to assign the value to the toxicity factor for the resident population threat. Enter this value in Table 5–1.

5.1.2.2 *Hazardous waste quantity.* Assign hazardous waste quantity factor value as specified in section 2.4.2. In estimating the hazardous waste quantity, use Table 5–2 and:

- Consider only the first 2 feet of depth of an area of observed contamination, except as specified for the volume measure.
- Use the volume measure (see section 2.4.2.1.3) only for those types of areas of observed contamination listed in Tier C of Table 5-2. In evaluating the volume measure for these listed areas of observed contamination, use the full volume, not just the volume within the top 2 feet.
- Use the area measure (see section 2.4.2.1.4), not the volume measure, for all other types of areas of observed contamination, even if their volume is known.

Enter the value assigned in Table 5-1.

TABLE 5-2.—HAZARDOUS WASTE QUANTITY EVALUATION EQUATIONS FOR SOIL EXPOSURE PATHWAY

Tier	Measure	Units	Equation for assigning value [a]
A	**Hazardous Constituent Quantity (C)**	lb	C
B [b]	**Hazardous Wastestream Quantity (W)**	lb	W/5,000
C [b]	**Volume (V)**		
	Surface Impoundment [c]	yd³	V/2.5
	Drums [d]	gallon	V/500
	Tanks and Containers Other Than Drums	yd³	V/2.5
D [b]	**Area (A)**		
	Landfill	ft²	A/34,000
	Surface Impoundment	ft²	A/13
	Surface Impoundment (Buried/backfilled).	ft²	A/13
	Land treatment	ft²	A/270
	Pile [e]	ft²	A/34
	Contaminated Soil	ft²	A/34,000

[a] Do not round nearest integer.

[b] Convert volume to mass when necessary: 1 ton=2,000 pounds=1 cubic yard=4 drums=200 gallons.

[c] Use volume measure only for surface impoundments containing hazardous substances present as liquids. Use area measures in Tier D for dry surface impoundments and for buried/backfilled surface impoundments.

[d] If actual volume of drums is unavailable, assume 1 drum=50 gallons.

[e] Use land surface area under pile, not surface area of pile.

5.1.2.3 *Calculation of waste characteristics factor category value.* Multiply the toxicity and hazardous waste quantity factor values, subject to a maximum product of 1 × 10^8. Based on this product, assign a value from Table 2-7 (section 2.4.3.1) to the waste characteristics factor category. Enter this value in Table 5-1.

5.1.3 *Targets.* Evaluate the targets factor category for the resident population threat based on five factors: resident individual, resident population, workers, resources, and terrestrial sensitive environments.

In evaluating the targets factor category for the resident population threat, count only the following as targets:

- Resident individual—a person living or attending school or day care on a property with an area of observed contamination *and* whose residence, school, or day care center, respectively, is on or within 200 feet of the area of observed contamination.
- Worker—a person working on a property with an area of observed contamination *and* whose workplace area is on or within 200 feet of the area of observed contamination.
- Resources located on an area of observed contamination, as specified in section 5.1.
- Terrestrial sensitive environments located on an area of observed contamination, as specified in section 5.1.

5.1.3.1 *Resident individual.* Evaluate this factor based on whether there is a resident individual, as specified in section 5.1.3, who is subject to Level I or Level II concentrations.

First, determine those areas of observed contamination subject to Level I concentrations and those subject to Level II concentrations as specified in sections 2.5.1 and 2.5.2. Use the health-based benchmarks from Table 5-3 in determining the level of contamination. Then assign a value to the resident individual factor as follows:

- Assign a value of 50 if there is at least one resident individual for one or more areas subject to Level I concentrations.
- Assign a value of 45 if there is no such resident individuals, but there is at least one resident individual for one or more areas subject to Level II concentrations.
- Assign a value of 0 if there is no resident individual.

Enter the value assigned in Table 5-1.

5.1.3.2 *Resident population.* Evaluate resident population based on two factors: Level I concentrations and Level II concentrations. Determine which factor applies as specified in sections 2.5.1 and 2.5.2, using the health-based benchmarks from Table 5-3. Evaluate populations subject to Level I concentrations as specified in section 5.1.3.2.1 and populations subject to Level II concentrations as specified in section 5.1.3.2.2.

TABLE 5-3.—HEALTH-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN SOILS

- Screening concentration for cancer corresponding to that concentration that corresponds to the 10^{-6} individual cancer risk for oral exposures.
- Screening concentration for noncancer toxicological responses corresponding to the Reference Dose (RfD) for oral exposures.

Count only those persons meeting the criteria for resident individual as specified in section 5.1.3. In estimating the number of people living on property with an area of observed contamination, when the estimate in based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located.

5.1.3.2.1 *Level I concentrations.* Sum the number of resident individuals subject to Level I concentrations and multiply this sum by 10. Assign the resulting product as the value for this factor. Enter this value in Table 5-1.

5.1.3.2.2 *Level II concentrations.* Sum the number of resident individuals subject to Level II concentrations. Do not include those people already counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in Table 5-1.

5.1.3.2.3 *Calculation of resident population factor value.* Sum the factor values for Level I concentrations and Level II concentrations. Assign this sum as the resident population factor value. Enter this value in Table 5-1.

5.1.3.3 *Workers.* Evaluate this factor based on the number of workers that meet the section 5.1.3 criteria. Assign a value for these workers using Table 5-4. Enter this value in Table 5-1.

TABLE 5-4.—FACTOR VALUES FOR WORKERS

Number of workers	Assigned value
0	0
1 to 100	5
101 to 1,000	10
Greater than 1,000	15

5.1.3.4 *Resources.* Evaluate the resources factor as follows:

- Assign a value of 5 to the resources factor if one or more of the following is present on an area of observed contamination at the site:
  - –Commercial agriculture.
  - –Commercial silviculture.
  - –Commercial livestock production or commercial livestock grazing.
- Assign a value of 0 if none of the above are present.

Enter the value assigned in Table 5-1.

5.1.3.5 *Terrestrial sensitive environments.* Assign value(s) from Table 5-5 to each terrestrial sensitive environment that meets the eligibility criteria of section 5.1.3.

Calculate a value (ES) for terrestrial sensitive environments as follows:

$$ES = \sum_{i=1}^{n} S_i$$

where:

S_i = Value(s) assigned from Table 5-5 to terrestrial sensitive environment i.

n=Number of terrestrial sensitive environments meeting section 5.1.3 criteria.

Because the pathway score based solely on terrestrial sensitive environments is limited to a maximum of 60, determine the value for the terrestrial sensitive environments factor as follows:

TABLE 5-5.—TERRESTRIAL SENSITIVE ENVIRONMENTS RATING VALUES

Terrestrial sensitive environments	Assigned value
Terrestrial critical habitat [a] for Federal designated endangered or threatened species	100
National Park	
Designated Federal Wilderness Area	
National Monument	
Terrestrial habitat known to be used by Federal designated or proposed threatened or endangered species	75
National Preserve (terrestrial)	
National or State Terrestrial Wildlife Refuge	
Federal land designated for protection of natural ecosystems	
Administratively proposed Federal Wilderness Area	
Terrestrial areas utilized for breeding by large or dense aggregations of animals [b]	
Terrestrial habitat known to be used by State designated endangered or threatened species	50
Terrestrial habitat known to be used by species under review as to its Federal designated endangered or threatened status	
State lands designated for wildlife or game management	25
State designated Natural Areas	
Particular areas, relatively small in size, important to maintenance of unique biotic communities	

[a] Critical habitat as defined in 50 CFR 424.02.
[b] Limit to vertebrate species.

- Multiply the values assigned to the resident population threat for likelihood of exposure (LE), waste characteristics (WC), and ES. Divide the product by 82,500.

  –If the result is 60 or less, assign the value ES as the terrestrial sensitive environments factor value.

  –If the result exceeds 60, calculate a value EC as follows:

$$EC = \frac{(60)(82,500)}{(LE)(WC)}$$

Assign the value EC as the terrestrial sensitive environments factor value. Do not round this value to the nearest interger.

Enter the value assigned for the terrestrial sensitive environments factor in Table 5-1.

5.1.3.6 *Calculation of resident population targets factor category value.* Sum the values for the resident individual, resident population, workers, resources, and terrestrial sensitive environments factors. Do not round to the nearest integer. Assign this sum as the targets factor category value for the resident population threat. Enter this value in Table 5-1.

5.1.4 *Calculation of resident population threat score.* Multiply the values for likelihood of exposure, waste characteristics, and targets for the resident population threat, and round the product to the nearest integer. Assign this product as the resident population threat score. Enter this score in Table 5-1.

5.2 *Nearby population threat.* Include in the nearby population only those individuals who live or attend school within a 1-mile travel distance of an area of observed contamination at the site and who do not meet the criteria for resident individual as specified in section 5.1.3.

Do not consider areas of observed contamination that have an attractiveness/accessibility factor value of 0 (see section 5.2.1.1) in evaluating the nearby population threat.

5.2.1 *Likelihood of exposure.* Evaluate two factors for the likelihood of exposure factor category for the nearby population threat: attractiveness/accessibility and area of contamination.

5.2.1.1. *Attractiveness/accessibility.* Assign a value for attractiveness/accessibility from Table 5-6 to each area of observed contamination, excluding any land used for residences. Select the highest value assigned to the areas evaluated and use it as the value for the attractiveness/accessibility factor. Enter this value in Table 5-1.

5.2.1.2 *Area of contamination.* Evaluate area of contamination based on the total area of the areas of observed contamination at the site. Count only the area(s) that meet the criteria in section 5.0.1 and that receive an attractiveness/accessibility value greater than 0. Assign a value to this factor from Table 5-7. Enter this value in Table 5-1.

TABLE 5-6.—ATTRACTIVENESS/ ACCESSIBILITY VALUES

Area of observed contamination	Assigned value
Designated recreational area	100
Regularly used for public recreation (for example, fishing, hiking, softball)	75
Accessible and unique recreational area (for example, vacant lots in urban area)	75
Moderately accessible (may have some access improvements—for example, gravel road), with some public recreation use	50
Slightly accessible (for example, extremely rural area with no road improvement), with some public recreation use	25
Accessible, with no public recreation use	10
Surrounded by maintained fence or combination of maintained fence and natural barriers	5
Physically inaccessible to public, with no evidence of public recreation use	0

TABLE 5-7.—AREA OF CONTAMINATION FACTOR VALUES

Total area of the areas of observed contamination (square feet)	Assigned value
Less than or equal to 5,000	5
Greater than 5,000 to 125,000	20
Greater than 125,000 to 250,000	40
Greater than 250,000 to 375,000	60
Greater than 375,000 to 500,000	80
Greater than 500,000	100

5.2.1.3 *Likelihood of exposure factor category value.* Assign a value from Table 5-8 to the likelihood of exposure factor category, based on the values assigned to the attractiveness/accessibility and area of contamination factors. Enter this value in Table 5-1.

TABLE 5-8.—NEARBY POPULATION LIKELIHOOD OF EXPOSURE FACTOR VALUES

Area of contamination factor value	Attractiveness/accessibility factor value						
	100	75	50	25	10	5	0
100	500	500	375	250	125	50	0
80	500	375	250	125	50	25	0
60	375	250	125	50	25	5	0
40	250	125	50	25	5	5	0
20	125	50	25	5	5	5	0
5	50	25	5	5	5	5	0

5.2.2 *Waste characteristics.* Evaluate waste characteristics based on two factors: toxicity and hazardous waste quantity. Evaluate only those hazardous substances that meet the criteria for observed contamination (see section 5.0.1) at areas that can be assigned an attractiveness/accessibility factor value greater than 0.

5.2.2.1 *Toxicity.* Assign a toxicity factor value as specified in section 2.4.1.1 to each hazardous substance meeting the criteria in section 5.2.2. Use the hazardous substance with the highest toxicity factor value to assign the value to the toxicity factor for the nearby population threat. Enter this value in Table 5-1.

5.2.2.2 *Hazardous waste quantity.* Assign a value to the hazardous waste quantity factor as specified in section 5.1.2.2, except: consider only those areas of observed contamination that can be assigned an attractiveness/accessibility factor value greater than 0. Enter the value assigned in Table 5-1.

5.2.2.3 *Calculation of waste characteristics factor category value.* Multiply the toxicity and hazardous waste quantity factor values, subject to a maximum product of 1×10^8. Based on this product, assign a value from Table 2-7 (section 2.4.3.1) to the waste characteristics factor category. Enter this value in Table 5-1.

5.2.3 *Targets.* Evaluate the targets factory category for the nearby population threat based on two factors: nearby individual and population within a 1-mile travel distance from the site.

5.2.3.1 *Nearby individual.* If one or mor persons meet the section 5.1.3 criteria for a resident individual, assign this factor a value of 0. Enter this value in Table 5–1.

If no person meets the criteria for a resident individual, determine the shortest travel distance from the site to any residence or school. In determining the travel distance, measure the shortest overland distance an individual would travel from a residence or school to the nearest area of observed contamination for the site with an attractiveness/accessibility factor value greater than 0. If there are no natural barriers to travel, measure the travel distance as the shortest straight-line distance from the residence or school to the area of observed contamination. If natural barriers exist (for example, a river), measure the travel distance as the shortest straight-line distance from the residence or school to the nearest crossing point and from there as the shortest straight-line distance to the area of observed contamination. Based on the shortest travel distance, assign a value from Table 5–9 to the nearest individual factor. Enter this value in Table 5–1.

TABLE 5–9.—NEARBY INDIVIDUAL FACTOR VALUES

Travel distance for nearby individual (miles)	Assigned value
Greater than 0 to ¼	1[a]
Greater than ¼ to 1	0

[a] Assign a value of 0 if one or more persons meet the section 5.1.3 criteria for resident individual.

5.2.3.2 *Population within 1 mile.* Determine the population within each travel distance category of Table 5–10. Count residents and students who attend school within this travel distance. Do not include those people already counted in the resident population threat. Determine travel distances as specified in section 5.2.3.1.

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located.

Based on the number of people included within a travel distance category, assign a distance-weighted population value for that travel distance from Table 5–10.

Calculate the value for the population within 1 mile factor (PN) as follows:

$$PN=\frac{1}{10}\sum_{i=1}^{3} W$$

where:

W_i=Distance-weighted population value from Table 5–10 for travel distance category i.

If PN is less than 1, do not round it to the nearest integer; if PN is 1 or more, round to the nearest integer. Enter this value in Table 5–1.

5.2.3.3 *Calculation of nearby population targets factor category value.* Sum the values for the nearby individual factor and the population within 1 mile factor. Do not round this sum to the nearest integer. Assign this sum as the targets factor category value for the nearby population threat. Enter this value in Table 5–1.

TABLE 5–10.—DISTANCE-WEIGHTED POPULATION VALUES FOR NEARBY POPULATION THREAT[a]

Travel distance category (miles)	Number of people within the travel distance category											
	0	1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000
Greater than 0 to ¼	0	0.1	0.4	1.0	4	13	41	130	408	1,303	4,081	13,034
Greater than ¼ to ½	0	0.05	0.2	0.7	2	7	20	65	204	652	2,041	6,517
Greater than ½ to 1	0	0.02	0.1	0.3	1	3	10	33	102	326	1,020	3,258

[a] Round the number of people present within a travel distance category to nearest integer. Do not round the assigned distance-weighted population value to nearest integer.

5.2.4 *Calculation of nearby population threat score.* Multiply the values for likelihood of exposure, waste characteristics, and targets for the nearby population threat, and round the product to the nearest integer. Assign this product as the nearby population threat score. Enter this score in Table 5–1.

5.3 *Calculation of soil exposure pathway score.* Sum the resident population threat score and the nearby population threat score, and divide the sum by 82,500. Assign the resulting value, subject to a maximum of 100, as the soil exposure pathway score (S_s). Enter this score in Table 5–1.

6.0 *Air Migration Pathway*

Evaluate the air migration pathway based on three factor categories: likelihood of release, waste characteristics, and targets. Figure 6–1 indicates the factors included within each factor category.

Determine the air migration pathway score (S_a) in terms of the factor category values as follows:

$$S_a = \frac{(LR)(WC)(T)}{SF}$$

where:

LR=Likelihood of release factor category value.

WC=Waste characteristics factor category value.

T=Targets factor category value.

SF=Scaling factor.

Table 6–1 outlines the specific calculation procedure.

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Likelihood of Release (LR)

Observed Release
or
Potential to Release
- Gas Potential to Release
  - Gas Containment
  - Gas Source Type
  - Gas Migration Potential
- Particulate Potential to Release
  - Particulate Containment
  - Particulate Source Type
  - Particulate Migration Potential

X

Waste Characteristics (WC)

Toxicity/Mobility
- Toxicity
  - Chronic
  - Carcinogenic
  - Acute
- Mobility
  - Gaseous Mobility
  - Particulate Mobility

Hazardous Waste Quantity
- Hazardous Constituent Quantity
- Hazardous Wastestream Quantity
- Volume
- Area

X

Targets (T)

Nearest Individual

Population
- Level I Concentrations
- Level II Concentrations
- Potential Contamination

Resources

Sensitive Environments
- Actual Contamination
- Potential Contamination

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FIGURE 6-1
OVERVIEW OF AIR MIGRATION PATHWAY

TABLE 6-1.—AIR MIGRATION PATHWAY SCORESHEET

Factor categories and factors	Maximum value	Value assigned
Likelihood of Release		
1. Observed Release	550	—
2. Potential to Release:		
2a. Gas Potential to Release	500	—
2b. Particulate Potential to Release	500	—
2c. Potential to Release (higher of lines 2a and 2b)	500	—
3. Likelihood of Release (higher of lines 1 and 2c)	550	—
Waste Characteristics		
4. Toxicity/Mobility	(a)	—
5. Hazardous Waste Quantity	(a)	—
6. Waste Characteristics	100	—
Targets		
7. Nearest Individual	50	—
8. Population:		
8a. Level I Concentrations	(b)	—
8b. Level II Concentrations	(b)	—
8c. Potential Contamination	(b)	—
8d. Population (lines 8a+8b+8c)	(b)	—
9. Resources	5	—
10. Sensitive Environments		
10a. Actual Contamination	(c)	—
10b. Potential Contamination	(c)	—
10c. Sensitive Environments (lines 10a+10b)	(c)	—
11. Targets (lines 7+8d+9+10c)	(b)	—
Air Migration Pathway Score		
12. Pathway Score (S_a) [(lines 3×6×11)/82,500] [d]	100	—

[a] Maximum value applies to waste characteristics category.
[b] Maximum value not applicable.
[c] No specific maximum value applies to factor. However, pathway score based solely on sensitive environments is limited to maximum of 60.
[d] Do not round to nearest integer.

6.1 *Likelihood of Release.* Evaluate the likelihood of release factor category in terms of an observed release factor or a potential to release factor.

6.1.1 *Observed release.* Establish an observed release to the atmosphere by demonstrating that the site has released a hazardous substance to the atmosphere. Base this demonstration on either:

- Direct observation—a material (for example, particulate matter) that contains one or more hazardous substances has been seen entering the atmosphere directly. When evidence supports the inference of a release of a material that contains one or more hazardous substances by the site to the atmosphere, demonstrated adverse effects accumulated with that release may be used to establish an observed release.
- Chemical analysis—an analysis of air samples indicates that the concentration of ambient hazardous substance(s) has increased significantly above the background concentration for the site (see section 2.3). Some portion of the significant increase must be attributable to the site to establish the observed release.

If an observed release can be established, assign an observed release factor value of 550, enter this value in Table 6-1, and proceed to section 6.1.3. If an observed release cannot be established, assign an observed release factor value of 0, enter this value in Table 6-1, and proceed to section 6.1.2.

6.1.2 *Potential to release.* Evaluate potential to release only if an observed release cannot be established. Determine the potential to release factor value for the site by separately evaluating the gas potential to release and the particulate potential to release for each source at the site. Select the highest potential to release value (either gas or particulate) calculated for the sources evaluated and assign that value as the site potential to release factor value as specified below.

6.1.2.1 *Gas potential to release.* Evaluate gas potential to release for those sources that contain gaseous hazardous substances—that is, those hazardous substances with a vapor pressure greater than or equal to 10^{-9} torr.

Evaluate gas potential to release for each source based on three factors: gas containment, gas source type, and gas migration potential. Calculate the gas potential to release value as illustrated in Table 6-2. Combine sources with similar characteristics into a single source in evaluating the gas potential to release factors.

TABLE 6-2.—GAS POTENTIAL TO RELEASE EVALUATION

Source	Source type [a]	Gas containment factor value [b]	Gas source type factor value [c]	Gas migration potential factor value [d]	Sum	Gas source value
		A	B	C	(B+C)	A(B+C)
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
Gas Potential to Release Factor (Select the Highest Gas Source Value)						

[a] Enter a Source Type listed in Table 6-4.
[b] Enter Gas Containment Factor Value from section 6.1.2.1.1.
[c] Enter Gas Source Type Factor Value from section 6.1.2.1.2.
[d] Enter Gas Migration Potential Factor Value from section 6.1.2.1.3.

6.1.2.1.1 *Gas containment.* Assign each source a value from Table 6–3 for gas containment. Use the lowest value from Table 6–3 that applies to the source, except: assign a value of 10 if there is evidence of biogas release or if there is an active fire within the source.

TABLE 6–3.—GAS CONTAINMENT FACTOR VALUES

Gas containment description	Assigned value
All situations except those specifically listed below	10
Evidence of biogas release	10 [a]
Active fire within source	10 [a]
Gas collection/treatment system functioning, regularly inspected, maintained, and completely covering source	0
Source substantially surrounded by engineering windbreak and no other containment specifically described in this table applies	7
Source covered with essentially impermeable, regularly inspected, maintained cover	0
Uncontaminated soil cover >3 feet:	
• Source substantially vegetated with little exposed soil	0
• Source lightly vegetated with much exposed soil	3
• Source substantially devoid of vegetation	7
Uncontaminated soil cover ≥1 foot and ≥3 feet:	
• Source heavily vegetated with essentially no exposed soil	
—Cover soil type resistant to gas migration [b]	3
—Cover soil type not resistant to gas migration [b] or unknown	7
• Source substantially vegetated with little exposed soil and cover soil type resistant to gas migration [b]	7
• Other	10
Uncontaminated soil cover <1 foot:	
• Source heavily vegetated with essentially no exposed soil and cover soil type resistant to gas migration [b]	7
• Other	10
Totally or partially enclosed within structurally intact building and no other containment specifically described in this table applies	7
Source consists solely of intact, sealed containers:	
• Totally protected from weather by regularly inspected, maintained cover	0
• Other	3

[a] This value must be used if applicable.

[b] *Consider moist fine-grained and saturated coarse-grained soils resistant to gas migration. Consider all other soils nonresistant.*

6.1.2.1.2 *Gas source type.* Assign a value for gas source type to each source as follows:

- Determine if the source meets the minimum size requirement based on the source hazardous waste quantity value (see section 2.4.2.1.5). If the source receives a source hazardous waste quantity value of 0.5 or more, consider the source to meet the minimum size requirement.
- If the source meets the minimum size requirement, assign it a value from Table 6–4 for gas source type.
- If the source does not meet the minimum size requirement, assign it a value of 0 for gas source type.

If no source at the site meets the minimum size requirement, assign each source at the site a value from Table 6–4 for gas source type.

TABLE 6–4.—SOURCE TYPE FACTOR VALUES

Source type	Assigned value	
	Gas	Particulate
Active fire area	14	30
Burn pit	19	22
Containers or tanks (buried/below-ground):		
• Evidence of biogas release	33	22
• No evidence of biogas release	11	22
Containers or tanks, not elsewhere specified	28	14
Contaminated soil (excluding land treatment)	19	22
Landfarm/land treatment	28	22

TABLE 6–4.—SOURCE TYPE FACTOR VALUES—Concluded

Source type	Assigned value	
	Gas	Particulate
Landfill:		
• Evidence of biogas release	33	22
• No evidence of biogas release	11	22
Pile:		
• Tailings pile	6	28
• Scrap metal or junk pile	6	17
• Trash pile	6	6
• Chemical waste pile	11	28
• Other waste piles	17	28
Surface impoundments (buried/backfilled):		
• Evidence of biogas release	33	22
• No evidence of biogas release	11	22
Surface impoundment (not buried/backfilled):		
• Dry	19	22
• Other	28	0
Other types of sources, not elsewhere specified	0	0

6.1.2.1.3 *Gas migration potential.* Evaluate this factor for each source as follows:

- Assign a value for gas migration potential to each of the gaseous hazardous substances associated with the source (see section 2.2.2) as follows:
  - –Assign values from Table 6–5 for vapor pressure and Henry's constant to each hazardous substance. If Henry's constant cannot be determined for a hazardous substance, assign that hazardous substance a value of 2 for the Henry's constant component.
  - –Sum the two values assigned to the hazardous substance.
  - –Based on this sum, assign the hazardous substance a value from Table 6–6 for gas migration potential.
- Assign a value for gas migration potential to each source as follows:
  - –Select three hazardous substances associated with the source:
    - – –If more than three gaseous hazardous substances can be associated with the source, select three that have the highest gas migration potential values.
    - – –If fewer than three gaseous hazardous substances can be associated with a source, select all of them.
  - –Average the gas migration potential values assigned to the selected hazardous substances.
  - –Based on this average value, assign the source a gas migration potential value from Table 6–7.

TABLE 6–5.—VALUES FOR VAPOR PRESSURE AND HENRY'S CONSTANT

Vapor pressure (Torr)	Assigned value
Greater than 10	3
Greater than 10^{-3} to 10	2
10^{-5} to 10^{-3}	1
Less than 10^{-5}	0

Henry's constant (atm-m³/mol)	Assigned value
Greater than 10^{-3}	3
Greater than 10^{-5} to 10^{-3}	2
10^{-7} to 10^{-5}	1
Less than 10^{-7}	0

TABLE 6-6.—GAS MIGRATION POTENTIAL VALUES FOR A HAZARDOUS SUBSTANCE

Sum of values for vapor pressure and Henry's constant	Assigned value
0	0
1 or 2	6
3 or 4	11
5 or 6	17

TABLE 6-7.—GAS MIGRATION POTENTIAL VALUES FOR THE SOURCE

Average of gas migration potential values for three hazardous substances [a]	Assigned value
0 to < 3	0
3 to < 8	6
8 to < 14	11
14 to 17	17

[a] If fewer than three hazardous substances can be associated with the source, compute the average based only on those hazardous substances that can be associated.

6.1.2.1.4 *Calculation of gas potential to release value.* Determine the gas potential to release value for each source as illustrated in Table 6-2. For each source, sum the gas source type factor value and gas migration potential factor value and multiply this sum by the gas containment factor value. Select the highest product calculated for the sources evaluated and assign it as the gas potential to release value for the site. Enter this value in Table 6-1.

6.1.2.2 *Particulate potential to release.* Evaluate particulate potential to release for those sources that contain particulate hazardous substances—that is, those hazardous substances with a vapor pressure less than or equal to 10^{-1} torr.

Evaluate particulate potential to release for each source based on three factors: particulate containment, particulate source type, and particulate migration potential. Calculate the particulate potential to release value as illustrated in Table 6-8. Combine sources with similar characteristics into a single source in evaluating the particulate potential to release factors.

6.1.2.2.1 *Particulate containment.* Assign each source a value from Table 6-9 for particulate containment. Use the lowest value from Table 6-9 that applies to the source.

6.1.2.2.2 *Particulate source type.* Assign a value for particulate source type to each source in the same manner as specified for gas sources in section 6.1.2.1.2.

6.1.2.2.3 *Particulate migration potential.* Based on the site location, assign a value from Figure 6-2 for particulate migration potential. Assign this same value to each source at the site.

TABLE 6-8.—PARTICULATE POTENTIAL TO RELEASE EVALUATION

Source	Source type [a]	Particulate containment factor value [b]	Particulate type factor value [c]	Particulate migration potential factor value [d]	Sum	Particulate source value
		A	B	C	(B+C)	A (B+C)
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
Particulate Potential to Release Factor Value (Select Highest Particulate Source Value)						

[a] Enter a Source Type listed in Table 6-4.
[b] Enter Particulate Containment Factor Value from section 6.1.2.2.1.
[c] Enter Particulate Source Type Factor Value from section 6.1.2.2.2.
[d] Enter Particulate Migration Potential Factor Value from section 6.1.2.2.3.

TABLE 6-9.—PARTICULATE CONTAINMENT FACTOR VALUES

Particulate containment description	Assigned value
All situations except those specifically listed below	10
Source contains only particulate hazardous substances totally covered by liquids	0
Source substantially surrounded by engineered windbreak and no other containment specifically described in this table applies	7
Source covered with essentially impermeable, regularly inspected, maintained cover	0
Uncontaminated soil cover > 3 feet:	
• Source substantially vegetated with little or no exposed soil	0
• Source lightly vegetated with much exposed soil	3
• Source substantially devoid of vegetation	7
Uncontaminated soil cover ≥ 1 foot and ≤ 3 feet:	
• Source heavily vegetated with essentially no exposed soil:	
—Cover soil type resistant to gas migration [a]	3
—Cover soil type not resistant to gas migration [a] or unknown	7
• Source substantially vegetated with little exposed soil and cover soil type resistant to gas migration [a]	7
• Other	10
Uncontaminated soil cover < 1 foot:	
• Source heavily vegetated with essentially no exposed soil and cover soil type resistant to gas migration [a]	7
• Other	10
Totally or partially enclosed within structurally intact building and no other containment specifically described in this table applies	7
Source consists solely of containers:	
• All containers contain only liquids	0
• All containers intact, sealed, and totally protected from weather by regularly inspected, maintained cover	0
• All containers intact and sealed	3
• Other	10

[a] Consider moist fine-grained and saturated coarse-grained soils resistant to gas migration. Consider all other soils nonresistant.

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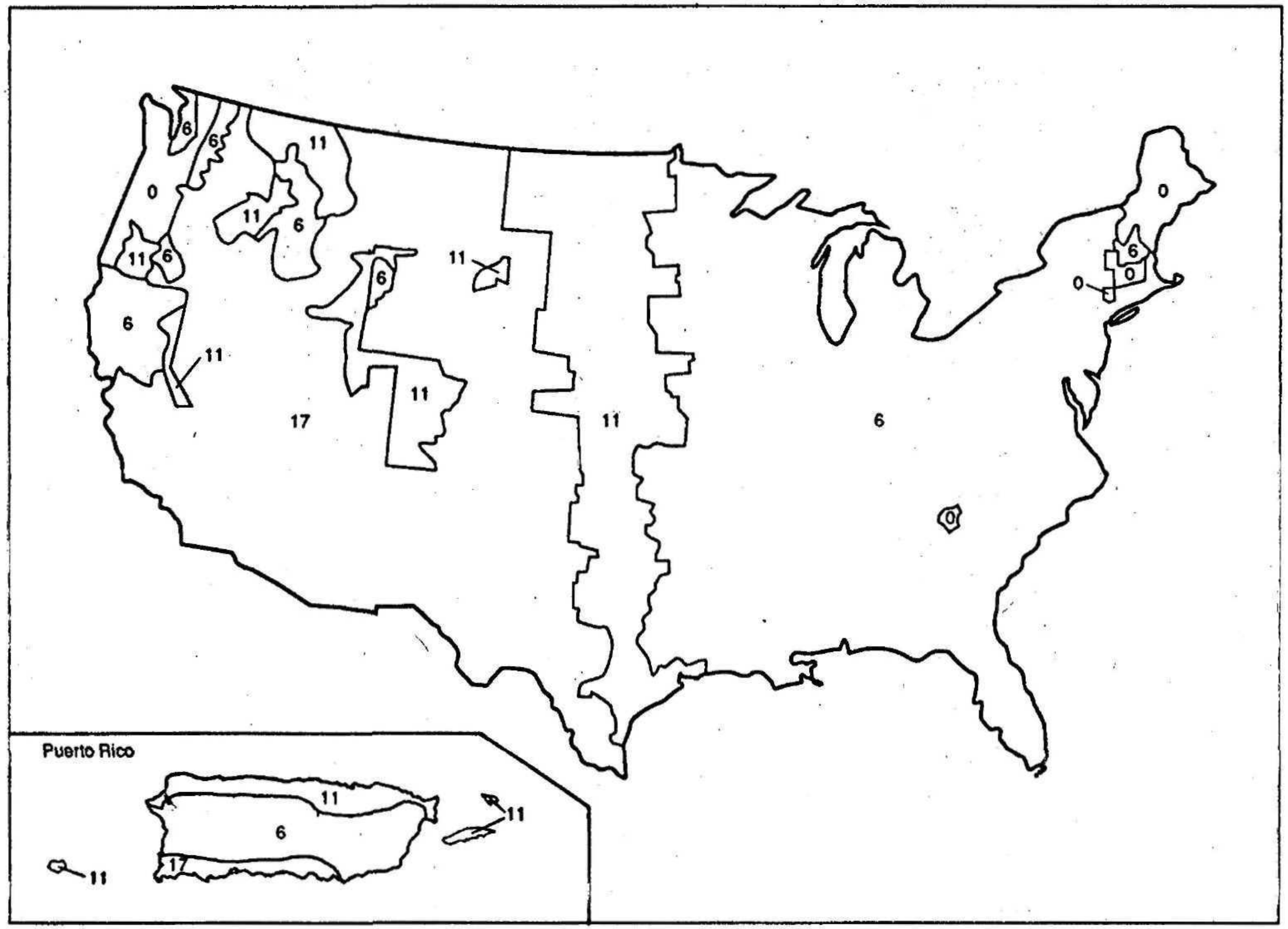

FIGURE 6-2
PARTICULATE MIGRATION POTENTIAL FACTOR VALUES

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FIGURE 6-2.—PARTICULATE MIGRATION POTENTIAL FACTOR VALUES—CONCLUDED

Location	Particulate migration potential assigned value
Hawaiian Islands	
Hilo, Hawaii	0
Honolulu, Oahu	17
Kahului, Maui	17
Lanai	17
Lihue, Kauai	11
Molokai	17
Pacific Islands	
Guam	6
Johnston Island	17
Koror Island	0
Kwajalein Island	6
Mujuro, Marshall Islands	0
Pago Pago, American Samoa	0
Ponape Island	0
Truk, Caroline Islands	0
Wake Island	17
Yap Island	0
Alaska	
Anchorage	17
Annette	0
Barrow	17
Barter Island	17
Bethel	17
Bettles	17
Big Delta	17
Cold Bay	6
Fairbanks	17
Gulkana	17
Homer	11
Juneau	0
King Salmon	11
Kodiak	0
Kutzebue	17
McGrath	17
Nome	11
St. Paul Island	11
Talkeetna	6
Unalakleet	17
Valdez	0
Yakutat	0
American Virgin Islands	
St. Croix	17
St. John	11
St. Thomas	11
Puerto Rico	
Arecibo	6
Coloso	6
Fajardo	11
Humacao	6
Isabela Station	11
Ponce	17
San Juan	11

For site locations not on Figure 6-2, and for site locations near the boundary points on Figure 6-2, assign a value as follows. First, calculate a Thornthwaite P-E index using the following equation:

$$PE = \sum_{i=1}^{12} 115\,[P_i/(T_i-10)]^{10/9}$$

where:

PE=Thornthwaite P-E index.

P_i=Mean monthly precipitation for month i, in inches.

T_i=Mean monthly temperature for month i, in degrees Fahrenheit; for any month having a mean monthly temperature less than 28.4 °F, use 28.4 °F.

Based on the calculated Thornthwaite P-E index, assign a source particulate migration potential value to the site from Table 6-10. Assign this same value to each source at the site.

TABLE 6-10.—PARTICULATE MIGRATION POTENTIAL VALUES

Thornthwaite P-E Index	Assigned value
Greater than 150	0
85 to 150	6
50 to less than 85	11
Less than 50	17

6.1.2.2.4 *Calculation of particulate potential to release value.* Determine the particulate potential to release value for each source as illustrated in Table 6-8. For each source, sum its particulate source type factor value and particulate migration potential factor value and multiply this sum by its particulate containment factor value. Select the highest product calculated for the sources evaluated and assign it as the particulate potential to release value for the site. Enter the value in Table 6-1.

6.1.2.3 *Calculation of potential to release factor value for the site.* Select the higher of the gas potential to release value assigned in section 6.1.2.1.4 and the particulate potential to release value assigned in section 6.1.2.2.4. Assign the value selected as the site potential to release factor value. Enter this value in Table 6-1.

6.1.3 *Calculation of likelihood of release factor category value.* If an observed release is established, assign the observed release factor value of 550 as the likelihood of release factor category value. Otherwise, assign the site potential to release factor value as the likelihood of release factor category value. Enter the value in Table 6-1.

6.2 *Waste characteristics.* Evaluate the waste characteristics factor category based on two factors: toxicity/mobility and hazardous waste quantity. Evaluate only those hazardous substances available to migrate from the sources at the site to the atmosphere. Such hazardous substances include:

- Hazardous substances that meet the criteria for an observed release to the atmosphere.
- All gaseous hazardous substances associated with a source that has a gas containment factor value greater than 0 (see section 2.2.2, 2.2.3, and 6.1.2.1.1).
- All particulate hazardous substances associated with a source that has a particulate containment factor value greater than 0 (see section 2.2.2, 2.2.3, and 6.1.2.2.1).

6.2.1 *Toxicity/mobility.* For each hazardous substance, assign a toxicity factor value, a mobility factor value, and a combined toxicity/mobility factor value as specified below. Select the toxicity/mobility factor value for the air migration pathway as specified in section 6.2.1.3.

6.2.1.1 *Toxicity.* Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

6.2.1.2 *Mobility.* Assign a mobility factor value to each hazardous substance as follows:

- Gaseous hazardous substance.
  - –Assign a mobility factor value of 1 to each gaseous hazardous substance that meets the criteria for an observed release to the atmosphere.
  - –Assign a mobility factor value from Table 6-11, based on vapor pressure, to each gaseous hazardous substance that does not meet the criteria for an observed release.
- Particulate hazardous substance.
  - –Assign a mobility factor value of 0.02 to each particulate hazardous substance that meets the criteria for an observed release to the atmosphere.
  - –Assign a mobility factor value from Figure 6-3, based on the site's location, to each particulate hazardous substance that does not meet the criteria for an observed release. (Assign all such particulate hazardous substances this same value.)
  - –For site locations not on Figure 6-3 and for site locations near the boundary points on Figure 6-3, assign a mobility factor value to each particulate hazardous substance that does not meet the criteria for an observed release as follows:
  - –Calculate a value M:

$$M=0.0182\,(U^3/[PE]^2)$$

where:

U=Mean average annual wind speed (meters per second).

PE=Thornthwaite P-E index from section 6.1.2.2.3.

  - –Based on the value M, assign a mobility factor value from Table 6-12 to each particulate hazardous substance.
- Gaseous and particulate hazardous substances.
  - –For a hazardous substance potentially present in both gaseous and particulate forms, select the higher of the factor values for gas mobility and particulate mobility for that substance and assign that value as the mobility factor value for the hazardous substance.

6.2.1.3 *Calculation of toxicity/mobility factor value.* Assign each hazardous substance a toxicity/mobility factor value from Table 6-13, based on the values assigned to the hazardous substance for the toxicity and mobility factors. Use the hazardous substance with the highest toxicity/mobility factor value to assign a value to the toxicity/mobility factor for the air migration pathway. Enter this value in Table 6-1.

TABLE 6-11.—GAS MOBILITY FACTOR VALUES

Vapor pressure (Torr)	Assigned value [a]
Greater than 10^{-1}	1.0
Greater than 10^{-3} to 10^{-1}	0.2
Greater than 10^{-5} to 10^{-3}	0.02
Greater than 10^{-7} to 10^{-5}	0.002
Less than or equal to 10^{-7}	0.0002

[a] Do not round to nearest integer.

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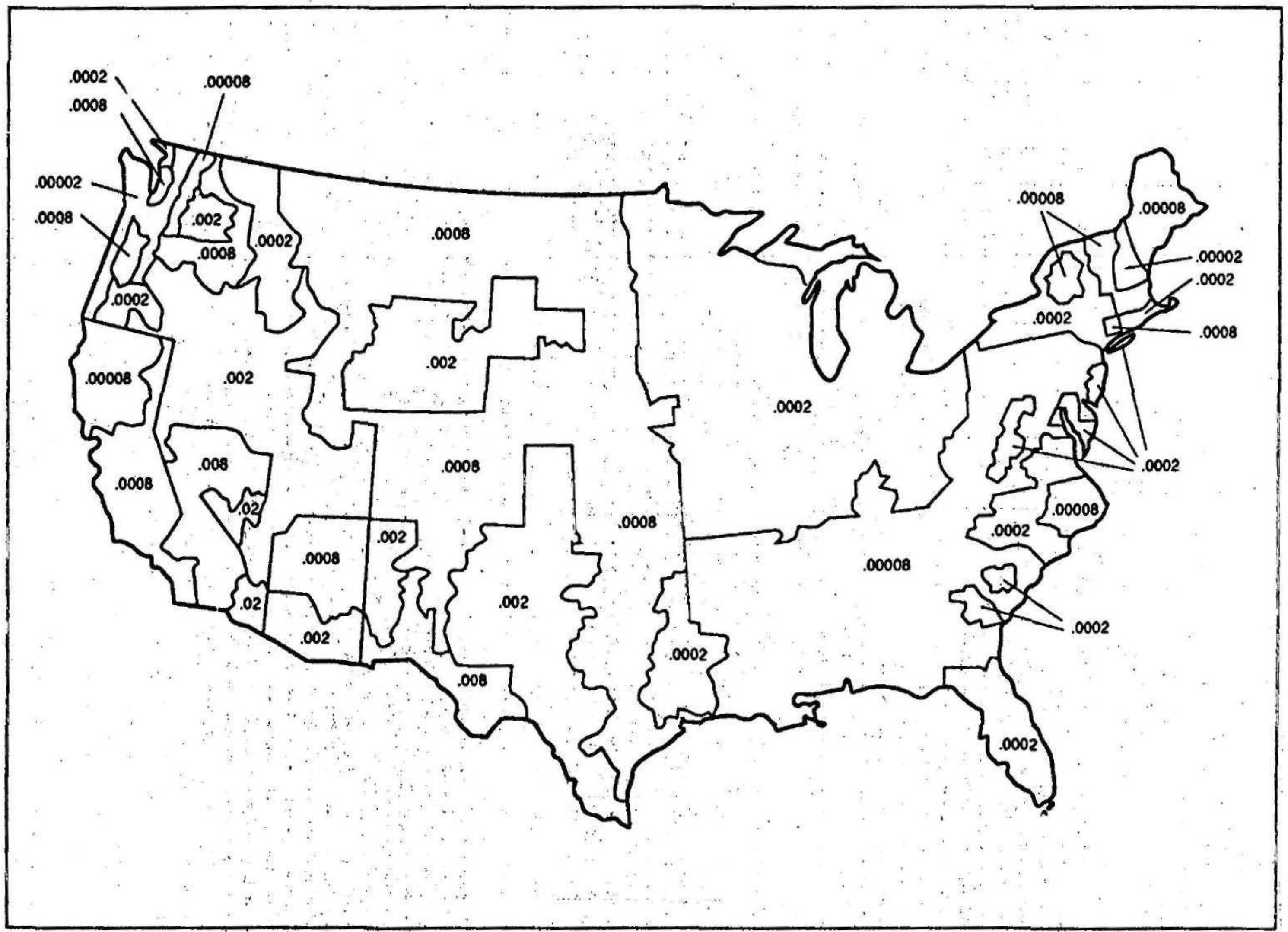
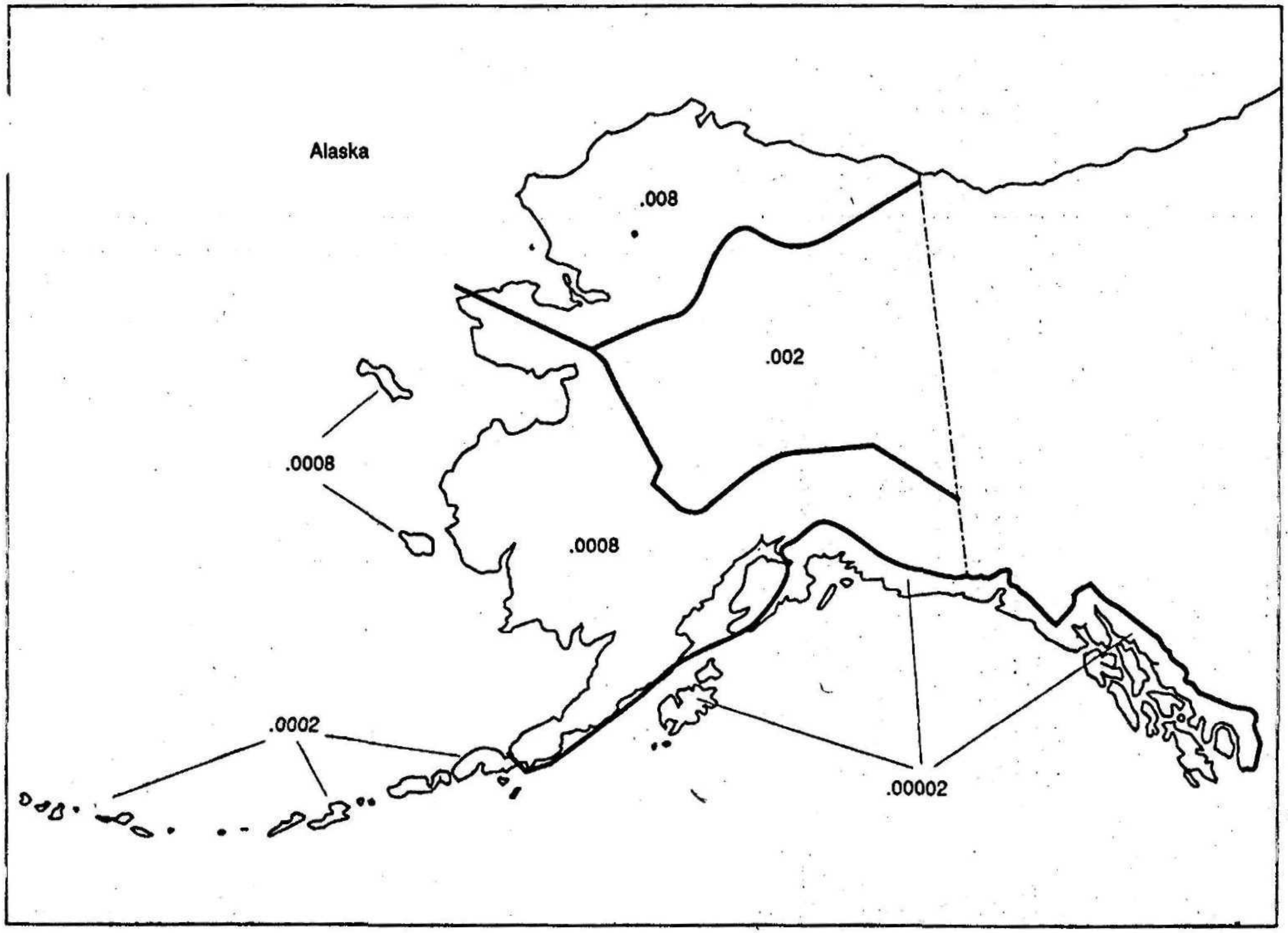


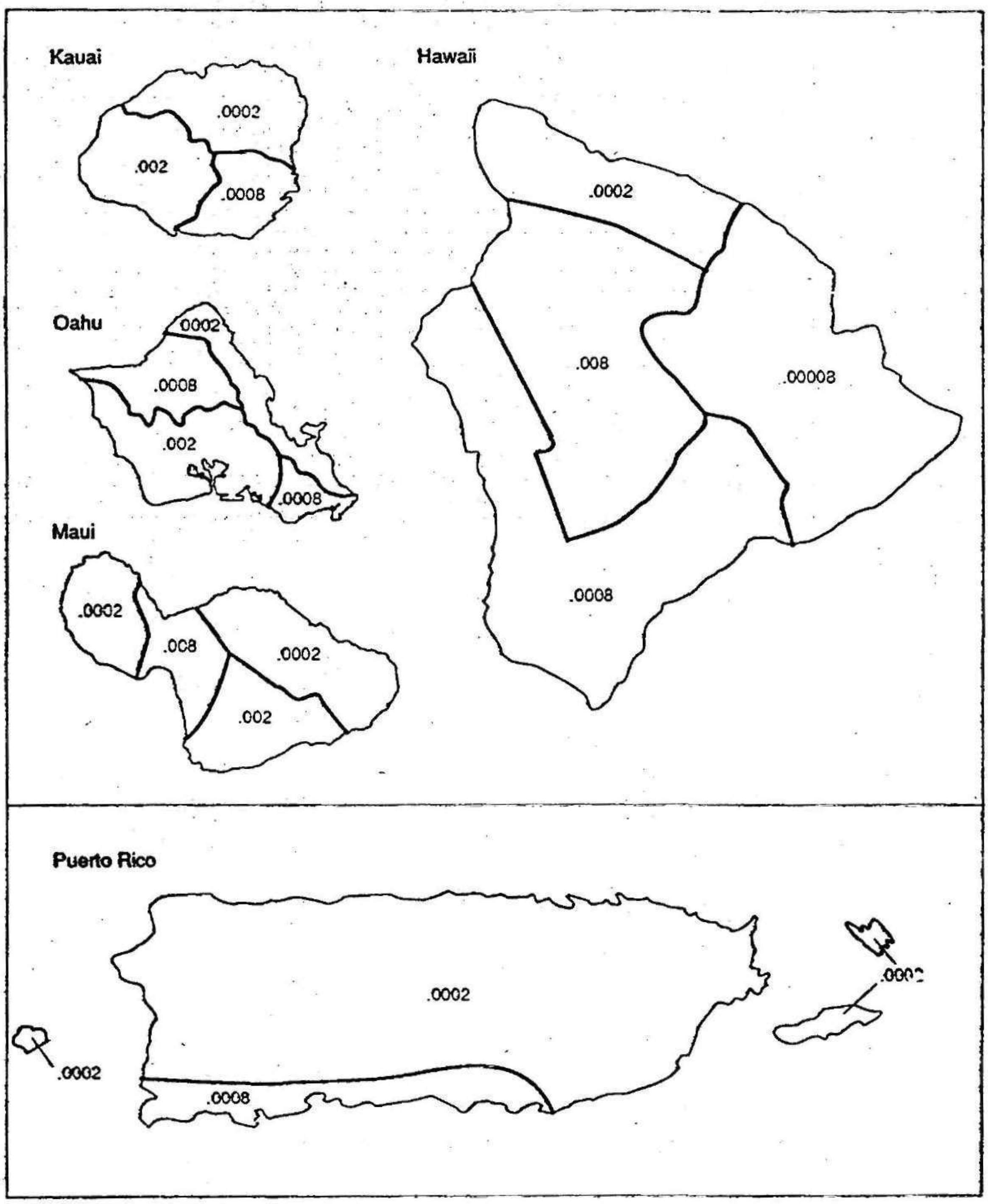
FIGURE 6-3
PARTICULATE MOBILITY FACTOR VALUES[a]

[a] Do not round to nearest integer.



[a] Do not round to nearest integer.

FIGURE 6-3
PARTICULATE MOBILITY FACTOR VALUES[a]
(CONTINUED)



[a] Do not round to nearest integer.

FIGURE 6-3
PARTICULATE MOBILITY FACTOR VALUES[a]
(CONTINUED)

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FIGURE 6-3. PARTICULATE MOBILITY FACTOR VALUES—CONTINUED

Location	Particulated mobility assigned value
Pacific Islands	
Guam	0.0002
Johnston Island	0.002
Koror Island	0.00008
Kwajalein Island	0.0002
Mujuro, Marshall Islands	0.00008
Pago Pago, American Samoa	0.00008
Ponape Island	0.00002
Truk, Caroline Islands	0.00008
Wake Island	0.002
Yap Island	0.00008

FIGURE 6-3.—PARTICULATE MOBILITY FACTOR VALUES—CONCLUDED

Location	Particulated mobility assigned value
American Virgin Islands	
St. Croix	0.0008
St. John	0.0002
St. Thomas	0.0002

TABLE 6-12.—PARTICULATE MOBILITY FACTOR VALUES

M	Assigned value[a]
Greater than 1.4×10^{-2}	0.02
Greater than 4.4×10^{-3} to 1.4×10^{-2}	0.008
Greater than 1.4×10^{-3} to 4.4×10^{-3}	0.002
Greater than 4.4×10^{-4} to 1.4×10^{-3}	0.0008
Greater than 1.4×10^{-4} to 4.4×10^{-4}	0.0002
Greater than 4.4×10^{-5} to 1.4×10^{-4}	0.00008
Less than or equal to 4.4×10^{-5}	0.00002

[a] Do not round to nearest integer.

TABLE 6-13.—TOXICITY/MOBILITY FACTOR VALUES[a]

Mobility factor value	Toxicity factor value					
	10,000	1,000	100	10	1	0
1.0	10,000	1,000	100	10	1	0
0.2	2,000	200	20	2	0.2	0
0.02	200	20	2	0.2	0.02	0
0.008	80	8	0.8	0.08	0.008	0
0.002	20	2	0.2	0.02	0.002	0
0.0008	8	0.8	0.08	0.008	0.0008	0
0.0002	2	0.2	0.02	0.002	0.0002	0
0.00008	0.8	0.08	0.008	0.0008	0.00008	0
0.00002	0.2	0.02	0.002	0.0002	0.00002	0

[a] Do not round to nearest integer.

6.2.2 *Hazardous waste quantity.* Assign a hazardous waste quantity factor value for the air migration pathway as specified in section 2.4.2. Enter this value in Table 6-1.

6.2.3 *Calculation of waste characteristics factor category value.* Multiply the toxicity/mobility factor value and the hazardous waste quantity factor value, subject to a maximum product of 1×10^8. Based on this product, assign a value from Table 2-7 (section 2.4.3.1) to the waste characteristics factor category. Enter this value in Table 6-1.

6.3 *Targets.*

Evaluate the targets factor category based on four factors: nearest individual, population, resources, and sensitive environments. Include only those targets (for example, individuals, sensitive environments) located within the 4-mile target distance limit, except: if an observed release is established beyond the 4-mile target distance limit, include those additional targets that are specified below in this section and in section 6.3.4.

Evaluate the nearest individual and population factors based on whether the target populations are subject to Level I concentrations, Level II concentrations, or potential contamination. Determine which applies to a target population as follows.

If no samples meet the criteria for an observed release to air and if there is no observed release by direct observation, consider the entire population within the 4-mile target distance limit to be subject to potential contamination.

If one or more samples meet the criteria for an observed release to air or if there is an observed release by direct observation, evaluate the population as follows:

- Determine the most distant sample location that meets the criteria for Level I concentrations as specified in sections 2.5.1 and 2.5.2 and the most distant location (that is, sample location or direct observation location) that meets the criteria for Level II concentrations. Use the health-based benchmarks from Table 6-14 in determining the level of contamination for sample locations. If the most distant Level II location is closer to a source than the most distant Level I sample location, do not consider the Level II location.
- Determine the single most distant location (sample location or direct observation location) that meets the criteria for Level I or Level II concentrations.
- If this single most distant location is within the 4-mile target distance limit, identify the distance categories from Table 6-15 in which the selected Level I concentrations sample and Level II concentrations sample (or direct observation location) are located:
  - –Consider the target population anywhere within this furthest Level I distance category, or anywhere within a distance category closer to a source at the site, as subject to Level I concentrations.
  - –Consider the target population located beyond any Level I distance categories, up to and including the population anywhere within the furthest Level II distance category, as subject to Level II concentrations.
  - –Consider the remainder of the target population within the 4-mile target distance limit as subject to potential contamination.
- If the single most distant location is beyond the 4-mile target distance limit, identify the distance at which the selected Level I concentrations sample and Level II concentrations sample (or direct observation location) are located:
  - –If the Level I sample location is within the 4-mile target distance limit, identify the target population subject to Level I concentrations as specified above.
  - –If the Level I sample location is beyond the 4-mile target distance limit, consider the target population located anywhere within a distance from the sources at the site equal to the distance to this sample location to be subject to Level I concentrations and include them in the evaluation.
  - –Consider the target population located beyond the Level I target population, but located anywhere within a distance from the sources at the site equal to the distance to the selected Level II location, to be subject to Level II concentrations and include them in the evaluation.

–Do not include any target population as subject to potential contamination.

TABLE 6-14.—HEALTH-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN AIR

- Concentration corresponding to National Ambient Air Quality Standard (NAAQS).
- Concentration corresponding to National Emission Standards for Hazardous Air Pollutants (NESHAPs).
- Screening concentration for cancer corresponding to that concentration that corresponds to the 10^{-6} individual cancer risk for inhalation exposures.
- Screening concentration for noncancer toxicological responses corresponding to the Reference Dose (RfD) for inhalation exposures.

TABLE 6-15.—AIR MIGRATION PATHWAY DISTANCE WEIGHTS

Distance category (miles)	Assigned distance weight[a]
0	1.0
Greater than 0 to ¼	0.25
Greater than ¼ to ½	0.054
Greater than ½ to 1	0.016
Greater than 1 to 2	0.0051
Greater than 2 to 3	0.0023
Greater than 3 to 4	0.0014
Greater than 4	0

[a] Do not round to nearest integer.

6.3.1 *Nearest individual.* Assign the nearest individual factor a value as follows:

- If one or more residences or regularly occupied buildings or areas is subject to Level I concentrations as specified in section 6.3, assign a value of 50.
- If not, but if one or more a residences or regularly occupied buildings or areas is subject to Level II concentrations, assign a value of 45.
- If none of the residences and regularly occupied buildings and areas is subject to Level I or Level II concentrations, assign a value to this factor based on the shortest distance to any residence or regularly occupied building or area, as measured from any source at the site with an air migration containment factor value greater than 0. Based on this shortest distance, assign a value from Table 6-16 to the nearest individual factor.

Enter the value assigned in Table 6-1.

TABLE 6-16.—NEAREST INDIVIDUAL FACTOR VALUES

Distance to nearest individual (miles)	Assigned value
Level I concentrations[a]	50
Level II concentrations[a]	45
0 to ⅛	20
Greater than ⅛ to ¼	7
Greater than ¼ to 1/2	2
Greater than ½ to 1	1
Greater than 1	0

[a] Distance does not apply.

6.3.2 *Population.* In evaluating the population factor, count residents, students, and workers regularly present within the target distance limit. Do not count transient populations such as customers and travelers passing through the area.

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located.

6.3.2.1 *Level of contamination.* Evaluate the population factor based on three factors: Level I concentrations, Level II concentrations, and potential contamination.

Evaluate the population subject to Level I concentrations (see section 6.3) as specified in section 6.3.2.2, the population subject to Level II concentrations as specified in section 6.3.2.3, and the population subject to potential contamination as specified in section 6.3.2.4.

For the potential contamination factor, use population ranges in evaluating the factor as specified in section 6.3.2.4. For the Level I and Level II concentrations factors, use the population estimate, not population ranges, in evaluating both factors.

6.3.2.2 *Level I concentrations.* Sum the number of people subject to Level I concentrations. Multiply this sum by 10. Assign the product as the value for this factor. Enter this value in Table 6-1.

6.3.2.3 *Level II concentrations.* Sum the number of people subject to Level II concentrations. Do not include those people already counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in Table 6-1.

6.3.2.4 *Potential contamination.* Determine the number of people within each distance category of the target distance limit (see Table 6-15) who are subject to potential contamination. Do not include those people already counted under the Level I and Level II concentrations factors.

Based on the number of people present within a distance category, assign a distance-weighted population value for that distance category from Table 6-17. (Note that the distance-weighted population values in Table 6-17 incorporate the distance weights from Table 6-15. Do not multiply the values from Table 6-17 by these distance weights.)

Calculate the potential contamination factor value (PI) as follows:

$$PI = \frac{1}{10} \sum_{i=1}^{n} W_i$$

where:

W_i = Distance-weighted population from Table 6-17 for distance category i.

n = Number of distance categories.

If PI is less than 1, do not round it to the nearest integer; if PI is 1 or more, round to the nearest integer. Enter this value in Table 6-1.

6.3.2.5 *Calculation of population factor value.* Sum the factor values for Level I concentrations, Level II concentrations, and potential contamination. Do not round this sum to the nearest integer. Assign this sum as the population factor value. Enter this value in Table 6-1.

TABLE 6-17.—DISTANCE-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FACTOR FOR AIR PATHWAY[a]

Distance category (miles)	Number of people within the distance category												
	0	1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,001 to 3,000,000
On a source	0	4	17	53	164	522	1,633	5,214	16,325	52,137	163,246	521,360	1,632,455
Greater than 0 to ¼	0	1	4	13	41	131	408	1,304	4,081	13,034	40,812	130,340	408,114
Greater than ¼ to ½	0	0.2	0.9	3	9	28	88	282	882	2,815	8,815	28,153	88,153
Greater than ½ to 1	0	0.06	0.3	0.9	3	8	26	83	261	834	2,612	8,342	26,119
Greater than 1 to 2	0	0.02	0.09	0.3	0.8	3	8	27	83	266	833	2,659	8,326
Greater than 2 to 3	0	0.009	0.04	0.1	0.4	1	4	12	38	120	375	1,199	3,755
Greater than 3 to 4	0	0.005	0.02	0.07	0.2	0.7	2	7	23	73	229	730	2,285

[a] Round the number of people present within a distance category to nearest integer. Do not round the assigned distance-weighted population value to nearest integer.

6.. 3 *Resources.* Evaluate the resources factor as follows:

- Assign a value of 5 if one or more of the following resources are present within one-half mile of a source at the site having an air migration containment factor value greater than 0:

–Commercial agriculture.
–Commercial silviculture.
–Major or designated recreation area.

- Assign a value of 0 if none of these resources is present.

Enter the value assigned in Table 6–1.

6.3.4 *Sensitive environments.* Evaluate sensitive environments based on two factors: actual contamination and potential contamination. Determine which factor applies as follows.

If no samples meet the criteria for an observed release to air and if there is no observed release by direct observation, consider all sensitive environments located, partially or wholly, within the target distance limit to be subject to potential contamination.

If one or more samples meet the criteria for an observed release to air or if there is an observed release by direct observation, determine the most distant location (that is, sample location or direct observation location) that meets the criteria for an observed release:

- If the most distant location meeting the criteria for an observed release is within the 4-mile target distance limit, identify the distance category from Table 6–15 in which it is located:
  –Consider sensitive environments located, partially or wholly, anywhere within this distance category or anywhere within a distance category closer to a source at the site as subject to actual contamination.
  –Consider all other sensitive environments located, partially or wholly, within the target distance limit as subject to potential contamination.
- If the most distant location meeting the criteria for an observed release is beyond the 4-mile target distance limit, identify the distance at which it is located:
  –Consider sensitive environments located, partially or wholly, anywhere within a distance from the sources at the site equal to the distance to this location to be subject to actual contamination and include all such sensitive environments in the evaluation.
  –Do not include any sensitive environments as subject to potential contamination.

6.3.4.1 *Actual contamination.* Determine those sensitive environments subject to actual contamination (i.e., those located partially or wholly within a distance category subject to actual contamination). Assign value(s) from Table 4–23 (section 4.1.4.3.1.1) to each sensitive environment subject to actual contamination.

For those sensitive environments that are wetlands, assign an additional value from Table 6–18. In assigning a value from Table 6–18, include only those portions of wetlands located within distance categories subject to actual contamination. If a wetland is located partially in a distance category subject to actual contamination and partially in one subject to potential contamination, then solely for purposes of Table 6–18, count the portion in the distance category subject to potential contamination under the potential contamination factor in section 6.3.4.2. Determine the total acreage of wetlands within those distance categories subject to actual contamination and assign a value from Table 6–18 based on this total acreage.

Calculate the actual contamination factor value (EA) as follows:

$$EA = WA + \sum_{i=1}^{n} S_i$$

where:

WA = Value assigned from Table 6–18 for wetlands in distance categories subject to actual contamination.
S_i = Value(s) assigned from Table 4–23 to sensitive environment i.
n = Number of sensitive environments subject to actual contamination.

Enter the value assigned in Table 6–1.

TABLE 6–18.—WETLANDS RATING VALUES FOR AIR MIGRATION PATHWAY [a]

Wetland area (acres)	Assigned value
Less than 1	0
1 to 50	25
Greater than 50 to 100	75
Greater than 100 to 150	125
Greater than 150 to 200	175
Greater than 200 to 300	250
Greater than 300 to 400	350
Greater than 400 to 500	450
Greater than 500	500

[a] Wetlands as defined in 40 CFR section 230.3.

6.3.4.2 *Potential contamination.* Determine those sensitive environments located, partially or wholly, within the target distance limit that are subject to potential contamination. Assign value(s) from Table 4–23 to each sensitive environment subject to potential contamination. Do not include those sensitive environments already counted for Table 4–23 under the actual contamination factor.

For each distance category subject to potential contamination, sum the value(s) assigned from Table 4–23 to the sensitive environments in that distance category. If a sensitive environment is located in more than one distance category, assign the sensitive environment only to that distance category having the highest distance weighting value from Table 6–15.

For those sensitive environments that are wetlands, assign an additional value from Table 6–18. In assigning a value from Table 6–18, include only those portions of wetlands located within distance categories subject to potential contamination, as specified in section 6.3.4.1. Treat the wetlands in each separate distance category as separate sensitive environments solely for purposes of applying Table 6–18. Determine the total acreage of wetlands within each of these distance categories and assign a separate value from Table 6–18 for each distance category.

Calculate the potential contamination factor value (EP) as follows:

$$EP = \frac{1}{10} \sum_{j=1}^{m} ([W_j + S_j]D_j)$$

Where:

$$S_j = \sum_{i=1}^{n} S_{ij}$$

S_{ij} = Value(s) assigned from Table 4–23 to sensitive environment in distance category j.
n = Number of sensitive environments subject to potential contamination.
W_j = Value assigned from Table 6–18 for wetland area in distance category j.
D_j = Distance weight from Table 6–15 for distance category j.
m = Number of distance categories subject to potential contamination.

If EP is less than 1, do not round it to the nearest integer; if EP is 1 or more, round to the nearest integer. Enter the value assigned in Table 6–1.

6.3.4.3 *Calculation of sensitive environments factor value.* Sum the factor values for actual contamination and potential contamination. Do not round this sum, designated as EB, to the nearest integer.

Because the pathway score based solely on sensitive environments is limited to a maximum of 60, use the value EB to determine the value for the sensitive environments factor as follows:

- Multiply the values assigned to likelihood of release (LR), waste characteristics (WC), and EB. Divide the product by 82,500.
  –If the result is 60 or less, assign the value EB as the sensitive environments factor value.
  –If the result exceeds 60, calculate a value EC as follows:

$$EC = \frac{(60)(82{,}500)}{(LR)(WC)}$$

Assign the value EC as the sensitive environments factor value. Do not round this value to the nearest integer.

Enter the value assigned for the sensitive environments factor in Table 6–1.

6.3.5 *Calculation of targets factor category value.* Sum the nearest individual, population, resources, and sensitive environments factor values. Do not round this sum to the nearest integer. Assign this sum as the targets factor category value. Enter this value in Table 6–1.

6.4 *Calculation of air migration pathway score.* Multiply the values for likelihood of release, waste characteristics, and targets, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum value of 100, as the air migration pathway score (S_a). Enter this score in Table 6–1.

7.0 Sites Containing Radioactive Substances.

In general, radioactive substances are hazardous substances under CERCLA and should be considered in HRS scoring. Releases of certain radioactive substances are, however, excluded from the definition of "release" in section 101(22) of CERCLA, as amended, and should not be considered in HRS scoring.

Evaluate sites containing radioactive substances using the instructions specified in sections 2 through 6, supplemented by the instructions in this section. Those factors denoted with a "yes" in Table 7-1 are evaluated differently for sites containing radioactive substances than for sites containing only nonradioactive hazardous substances, while those denoted with a "no" are not evaluated differently and are not addressed in this section.

TABLE 7-1.—HRS FACTORS EVALUATED DIFFERENTLY FOR RADIONUCLIDES

Ground water pathway	Status [a]	Surface water pathway	Status [a]	Soil exposure pathway	Status [a]	Air pathway	Status [a]
Likelihood of Release		**Likelihood of Release**		**Likelihood of Exposure**		**Likelihood of Release**	
Observed Release	Yes	Observed Release	Yes	Observed Contamination	Yes	Observed Release	Yes
Potential to Release	No	Potential to Release	No	Attractiveness/Accessibility to Nearby Residents	No	Gas Potential to Release	No
Containment	No	Overland Flow Containment.	No			Gas Containment	No
Net Precipitation	No	Runoff	No	Area of Contamination	No	Gas Source Type	No
Depth to Aquifer	No	Distance to Surface Water	No			Gas Migration Potential	No
Travel Time	No	Flood Frequency	No			Particulate Potential to Release	No
		Flood Containment	No			Particulate Containment	No
						Particulate Source Type	No
						Particulate Migration Potential.	No
Waste Characteristics		**Waste Characteristics**		**Waste Characteristics**		**Waste Characteristics**	
Toxicity	Yes	Toxicity/Ecotoxicity	Yes/ Yes	Toxicity	Yes	Toxicity	Yes
Mobility	No	Persistence/Mobility	Yes/No	Hazardous Waste Quantity	Yes	Mobility	No
Hazardous Waste Quantity	Yes	Bioaccumulation Potential	No			Hazardous Waste Quantity	Yes
		Hazardous Waste Quantity	Yes				
Targets		**Targets**		**Targets**		**Targets**	
Nearest Well	Yes [b]	Nearest Intake	Yes [b]	Resident Individual	Yes [b]	Nezrest Individual	Yes [b]
Population	Yes [b]	Drinking Water Population	Yes [b]	Resident Population	Yes [b]	Population	Yes [b]
Resources	No	Resources	No	Workers	No	Resources	No
Wellhead Protection Area	No	Sensitive Environments	Yes [b]	Resources	No	Sensitive Environments	No
		Human Food Chain Individual.	Yes [b]	Terrestrial Sensitive Environments.	No		
		Human Food Chain Population.	Yes [b]				
				Nearby Individual	No		
				Population Within 1 Mile	No		

[a] Factors evaluated differently are denoted by "yes"; factors not evaluated differently are denoted by "no."
[b] Difference is in the determination of Level I and Level II concentrations.

In general, sites containing mixed radioactive and other hazardous substances involve more evaluation than sites containing only radionuclides. For sites containing mixed radioactive and other hazardous substances, HRS factors are evaluated based on considerations of both the radioactive substances and the other hazardous substances in order to derive a single set of factor values for each factor category in each of the four pathways. Thus, th. HRS score for these sites reflects the combined potential hazards posed by both the radioactive and other hazardous substances.

Section 7 is organized by factor category, similar to sections 3 through 6. Pathway-specific differences in evaluation criteria are specified under each factor category, as appropriate. These differences apply largely to the soil exposure pathway and to sites containing mixed radioactive and other hazardous substances. All evaluation criteria specified in sections 2 through 6 must be met, except where modified in section 7.

7.1 *Likelihood of release/likelihood of exposure.* Evaluate likelihood of release for the three migration pathways and likelihood of exposure for the soil exposure pathway as specified in sections 2 through 6, except: establish an observed release and observed contamination as specified in section 7.1.1. When an observed release cannot be established for a migration pathway, evaluate potential to release as specified in section 7.1.2. When observed contamination cannot be established, do not evaluate the soil exposure pathway.

7.1.1 *Observed release/observed contamination.* For radioactive substances, establish an observed release for each migration pathway by demonstrating that the site has released a radioactive substance to the pathway (or watershed or aquifer, as appropriate); establish observed contamination for the soil exposure pathway as indicated below. Base these demonstrations on one or more of the following, as appropriate to the pathway being evaluated:

- Direct observation:
  - –For each migration pathway, a material that contains one or more radionuclides has been seen entering the atmosphere, surface water, or ground water, as appropriate, or is known to have entered ground water or surface water through direct deposition, or
  - –For the surface water migration pathway, a source area containing radioactive substances has been flooded at a time that radioactive substances were present and one or more radioactive substances were in contact with the flood waters.
- Analysis of radionuclide concentrations in samples appropriate to the pathway (that is, ground water, soil, air, surface water, benthic, or sediment samples):
  - –For radionuclides that occur naturally and for radionuclides that are ubiquitous in the environment:
    - – –Measured concentration (in units of activity, for example, pCi per kilogram [pCi/kg], pCi per liter [pCi/1], pCi per cubic meter [pCi/m³]) of a given radionuclide in the sample are at a level that:
      - – – –Equals or exceeds a value 2 standard deviations above the mean site-specific background concentration for that

radionuclide in that type of sample, or

-
  -
    - Exceeds the upper-limit value of the range of regional background concentration values for that specific radionuclide in that type of sample.
  - Some portion of the increase must be attributable to the site to establish the observed release (or observed contamination), and
  - For the soil exposure pathway only, the radionuclide must also be present at the surface or covered by 2 feet or less of cover material (for example, soil) to establish observed contamination.
- For man-made radionuclides without ubiquitous background concentrations in the environment:
  - Measured concentration (in units of activity) of a given radionuclide in a sample equals or exceeds the sample quantitation limit for that specific radionuclide in that type of media and is attributable to the site.
  - However, if the radionuclide concentration equals or exceeds its sample quantitation limit, but its release can also be attributed to one or more neighboring sites, then the measured concentration of that radionuclide must also equal or exceed a value either 2 standard deviations above the mean concentration of that radionuclide contributed by those neighboring sites or 3 times its background concentration, whichever is lower.
  - If the sample quantitation limit cannot be established:
    - If the sample analysis was performed under the EPA Contract Laboratory Program, use the EPA contract-required quantitation limit (CRQL) in place of the sample quantitation limit in establishing an observed release (or observed contamination).
    - If the sample analysis is not performed under the EPA Contract Labatory Program, use the detection limit in place of the sample quantitation limit.
  - For the soil exposure pathway only, the radionuclide must also be present at the surface or covered by 2 feet or less of cover material (for example, soil) to establish observed contamination.

- Gamma radiation measurements (applies only to observed contamination for the soil exposure pathway):
  - The gamma radiation exposure rate, as measured in microroentgens per hour (μR/hr) using a survey instrument held 1 meter above the ground surface (or 1 meter away from an aboveground source), equals or exceeds 2 times the site-specific background gamma radiation exposure rate.
  - Some portion of the increase must be attributable to the site to establish observed contamination. The gamma-emitting radionuclides do not have to be within 2 feet of the surface of the source.

For the three migration pathways, if an observed release can be established for the pathway (or aquifer or watershed, as appropriate), assign the pathway (or aquifer or watershed) an observed release factor value of 550 and proceed to section 7.2. If an observed release cannot be established, assign an observed release factor value of 0 and proceed to section 7.1.2.

For the soil exposure pathway, if observed contamination can be established, assign the likelihood of exposure factor for resident population a value of 550 if there is an area of observed contamination in one or more locations listed in section 5.1; evaluate the likelihood of exposure factor for nearby population as specified in section 5.2.1; and proceed to section 7.2. If observed contamination cannot be established, do not evaluate the soil exposure pathway.

At sites containing mixed radioactive and other hazardous substances, evaluate observed release (or observed contamination) separately for radionuclides as described in this section and for other hazardous substances as described in sections 2 through 6.

For the three migration pathways, if an observed release can be established based on either radionuclides or other hazardous substances, or both, assign the pathway (or aquifer or watershed) an observed release factor value of 550 and proceed to section 7.2. If an observed release cannot be established based on either radionuclides or other hazardous substances, assign an observed release factor value of 0 and proceed to section 7.1.2.

For the soil exposure pathway, if observed contamination can be established based on either radionuclides or other hazardous substances, or both, assign the likelihood of exposure factor for resident population a value of 550 if there is an area of observed contamination in one or more locations listed in section 5.1; evaluate the likelihood of exposure factor for nearby population as specified in section 5.2.1; and proceed to section 7.2. If observed contamination cannot be established based on either radionuclides or other hazardous substances, do not evaluate the soil exposure pathway.

7.1.2 *Potential to release.* For the three migration pathways, evaluate potential to release for sites containing radionuclides in the same manner as specified for sites containing other hazardous substances. Base the evaluation on the physical and chemical properties of the radionuclides, not on their level of radioactivity.

For sites containing mixed radioactive and other hazardous substances, evaluate potential to release considering radionuclides and other hazardous substances together. Evaluate potential to release for each migration pathway as specified in sections 3, 4, or 6, as appropriate.

7.2 *Waste characteristics.* For radioactive substances, evaluate the human toxicity factor, the ecosystem toxicity factor, the surface water persistence factor, and the hazardous waste quantity factor as specified in the following sections. Evaluate all other waste characteristic factors as specified in sections 2 through 6.

7.2.1 Human toxicity. For radioactive substances, evaluate the human toxicity factor as specified below, not as specified in section 2.4.1.1.

Assign human toxicity factor values to those radionuclides available to the pathway based on quantitative dose-response parameters for cancer risks as follows:

- Evaluate radionuclides only on the basis of carcinogenicity and assign all radionuclides to weight-of-evidence category A.
- Assign a human toxicity factor value from Table 7-2 to each radionuclide based on its slope factor (also referred to as cancer potency factor).
  - For each radionuclide, use the higher of the slope factors for inhalation and ingestion to assign the factor value.
  - If only one slope factor is available for the radionuclide, use it to assign the toxicity factor value.
  - If no slope factor is available for the radionuclide, assign that radionuclide a toxicity factor value of 0 and use other radionuclides for which a slope factor is available to evaluate the pathway.
- If all radionuclides available to a particular pathway are assigned a human toxicity factor value of 0 (that is, no slope factor is available for all the radionuclides), use a default human toxicity factor value of 1,000 as the human toxicity factor value for all radionuclides available to the pathway.

At sites containing mixed radioactive and other hazardous substances, evaluate the toxicity factor separately for the radioactive and other hazardous substances and assign each a separate toxicity factor value. This applies regardless of whether the radioactive and other hazardous substances are physically separated, combined chemically, or simply mixed together. Assign toxicity factor values to the radionuclides as specified above and to the other hazardous substances as specified in section 2.4.1.1.

At sites containing mixed radioactive and other hazardous substances, if all radionuclides available to a particular pathway are assigned a human toxicity factor value of 0, use a default human toxicity factor value of 1,000 for all those radionuclides even if nonradioactive hazardous substances available to the pathway are assigned human toxicity factor values greater than 0. Similarly, if all nonradioactive hazardous substances available to the pathway are assigned a human toxicity factor value of 0, use a default human toxicity factor value of 100 for all these nonradioactive hazardous substances even if radionuclides available to the pathway are assigned human toxicity factor values greater than 0.

7.2.2 *Ecosystem toxicity.* For the surface water environmental threat (see sections 4.1.4 and 4.2.4), assign an ecosystem toxicity factor value to radionuclides (alone or combined chemically or mixed with other hazardous substances) using the same slope factors and procedures specified for the human toxicity factor in section 7.2.1, except: use a default of 100, not 1,000, if all radionuclides eligible to be evaluated for ecosystem toxicity receive an ecosystem toxicity factor value of 0.

TABLE 7-2.—TOXICITY FACTOR VALUES FOR RADIONUCLIDES

Cancer slope factor [a] (SF) $(pCi)^{-1}$	Assigned value
$3\times10^{-11}\leq SF$	10,000
$3\times10^{-12}\leq SF<3\times10^{-11}$	1,000
$SF<3\times10^{-12}$	100
SF not available for the radionuclide	0

[a] Radionuclide slope factors are estimates of age-averaged, individual lifetime total excess cancer risk per picocurie of radionuclide inhaled or ingested.

At sites containing mixed radioactive and other hazardous substances, evaluate the ecosystem toxicity factor separately for the radioactive and other hazardous substances and assign each a separate ecosystem toxicity factor value. This applies regardless of whether the radioactive and other hazardous substances are physically separated, combined chemically, or simply mixed together. Assign ecosystem toxicity factor values to the radionuclides as specified above and to the other hazardous substances as specified in sections 4.1.4.2.1.1 and 4.2.4.2.1.1. If all radionuclides available to a particular pathway are assigned an ecosystem toxicity factor value of 0, use a default ecosystem toxicity factor value of 100 for all these radionuclides even if nonradioactive hazardous substances available to the pathway are assigned ecosystem toxicity factor values greater than 0. Similarly, if all nonradioactive hazardous substances available to the pathway are assigned an ecosystem toxicity factor value of 0, use a default ecosystem toxicity factor value of 100 for all these nonradioactive hazardous substances even if radionuclides available to the pathway are assigned ecosystem toxicity factor values greater than 0.

7.2.3 *Persistence.* For radionuclides, evaluate the surface water persistence factor based solely on half-life; do not include sorption to sediments in the evaluation as is done for nonradioactive hazardous substances. Assign a persistence factor value from Table 4-10 (section 4.1.2.2.1.2) to each radionuclide based on half-life ($t_{1/2}$) calculated as follows:

$$t_{1/2}=\frac{1}{\frac{1}{r}+\frac{1}{v}}$$

where:

r=Radioactive half-life.
v=Volatilization half-life.

If the volatilization half-life cannot be estimated for a radionuclide from available data, delete it from the equation. Select the portion of Table 4-10 to use in assigning the persistence factor value as specified in section 4.1.2.2.1.2.

At sites containing mixed radioactive and other hazardous substances, evaluate the persistence factor separately for each radionuclide and for each nonradioactive hazardous substance, even if the available data indicate that they are combined chemically. Assign a persistence factor value to each radionuclide as specified in this section and to each nonradioactive hazardous substance as specified in section 4.1.2.2.1.2. When combined chemically, assign a single persistence factor value based on the higher of the two values assigned (individually) to the radioactive and nonradioactive components.

7.2.4 *Selection of substance potentially posing greatest hazard.* For each migration pathway (threat, aquifer, or watershed, as appropriate), select the radioactive substance or nonradioactive hazardous substance that potentially poses the greatest hazard based on its toxicity factor value, combined with the applicable mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential factor values. Combine these factor values as specified in sections 2, 3, 4, and 6. For the soil exposure pathway, base the selection on the toxicity factor alone (see sections 2 and 5).

7.2.5 *Hazardous waste quantity.* To calculate the hazardous waste quantity factor value for sites containing radioactive substances, evaluate source hazardous waste quantity (see section 2.4.2.1) using only the following two measures in the following hierarchy (these measures are consistent with Tiers A and B for nonradioactive hazardous substances in sections 2.4.2.1.1 and 2.4.2.1.2):

- Radionuclide constituent quantity (Tier A).
- Radionuclide wastestream quantity (Tier B).

7.2.5.1 *Source hazardous waste quantity for radionuclides.* For each migration pathway, assign a source hazardous waste quantity value to each source having a containment factor value greater than 0 for the pathway being evaluated. For the soil exposure pathway, assign a source hazardous waste quantity value to each area of observed contamination, as applicable to the threat being evaluated. Allocate hazardous substances and hazardous wastestreams to specific sources (or areas of observed contamination) as specified in section 2.4.2.

7.2.5.1.1 *Radionuclide constituent quantity (Tier A).* Evaluate radionuclide constituent quantity for each source (or area of observed contamination) based on the activity content of the radionuclides allocated to the source (or area of observed contamination) as follows:

- Estimate the net activity content (in curies) for the source (or area of observed contamination) based on:
  - –Manifests, or
  - –Either of the following equations, as applicable:

$$N=9.1\times10^{-7}(V)\sum_{i=1}^{n}AC_i$$

where:

N=Estimated net activity content (in curies) for the source (or area of observed contamination).
V=Total volume of material (in cubic yards) in a source (or area of observed contamination) containing radionuclides.
AC_i=Activity concentration above the respective background concentration (in pCi/g) for each radionuclide i allocated to the source (or area of observed contamination).
n=Number of radionuclides allocated to the source (or area of observed contamination) above the respective background concentrations.

or,

$$N=3.8\times10^{-12}(V)\sum_{i=1}^{n}AC_i$$

where:

N=Estimated net activity content (in curies) for the source (or area of observed contamination).
V=Total volume of material (in gallons) in a source (or area of observed contamination) containing radionuclides.
AC_i=Activity concentration above the respective background concentration (in pCi/1) for each radionuclide i allocated to the source (or area of observed contamination).
n=Number of radionuclides allocated to the source (or area of observed contamination) above the respective background concentrations.

- –Estimate volume for the source (or volume for the area of observed contamination) based on records or measurements.
- –For the soil exposure pathway, in estimating the volume for areas of observed contamination, do not include more than the first 2 feet of depth, except: for those types of areas of observed contamination listed in Tier C of Table 5-2 (section 5.1.2.2), include the entire depth, not just that within 2 feet of the surface.

- Convert from curies of radionuclides to equivalent pounds of nonradioactive hazardous substances by multiplying the activity estimate for the source (or area of observed contamination) by 1,000.
- Assign this resulting product as the radionuclide constituent quantity value for the source (or area of observed contamination).

If the radionuclide constituent quantity for the source (or area of observed contamination) is adequately determined (that is, the total activity of all radionuclides in the source and releases from the source (or in the area of observed contamination) is known or is estimated with reasonable confidence), do not evaluate the radionuclide wastestream quantity measure in section 7.2.5.1.2. Instead, assign radionuclide wastestream quantity a value of 0 and proceed to section 7.2.5.1.3. If the radionuclide constituent quantity is not adequately determined, assign the source (or area of observed contamination) a value for radionuclide constituent quantity based on the available data and proceed to section 7.2.5.1.2.

7.2.5.1.2 *Radionuclide wastestream quantity (Tier B).* Evaluate radionuclide wastestream quantity for the source (or area of observed contamination) based on the activity content of radionuclide wastestreams allocated to the source (or area of observed contamination) as follows:

- Estimate the total volume (in cubic yards or in gallons) of wastestreams containing radionuclides allocated to the source (or area of observed contamination).
- Divide the volume in cubic yards by 0.55 (or the volume in gallons by 110) to convert to the activity content expressed in terms of equivalent pounds of nonradioactive hazardous substances.
- Assign the resulting value as the radionuclide wastestream quantity value for the source (or area of observed contamination).

7.2.5.1.3 *Calculation of source hazardous waste quantity value for radionuclides.* Select the higher of the values assigned to the source (or area of observed contamination) for radionuclide constituent quantity and radionuclide wastestream quantity. Assign this value as the source hazardous waste quantity value for the source (or area of observed contamination). Do not round to th nearest integer.

7.2.5.2 *Calculation of hazardous waste quantity factor value for radionuclides.* Sum the source hazardous waste quantity values assigned to all sources (or areas of observed contamination) for the pathway being evaluated and round this sum to the nearest integer, except: if the sum is greater than 0, but less than 1, round it to 1. Based on this value, select a hazardous waste quantity factor value for this pathway from Table 2–6 (section 2.4.2.2).

For a migration pathway, if the radionuclide constituent quantity is adequately determined (see section 7.2.5.1.1) for all sources (or all portions of sources and releases remaining after a removal action), assign the value from Table 2–6 as the hazardous waste quantity factor value for the pathway. If the radionuclide constituent quantity is not adequately determined for one or more sources (or one or more portions of sources or releases remaining after a removal action), assign a factor value as follows:

- If any target for that migration pathway is subject to Level I or Level II concentration (see section 7.3), assign either the value from Table 2–6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway.
- If none of the targets for that pathway is subject to Level I or Level II concentrations, assign a factor value as follows:
    - If there has been no removal action, assign either the value from Table 2–6 or a value of 10, whichever is greater, as the hazardous waste quantity factor value for that pathway.
    - If there has been a removal action:
        - Determine values from Table 2–6 with and without consideration of the removal action.
        - If the value that would be assigned from Table 2–6 without consideration of the removal action would be 100 or greater, assign either the value from Table 2–6 with consideration of the removal action or a value of 100, whichever is greater, as the hazardous waste quantity factor value for the pathway.
        - If the value that would be assigned from Table 2–6 without consideration of the removal action would be less than 100, assign a value of 10 as the hazardous waste quantity factor value for the pathway.

For the soil exposure pathway, if the radionuclide constituent quantity is adequately determined for all areas of observed contamination, assign the value from Table 2–6 as the hazardous waste quantity factor value. If the radionuclide constituent quantity is not adequately determined for one or more areas of observed contamination, assign either the value from Table 2–6 or a value of 10, whichever is greater, as the hazardous waste quantity factor value.

7.2.5.3 *Calculation of hazardous waste quantity factor value for sites containing mixed radioactive and other hazardous substances.* For each source (or area of observed contamination) containing mixed radioactive and other hazardous substances, calculate two source hazardous waste quantity values—one based on radionuclides as specified in sections 7.2.5.1 through 7.2.5.1.3 and the other based on the nonradioactive hazardous substances as specified in sections 2.4.2.1 through 2.4.2.1.5 (that is, determine each value as if the other type of substance was not present). Sum the two values to determine a combined source hazardous waste quantity value for the source (or area of observed contamination). Do not round this value to the nearest integer.

Use this combined source hazardous waste quantity value to calculate the hazardous waste quantity factor value for the pathway as specified in section 2.4.2.2, except: if either the hazardous constituent quantity or the radionuclide constituent quantity, or both, are not adequately determined for one or more sources (or one or more portions of sources or releases remaining after a removal action) or for one or more areas of observed contamination, as applicable, assign the value from Table 2–6 or the default value applicable for the pathway, whichever is greater, as the hazardous waste quantity factor value for the pathway.

7.3 *Targets.* For radioactive substances, evaluate the targets factor category as specified in section 2.5 and sections 3 through 6, except: establish Level I and Level II concentrations at sampling locations as specified in sections 7.3.1 and 7.3.2.

For all pathways (and threats), use the same target distance limits for sites containing radioactive substances as is specified in sections 3 through 6 for sites containing nonradioactive hazardous substances. At sites containing mixed radioactive and other hazardous substances, include all sources (or areas of observed contamination) at the site in identifying the applicable targets for the pathway.

7.3.1 *Level of contamination at a sampling location.* Determine whether Level I or Level II concentrations apply at a sampling location (and thus to the associated targets) as follows:

- Select the benchmarks from section 7.3.2 applicable to the pathway (or threat) being evaluated.
- Compare the concentrations of radionuclides in the sample (or comparable samples) to their benchmark concentrations for the pathway (or threat) as specified in section 7.3.2. Treat comparable samples as specified in section 2.5.1.
- Determine which level applies based on this comparison.
- If none of the radionuclides eligible to be evaluated for the sampling location have an applicable benchmark, assign Level II to the actual contamination at that sampling location for the pathway (or threat).
- In making the comparison, consider only those samples, and only those radionuclides in the sample, that meet the criteria for an observed release (or observed contamination) for the pathway, except: tissue samples from aquatic human food chain organisms may also be used for the human food chain threat of the surface water pathway as specified in sections 4.1.3.3 and 4.2.3.3.

7.3.2 *Comparison to benchmarks.* Use the following media specific benchmarks (expressed in activity units, for example, pCi/l for water, pCi/kg for soil and for aquatic human food chain organisms, and pCi/m^3 for air) for making the comparisons for the indicated pathway (or threat):

- Maximum Contaminant Levels (MCLs)—ground water migration pathway and drinking water threat in surface water migration pathway.
- Uranium Mill Tailings Radiation Control Act (UMTRCA) standards—soil exposure pathway only.
- *Screening concentration for cancer* corresponding to that concentration that corresponds to the 10^{-6} individual cancer risk for inhalation exposures (air migration pathway) or for oral exposures (ground water migration pathway; drinking water or human food chain threats in surface water migration pathway; and soil exposure pathway).
    - For the soil exposure pathway, include two screening concentrations for cancer—one for ingestion of surface materials and one for external radiation exposures from gamma-emitting radionuclides in surface materials.

Select the benchmark(s) applicable to the pathway (or threat) being evaluated. Compare the concentration of each radionuclide from the sampling location to its benchmark concentration(s) for that pathway (or threat). Use only those samples and only those radionuclides in the sample that meet the criteria for an observed release (or observed contamination) for the pathway, except: tissue samples from aquatic human food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of any applicable radionuclide from any sample equals or exceeds its benchmark concentration, consider the sampling location to be subject to Level I concentrations for that pathway (or threat). If more than one benchmark applies to the radionuclide, assign Level I if the radionuclide concentration equals or exceeds the lowest applicable benchmark concentration. In addition, for the soil exposure pathway, assign Level I concentrations at the sampling location if measured gamma radiation exposure rates equal or exceed 2 times the background level (see section 7.1.1).

If no radionuclide individually equals or exceeds its benchmark concentration, but more than one radionuclide either meets the criteria for an observed release (or observed contamination) for the sample or is eligible to be evaluated for a tissue sample (see sections 4.1.3.3 and 4.2.3.3), calculate a value for index I for these radionuclides as specified in section 2.5.2. If I equals or exceeds 1, assign Level I to the sampling location. If I is less than 1, assign Level II.

At sites containing mixed radioactive and other hazardous substances, establish the level of contamination for each sampling location considering radioactive substances and nonradioactive hazardous substances separately. Compare the concentration of each radionuclide and each nonradioactive hazardous substance from the sampling location to its respective benchmark concentration(s). Use only those samples and only those substances in the sample that meet the criteria for an observed release (or observed contamination) for the pathway except: tissue samples from aquatic human food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of one or more applicable radionuclides or other hazardous substances from any sample equals or exceeds its benchmark concentration, consider the sampling location to be subject to Level I concentrations. If more than one benchmark applies to a radionuclide or other hazardous substance, assign Level I if the concentration of the radionuclide or other hazardous substance equals or exceeds its lowest applicable benchmark concentration.

If no radionuclide or other hazardous substance individually exceed a benchmark concentration, but more than one radionuclide or other hazardous substance either meets the criteria for an observed release (or observed contamination) for the sample or is eligible to be evaluated for a tissue sample, calculate an index I for both types of substances as specified in section 2.5.2. Sum the index I values for the two types of substances. If the value, individually or combined, equals or exceeds 1, assign Level I to the sample location. If it is less than 1, calculate an index J for the nonradioactive hazardous substances as specified in section 2.5.2. If J equals or exceeds 1, assign Level I to the sampling location. If J is less than 1, assign Level II.

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SUPERFUND CHEMICAL DATA MATRIX METHODOLOGY

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1.0 INTRODUCTION

The Superfund Chemical Data Matrix (SCDM) is a database containing factor values and benchmark values used for applying the Hazard Ranking System (HRS; 40 CFR Part 300 Appendix A, 55 *FR* 51583) to evaluate potential National Priorities List (NPL) sites. The HRS assigns factor values for toxicity, gas migration potential, gas and ground water mobility, surface water persistence, and bioaccumulation potential. These assignments are based on the physical, chemical, ecological, toxicological, and radiological properties of hazardous substances present at a site. Hazardous substances, as defined for HRS purposes, includes both hazardous substances referenced in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) section 101(14), which are substances specifically listed under other federal laws and are known as "CERCLA hazardous substances," and "pollutants or contaminants" as defined in CERCLA itself in section 101(33).

SCDM contains HRS factor values and benchmarks for those hazardous substances frequently found at sites that are evaluated using the HRS. SCDM also contains the physical, chemical, toxicological, and radiological input data used to calculate the factors and benchmarks. The input data presented in SCDM are taken directly from peer reviewed, generally accepted literature sources and databases and/or EPA developed literature sources and databases; or are calculated using procedures set forth by EPA and in the HRS. Further HRS procedures are then applied to the input data to determine a factor value or benchmark. The HRS also assigns extra weight to targets with exposure levels to hazardous substances that are at or above benchmarks. These benchmarks include both risk-based screening concentrations and concentrations specified in regulatory limits for the hazardous substances present at a site for a particular migration pathway.

Chapter 2.0, *Data Selection Methodology*, of this document explains how data are selected and prioritized into a hierarchy for assigning SCDM values. Chapter 3.0, *Calculations in SCDM*, describes how some types of data (i.e., volatilization half-lives, distribution coefficients, and screening concentrations) are internally calculated using data in SCDM and methodologies from published literature or regulatory guidance documents. Chapter 4.0, *Chemical Data, Factor Values, and Benchmarks*, describes how SCDM data, HRS factor values, and benchmark values are presented. The factor values and benchmark values are listed, substance by substance, in Appendix A. Appendix B contains the HRS factor values and benchmark tables (organized by pathway) for both nonradiological hazardous substances and radionuclides. Please note that *National Recommended Water Quality Criteria* (*NRWQC)* Chronic Criteria Continuous Concentration (CCC) and Acute Criteria Maximum Concentration (CMC) values have endnotes associated with them listed at the end of Appendix B. Appendix C contains a cross-reference index of substance name synonyms.

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Acenaphthene	000083-32-9	10†	1.00E+00	1.00E-04*	2.00E-01	2.00E-05*	0.4000	0.4000	500.0	500.0	500.0	500.0	10000	1000*	11	0.2000	Yes	Yes
Acenaphthylene	000208-96-8	0	1.00E+00	1.00E-04*	2.00E-01	2.00E-05*	0.4000	1.0000	500.0	500.0	500.0	500.0	0	0	11	0.0200	Yes	Yes
Acetone	000067-64-1	1*†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0700*	0.0700	0.5	0.5	0.5	0.5	100	1	17	1.0000	Yes	No
Acrolein	000107-02-8	10000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0700	0.0700	500.0	500.0	500.0	500.0	10000	1000	17	1.0000	Yes	No
Acrylamide	000079-06-1	10000	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	1.0000	5.0	5.0	5.0	5.0	10	10	6	0.2000	Yes	Yes
Alachlor**	015972-60-8	100	1.00E+00	1.00E-02	1.00E+00	1.00E-02	0.4000	0.0700	500.0	500.0	50.0	50.0	1000	1000	6	0.0200	Yes	Yes
Aldrin	000309-00-2	10000	1.00E+00	1.00E-04	2.00E-03	2.00E-07	1.0000	1.0000	5000.0*	50000.0	50000.0	50000.0	10000	10000	6	0.0020	Yes	Yes
Aluminum	007429-90-5	0	1.00E+00	1.00E+00*	1.00E+00*	1.00E+00*	1.0000	1.0000	50.0	50.0	5000.0*	5000.0*	100	100	...	...	No	Yes
Americium**	007440-35-9	0	1.00E+00	1.00E+00	...	...	1.0000	1.0000	5000.0	5000.0	5000.0	5000.0	0	0	...	...	No	Yes
Aniline	000062-53-3	10000	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	0.4000	50.0*	50.0*	500.0	500.0	10000	10	11	1.0000	Yes	No
Anthracene	000120-12-7	10†	1.00E+00	1.00E-04*	2.00E-03	2.00E-07*	0.4000*	0.4000*	50000.0*	50000.0*	50000.0*	50000.0*	10000	10000*	6	0.0020	Yes	Yes
Antimony	007440-36-0	10000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5.0*	5.0*	5.0	50.0*	100	100	...	...	No	Yes
Arsenic	007440-38-2	10000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5.0	500.0	5000.0*	500.0	10	100	...	...	No	Yes
Asbestos	001332-21-4	10000	1.00E+00	1.00E-04	...	...	1.0000	1.0000	0.5	0.5	0.5	0.5	0	0	...	...	No	Yes
Barium	007440-39-3	10000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	500.0*	500.0*	500.0*	500.0*	1	1	...	...	No	Yes

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).

** Indicates new hazardous substance in current version of chemical data (JAN04).

† See December 2011 SCDM update for volatile substances.

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Benz(a)anthracene	000056-55-3	1000	1.00E+00	1.00E-04*	2.00E-05	2.00E-09*	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	10000	10000	6	0.0020	Yes	Yes
Benzene	000071-43-2	1000*†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	0.4000	5000.0	5000.0	5000.0*	50000.0	1000*	1000	17	1.0000	Yes	No
Benzidine	000092-87-5	10000	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	0.4000	50.0	50.0	5000.0*	5000.0*	100*	100*	0	0.0002	Yes	Yes
Benzo(a)pyrene	000050-32-8	10000	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0*	50000.0	50000.0*	10000	1000	6	0.0002	Yes	Yes
Benzo(g,h,i)perylene	000191-24-2	0	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	...	...	No	Yes
Benzo(j,k)fluorene (Fluoranthene)	000206-44-0	100	1.00E+00	1.00E-04*	2.00E-03	2.00E-07*	1.0000	1.0000	500.0*	5000.0	5000.0*	5000.0	10000	10000*	6	0.0020	Yes	Yes
Benzo(k)fluoranthene	000207-08-9	100	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	6	0.0002	Yes	Yes
Beryllium	007440-41-7	10000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	50.0	50.0	50.0	50.0	0	0	...	...	No	Yes
Bis (2-ethylhexyl) phthalate	000117-81-7	100	1.00E+00	1.00E-04	2.00E-03	2.00E-07	1.0000	1.0000	50000.0	500.0*	50000.0	5000.0*	1000	1000*	6	0.0002*	Yes	Yes
Boron	007440-42-8	100	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	1.0000	0.5	0.5	0.5	0.5	0	0	...	...	No	Yes
Bromodichloromethane	000075-27-4	100†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	50.0	50.0	50.0	50.0	0	0	17	1.0000	Yes	No
Butylbenzyl phthalate	000085-68-7	10	1.00E+00	1.00E-04*	2.00E-01	2.00E-05*	1.0000	1.0000	500.0	500.0	500.0	500.0	1000*	1000*	6	0.0020	Yes	Yes
Cadmium	007440-43-9	10000	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	5000.0	50000.0*	50000.0*	50000.0*	10000*	1000	...	...	No	Yes
Carbazole	000086-74-8	10	1.00E+00	1.00E-02*	2.00E-01	2.00E-03*	0.4000	0.0700	500.0	500.0	500.0	500.0	1000*	1000*	6*	0.0200*	Yes	Yes

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			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Carbon disulfide	000075-15-0	10†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	0.4000	500.0	500.0	500.0	500.0	100	10*	17	1.0000	Yes	No
Carbon tetrachloride	000056-23-5	1000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	50.0	50.0	500.0*	500.0*	100	10*	17	1.0000	Yes	No
Cesium	007440-46-2	0	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5.0*	50.0*	5.0*	50.0*	0	0	...	...	No	Yes
Chlordane	000057-74-9	10000	1.00E+00	1.00E-02	2.00E-03	2.00E-05	1.0000	1.0000	5000.0*	5000.0*	50000.0	5000.0*	10000	10000	6	0.0020	Yes	Yes
Chlordane, alpha-	005103-71-9	10000*	1.00E+00	1.00E-02	2.00E-03	2.00E-05	1.0000	1.0000	50000.0*	50000.0*	50000.0*	50000.0*	10000	10000	11*	0.0200*	Yes*	Yes
Chlordane, gama-	005566-34-7	10000*	1.00E+00	1.00E-02	2.00E-03	2.00E-05	1.0000	1.0000	50000.0	50000.0	50000.0*	50000.0*	0*	0*	6*	0.0020*	Yes*	Yes
Chlorobenzene	000108-90-7	100†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0007	0.0700	50.0	50.0	5000.0*	5000.0*	10000*	100	17	1.0000	Yes	No
Chloroform	000067-66-3	100†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	5.0	5.0	500.0*	500.0*	100*	10	17	1.0000	Yes	No
Chromium	007440-47-3	10000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	500.0*	500.0	500.0*	500.0	10000*	100	...	...	No	Yes
Chromium(III)	016065-83-1	1	1.00E+00	1.00E-04	1.00E+00	1.00E-04	1.0000	1.0000	500.0	500.0	500.0	500.0	100*	100*	...	...	No	Yes
Chromium(VI)	018540-29-9	10000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5.0	500.0	5.0	500.0	100	100	...	...	No	Yes
Chrysene	000218-01-9	10	1.00E+00	1.00E-04*	2.00E-05	2.00E-09*	1.0000	1.0000	5.0*	5.0*	5000.0	500.0	1000	1000	6	0.0002	Yes	Yes
Cobalt	007440-48-4	10*	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5000.0*	5000.0*	5000.0	5000.0	0	0	...	...	No	Yes
Copper	007440-50-8	0	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	500.0*	50000.0	5000.0*	50000.0	1000*	1000*	...	...	No	Yes
Cumene	000098-82-8	10*†	1.00E+00	1.00E-02*	2.00E-01	2.00E-03*	0.4000	0.4000	500.0	500.0	500.0	500.0	100	1	17	1.0000	Yes	No

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			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Cyanamide**	000420-04-2	10	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	1.0000	0.5	0.5	0.5	0.5	10	100	6	0.2000	Yes	Yes
Cyanide	000057-12-5	100	1.00E+00	1.00E+00	1.00E+00*	1.00E+00*	1.0000*	1.0000*	0.5	0.5	0.5	0.5	1000	1000	17*	1.0000*	Yes*	No*
DDD	000072-54-8	100	1.00E+00	1.00E-04	2.00E-03	2.00E-07	1.0000	1.0000	50000.0	50000.0	50000.0	50.0*	10000	10000	6	0.0020	Yes	Yes
DDE	000072-55-9	100	1.00E+00	1.00E-04	2.00E-03	2.00E-07	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	10000	10000	6	0.0020	Yes	Yes
DDT	000050-29-3	1000	1.00E+00	1.00E-04	2.00E-03	2.00E-07	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	10000	10000	6	0.0020	Yes	Yes
Di-n-butyl phthalate	000084-74-2	10	1.00E+00	1.00E-04*	2.00E-01	2.00E-05*	1.0000	1.0000	5000.0	5000.0	5000.0	5000.0	1000	10000	6	0.0200	Yes	Yes
Di-n-octyl phthalate	000117-84-0	100	1.00E+00	1.00E-04	2.00E-03	2.00E-07	1.0000	1.0000	500.0	500.0	50000.0*	50000.0*	0	0	6	0.0020	Yes	Yes
Dibenz(a,h)anthracene	000053-70-3	10000	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	...	...	No	Yes
Dibenzofuran	000132-64-9	1000*†	1.00E+00	1.00E-04*	2.00E-01	2.00E-05*	1.0000	1.0000	500.0	500.0	500.0	500.0	1000*	1000*	11	0.0200	Yes	Yes
Dibromo-3-chloropropane, 1,2-	000096-12-8	10000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	1.0000	50.0	50.0	50.0	50.0	10*	10*	11	1.0000	Yes	No
Dibromoethane, 1,2-	000106-93-4	1000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	5.0	5.0	5.0	5.0	10*	100*	17	1.0000	Yes	No
Dichlorobenzene, 1,4-	000106-46-7	10†	1.00E+00	1.00E+00	2.00E-01	2.00E-01	0.4000	1.0000	5000.0*	5000.0*	5000.0*	5000.0*	1000*	100	17	1.0000	Yes	No
Dichloroethane, 1,1-	000075-34-3	10†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	5.0	5.0	5.0	5.0	0	0	17	1.0000	Yes	No
Dichloroethane, 1,2-	000107-06-2	1000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	5.0	5.0	5.0	5.0	10*	1	17	1.0000	Yes	No

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			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Dichloroethylene, 1,1-	000075-35-4	10†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	50.0	50.0	50.0	50.0	100*	1	17	1.0000	Yes	No
Dichloroethylene, 1,2-**	000540-59-0	100†	1.00E+00	1.00E-02	1.00E+00	1.00E-02	0.4000	1.0000	50.0	50.0	50.0	50.0	1	1	17	1.0000	Yes	No
Dichloroethylene, cis-1,2-	000156-59-2	1000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	5.0	5.0	5.0	5.0	0	0	17	1.0000	Yes	No
Dichloroethylene, trans-1,2-	000156-60-5	100†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	50.0	50.0	50.0	50.0	1	1	17	1.0000	Yes	No
Dichlorophenol, 2,4-	000120-83-2	1000	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0007	0.0700	50.0	50.0	500.0	500.0	10000*	100	11	0.2000	Yes	Yes
Dichloropropane, 1,2-	000078-87-5	1000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	50.0*	50.0*	50.0*	50.0*	10	10*	17	1.0000	Yes	No
Dichloropropene, 1,3-	000542-75-6	100*†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	0.4000	5.0*	5.0*	5.0*	5.0*	1000	1000*	17	1.0000	Yes	No
Dieldrin	000060-57-1	10000	1.00E+00	1.00E-02	2.00E-03	2.00E-05	1.0000	1.0000	50000.0	5000.0	50000.0	50000.0*	10000	10000	6	0.0020	Yes	Yes
Diethyl phthalate	000084-66-2	1	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	1.0000	1.0000	500.0	500.0	500.0	500.0	10	100*	11	0.2000	Yes	Yes
Dimethyl phenol, 2,4-	000105-67-9	100	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	1.0000	0.4000	500.0	500.0	500.0	500.0	100	1000*	11	0.2000	Yes	Yes
Dinitrobenzene, 1,3-	000099-65-0	10000	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	0.4000*	5.0	5.0	5.0	5.0	100	100	6	0.0200	Yes	Yes
Dioxin 1,4-**	000290-67-5	10	1.00E+00	...	...	...	0.4000	0.0700	0.5	0.5	0.5	0.5	0	0	...	...	No	Yes
Diphenylhydrazine, 1,2-	000122-66-7	1000	1.00E+00	1.00E-02*	2.00E-01	2.00E-03*	1.0000	1.0000	50.0	50.0	50.0	50.0	1000	1000	6	0.0200	Yes	Yes
Disulfoton	000298-04-4	10000	1.00E+00	1.00E-04*	2.00E-01	2.00E-05*	1.0000	0.4000	500.0	500.0	5000.0*	5000.0*	10000	10000*	6	0.0200	Yes	Yes

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			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Endosulfan (I or II)	000115-29-7	100	1.00E+00	1.00E+00	2.00E-03	2.00E-03	1.0000	0.4000	5.0*	5000.0	50000.0	5000.0	10000	10000	11	0.0020	Yes	Yes
Endosulfan I**	000959-98-8	100	1.00E+00	1.00E+00	2.00E-03	2.00E-03	1.0000	1.0000	500.0	500.0	50000.0	50000.0	10000	10000	11	0.0020	Yes	Yes
Endosulfan II**	033213-65-9	100	1.00E+00	1.00E+00	...	...	1.0000	1.0000	500.0	500.0	5000.0	5000.0	10000	10000	11	0.0020	Yes	Yes
Endrin	000072-20-8	10000	1.00E+00	1.00E-02	2.00E-03	2.00E-05	1.0000	1.0000	5000.0	5000.0	50000.0	5000.0	10000	10000	6	0.0020	Yes	Yes
Endrin aldehyde	007421-93-4	0	1.00E+00	1.00E-04*	2.00E-03*	2.00E-07*	1.0000*	1.0000*	5000.0*	5000.0*	5000.0*	5000.0*	0	0	6*	0.0020*	Yes*	Yes
Ethyl benzene	000100-41-4	10†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0007*	0.0700*	50.0	50.0	50.0	50.0	100	1000*	17	1.0000	Yes	No
Ethyl chloride	000075-00-3	1	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0007	0.0700	5.0	5.0	5.0	5.0	0	0	17	1.0000	Yes	No
Ethylene glycol monobutyl ether (EBGE)**	000111-76-2	10	1.00E+00	1.00E+00	...	...	1.0000	1.0000	5.0	5.0	5.0	5.0	1	1	...	...	No	Yes
Fluorene	000086-73-7	100†	1.00E+00	1.00E-04*	2.00E-01	2.00E-05*	1.0000	1.0000	500.0*	500.0*	5000.0	5000.0	1000	1000	11	0.0200	Yes	Yes
Fluorine	007782-41-4	10	1.00E+00	1.00E-02	2.00E-01*	2.00E-03*	0.4000	0.0700	50000.0*	50000.0*	50000.0*	50000.0*	0	0	17	1.0000	Yes	No
Heptachlor	000076-44-8	1000	1.00E+00	1.00E-04	2.00E-03	2.00E-07	0.4000*	0.4000*	50000.0*	50000.0*	50000.0	50000.0	10000	10000	11	0.0200	Yes	Yes
Heptachlor epoxide, alpha, beta, gamma	001024-57-3	10000	1.00E+00	1.00E-04*	2.00E-03	2.00E-07*	1.0000	1.0000	5000.0*	5000.0*	50000.0	5000.0*	10000	10000	6	0.0200	Yes	Yes
Heptachlorodibenzo-p-dioxin**	037871-00-4	0	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	...	...	No	Yes
Heptachlorodibenzo-p-dioxin 1,2,3,4,6,7,8-	035822-46-9	10000	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	...	...	No	Yes

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			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Heptachlorodibenzofuran 1,2,3,4,6,7,8-	067562-39-4	10000	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	6*	0.0002*	Yes*	Yes
Heptachlorodibenzofuran 1,2,3,4,7,8,9-	055673-89-7	10000*	1.00E+00	...	...	...	0.4000	0.0700	0.5	0.5	0.5	0.5	0	0	...	...	No	Yes
Hexabromobiphenyl (PBB)**	036355-01-8	1	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	6	0.0002	Yes	Yes
Hexachlorobenzene	000118-74-1	1000	1.00E+00	1.00E-02	2.00E-05	2.00E-07	1.0000	1.0000	50000.0*	50000.0	50000.0	50000.0	10000*	10000	11	0.0200	Yes	Yes
Hexachlorobutadiene	000087-68-3	10000	1.00E+00	1.00E-04*	2.00E-01	2.00E-05*	1.0000	1.0000	50.0	50000.0*	5000.0	50000.0*	10000	1000*	17	1.0000	Yes	No
Hexachlorocyclohexane, alpha-	000319-84-6	10000	1.00E+00	1.00E+00	2.00E-01	2.00E-01	1.0000	1.0000	5000.0*	50000.0*	5000.0*	50000.0*	1000*	1000	11	0.0200	Yes	Yes
Hexachlorocyclohexane, beta-	000319-85-7	100	1.00E+00	1.00E+00	2.00E-03	2.00E-03	1.0000	1.0000	500.0	500.0	5000.0*	5000.0	1000*	1000*	6	0.0020	Yes	Yes
Hexachlorodibenzo-p-dioxin 1,2,3,4,7,8-	039227-28-6	10000	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	...	...	No	Yes
Hexachlorodibenzo-p-dioxin 1,2,3,6,7,8-	057653-85-7	10000	1.00E+00	1.00E-04*	...	...	1.0000*	1.0000*	5000.0	5000.0	5000.0	5000.0	0*	0*	...	...	No	Yes
Hexachlorodibenzo-p-dioxin 1,2,3,7,8,9-	019408-74-3	10000	1.00E+00	1.00E-04*	2.00E-05*	2.00E-09*	1.0000*	1.0000*	50000.0*	50000.0*	50000.0*	50000.0*	0	0	...	...	No	Yes
Hexachlorodibenzofuran 1,2,3,4,7,8-	070648-26-9	10000	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	...	...	No	Yes
Hexachlorodibenzofuran 1,2,3,6,7,8-	057117-44-9	10000	1.00E+00	...	...	...	0.4000	0.0700	0.5	0.5	0.5	0.5	0	0	...	...	No	Yes
Hexachlorodibenzofuran 1,2,3,7,8,9-	072918-21-9	10000	1.00E+00	...	...	...	0.4000	0.0700	0.5	0.5	0.5	0.5	0	0	...	...	No	Yes

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			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Hexachlorodibenzofuran 2,3,4,6,7,8-	060851-34-5	10000	1.00E+00	...	...	...	0.4000	0.0700	0.5	0.5	0.5	0.5	0	0	...	...	No	Yes
Hydrazine	000302-01-2	10000	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000*	0.0700*	0.5	0.5	0.5	0.5	10000	100	11*	1.0000	Yes	No
Hydrogen sulfide	007783-06-4	1000*	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0007*	0.0700	0.5	0.5	0.5	0.5	1000	1000	17	1.0000	Yes	No
Indeno(1,2,3-cd)pyrene	000193-39-5	1000	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	...	...	No	Yes
Iron	007439-89-6	1	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5000.0*	5000.0*	5000.0*	5000.0*	10	10	...	...	No	Yes
Lead	007439-92-1	10000	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	5.0*	5000.0	50000.0*	5000.0	1000	1000	...	...	No	Yes
Lead chromate**	007758-97-6	10000	1.00E+00	...	2.00E-03	...	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	...	...	No	Yes
Lindane	000058-89-9	10000	1.00E+00	1.00E+00	2.00E-01	2.00E-01	1.0000	1.0000	50000.0*	5000.0*	50000.0*	5000.0*	10000	10000	11	0.0200	Yes	Yes
Manganese	007439-96-5	10000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	50000.0*	50000.0*	50000.0	50000.0	0	0	...	...	No	Yes
Mercury	007439-97-6	10000†	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000*	1.0000	50000.0	50000.0	50000.0	50000.0	10000	10000	17	0.2000	Yes	Yes
Methoxychlor	000072-43-5	100	1.00E+00	1.00E-04*	2.00E-03	2.00E-07*	1.0000	1.0000	5.0*	50000.0*	5000.0*	50000.0*	10000	10000	6	0.0020	Yes	Yes
Methyl Parathion	000298-00-0	10000	1.00E+00	1.00E-02*	2.00E-01	2.00E-03*	1.0000	0.4000	50.0	50.0	50.0	50.0	10000	10000	6	0.0200	Yes	Yes
Methyl ethyl ketone	000078-93-3	1*†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	0.4000	0.5	0.5	0.5	0.5	1	1	17	1.0000	Yes	No
Methyl isobutyl ketone	000108-10-1	10*	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	0.4000	5.0	5.0	5.0	5.0	1	1	17	1.0000	Yes	No

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			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Methyl phenol, 4-	000106-44-5	100	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	0.0007*	0.0007*	5.0	5.0	5.0	5.0	100*	100*	11	1.0000	Yes	No
Methyl tert-butyl ether (MTBE)**	001634-04-4	10†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	5.0	5.0	5.0	5.0	1	1	17	1.0000	Yes	No
Methylene chloride (dichloromethane)	000075-09-2	10†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	5.0	5.0	500.0*	500.0*	1	10	17	1.0000	Yes	No
Methylnaphthalene, 2-	000091-57-6	1000†	1.00E+00	1.00E-02	2.00E-01	2.00E-03	0.4000	0.4000	50000.0*	50000.0*	50000.0*	50000.0*	100*	1000	11	0.2000	Yes	Yes
Naphthalene	000091-20-3	1000*†	1.00E+00	1.00E-02*	2.00E-01	2.00E-03*	0.4000	0.4000	50000.0*	5000.0*	50000.0*	5000.0	1000	1000	11	0.2000	Yes	Yes
Nickel	007440-02-0	10000	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	0.5	500.0	500.0	500.0	100*	1000	...	...	No	Yes
Nitrosodiphenylamine, N-	000086-30-6	10	1.00E+00	1.00E-02*	2.00E-01	2.00E-03*	1.0000	1.0000	500.0	500.0	500.0	500.0	100	100	6	0.0200	Yes	Yes
Pentachlorodibenzo-p-dioxin 1,2,3,7,8-	040321-76-4	10000	1.00E+00	1.00E-04	2.00E-05*	2.00E-09*	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0*	0*	...	...	No	Yes
Pentachlorodibenzofuran 1,2,3,7,8-	057117-41-6	0*	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	...	...	No	Yes
Pentachlorodibenzofuran 2,3,4,7,8-**	057117-31-4	10000	1.00E+00	1.00E-04	...	...	1.0000	1.0000	0.5	0.5	0.5	0.5	0	0	6	0.0020	Yes	Yes
Pentachlorophenol (PCP)	000087-86-5	100	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	1.0000	50000.0*	5000.0*	50000.0*	5000.0*	100	1000	6	0.0200	Yes	Yes
Perchlorate**	014797-73-0	10000	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	0.0700	0.5	0.5	0.5	0.5	0	0	...	...	No	Yes
Phenanthrene	000085-01-8	0	1.00E+00	1.00E-04*	2.00E-01	2.00E-05*	0.4000*	0.4000*	5000.0*	5000.0*	50000.0*	5000.0*	10000*	10000*	11	0.0200	Yes	Yes
Phenol	000108-95-2	10*	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0007*	0.0700*	50.0*	5.0	50000.0*	5.0	10000	1000*	11	1.0000	Yes	No
Plutonium	007440-07-5	0	1.00E+00	1.00E-04	...	...	1.0000	1.0000	500.0*	500.0*	500.0*	500.0*	0	0	...	...	No	Yes

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Substance Name	CAS Number	Toxicity	Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity		Air Gas Migration	Air Gas Mobility	Gas	Part
			Liquid		Non-Liquid				Food Chain		Environment							
			Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt				
Polychlorinated biphenyls (PCBs)	001336-36-3	10000	1.00E+00	1.00E-04	2.00E-03	2.00E-07	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	10000	10000	11	0.0200	Yes	Yes
Pyrene	000129-00-0	100†	1.00E+00	1.00E-04*	2.00E-01*	2.00E-05	1.0000	1.0000	50000.0*	5000.0	50000.0*	5000.0	10000	10000	6	0.0020	Yes	Yes
Radium	007440-14-4	0	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	0	0	...	...	No	Yes
Radon	010043-92-2	0	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	0.0700	0.5	0.5	0.5	0.5	0	0	17	1.0000	Yes	No
Selenium	007782-49-2	100	1.00E+00	1.00E+00*	1.00E+00	1.00E+00*	1.0000	1.0000	50.0*	500.0*	500.0*	500.0*	1000	100	...	...	No	Yes
Silver	007440-22-4	100	1.00E+00	1.00E+00	1.00E+00*	1.00E+00*	1.0000	1.0000	50.0	50000.0*	50.0	50000.0*	10000	10000	...	...	No	Yes
Strontium	007440-24-6	1	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5.0*	5.0*	5.0*	5.0*	0	0	...	...	No	Yes
Styrene	000100-42-5	10†	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	0.4000	1.0000	50.0	50.0	50.0	50.0	100	100	17	1.0000	Yes	No
Tetrachlorobenzene, 1,2,4,5-	000095-94-3	10000	1.00E+00	1.00E-02	2.00E-03	2.00E-05	1.0000	1.0000	5000.0	5000.0	5000.0	5000.0	10000*	1000	17	0.2000	Yes	Yes
Tetrachlorodibenzo-p-dioxin**	041903-57-5	0	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	...	...	No	Yes
Tetrachlorodibenzo-p-dioxin 2,3,7,8- (TCDD)	001746-01-6	10000	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	5000.0	5000.0	5000.0	5000.0	0*	0*	6	0.0002	Yes	Yes
Tetrachlorodibenzofuran 2,3,7,8-	051207-31-9	10000	1.00E+00	1.00E-04	2.00E-05*	2.00E-09*	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	0	0	6*	0.0020*	Yes*	Yes
Tetrachloroethane, 1,1,2,2-	000079-34-5	100†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	5.0	5.0	5.0	5.0	0*	0*	11	1.0000	Yes	No
Tetrachloroethylene	000127-18-4	100†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	50.0	50.0	50.0	50.0	0*	0*	17	1.0000	Yes	No

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			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Thallium	007440-28-0	100	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	1.0000	1.0000	500.0	50.0	500.0	50.0	0*	0*	...	...	No	Yes
Toluene	000108-88-3	10†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0700*	0.0700*	50.0	50.0	5000.0*	50.0	100	100	17	1.0000	Yes	No
Toxaphene	008001-35-2	1000	1.00E+00	1.00E-04*	2.00E-03	2.00E-07*	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	10000	10000	6	0.0020	Yes	Yes
Trichlorobenzene, 1,2,4-	000120-82-1	1000†	1.00E+00	1.00E+00	2.00E-01	2.00E-01	0.4000	1.0000	5000.0*	500.0	5000.0*	500.0	1000	10000*	17	1.0000	Yes	No
Trichloroethane, 1,1,1-	000071-55-6	1†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	5.0	5.0	5.0	5.0	10	10	17	1.0000	Yes	No
Trichloroethane, 1,1,2-	000079-00-5	10000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	50.0	50.0	50.0	50.0	100*	10	17	1.0000	Yes	No
Trichloroethylene (TCE)	000079-01-6	Refer to Trichloroethylene (TCE) Appendix BI Interim Report, 10/23/2006																
Trichlorofluoromethane	000075-69-4	10†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	50.0	50.0	50.0	50.0	0	0	17	1.0000	Yes	No
Trichlorophenol, 2,4,6-	000088-06-2	10	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	0.4000	5000.0*	5000.0*	50000.0	50000.0	1000	100	11	0.2000	Yes	Yes
Trichloropropane, 1,2,3-	000096-18-4	10000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	5.0*	5.0*	5.0*	5.0*	10	10	11	1.0000	Yes	No
Trifluralin (Treflan)	001582-09-8	100	1.00E+00	1.00E-02	2.00E-01	2.00E-03	1.0000	1.0000	5000.0	5000.0	50000.0	50000.0	10000	10000*	11	0.0200	Yes	Yes
Trinitrobenzene, 1,3,5-	000099-35-4	100*	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	0.0700	5.0	5.0	5.0	5.0	1000	1000	0*	0.0020*	Yes	Yes
Vanadium	007440-62-2	100	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	500.0*	500.0*	500.0*	500.0*	0	0	...	...	No	Yes
Vinyl acetate	000108-05-4	10†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0700*	0.0700*	0.5	0.5	0.5	0.5	10	100*	17	1.0000	Yes	No

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			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Vinyl chloride	000075-01-4	10000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0007	0.0700	5.0	5.0	5.0	5.0	0	0	17	1.0000	Yes	No
Xylene**	001330-20-7	100†	1.00E+00	1.00E-02	1.00E+00	1.00E-02	0.4000	1.0000	50.0	50.0	50.0	50.0	100	100	17	1.0000	Yes	No
Xylene, m-	000108-38-3	100†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0007*	0.0700*	500.0	500.0	500.0	500.0	100	100*	17	1.0000	Yes	No
Xylene, o-	000095-47-6	100†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	50.0	50.0	50.0	50.0	100	100	17	1.0000	Yes	No
Xylene, p-	000106-42-3	100†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0007*	0.0700*	50.0	50.0	50.0	50.0	100	100*	17	1.0000	Yes	No
Zinc	007440-66-6	10	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	5.0*	50000.0	50000.0*	50000.0	10	100	...	...	No	Yes

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			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Americium 241	014596-10-2	10000	1.00E+00	1.00E-02	...	...	1.0000	1.0000	0.5	0.5	0.5	0.5	10000	10000	...	...	No	Yes
Antimony 125(+D) (radionuclide)	014234-35-6	1000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5.0*	5.0*	5.0	50.0*	1000	1000	...	...	No	Yes
Cadmium 109 (radionuclide)	014109-32-1	1000	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	5000.0	50000.0*	50000.0*	50000.0*	1000	1000	...	...	No	Yes
Cesium 137(+D) (radionuclide)	010045-97-3	10000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5.0*	50.0*	5.0*	50.0*	10000	10000	...	...	No	Yes
Cobalt 57 (radionuclide)	013981-50-5	100	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5000.0*	5000.0*	5000.0	5000.0	100	100	...	...	No	Yes
Cobalt 60 (radionuclide)	010198-40-0	10000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5000.0*	5000.0*	5000.0	5000.0	10000	10000	...	...	No	Yes
Iron 55 (radionuclide)	014681-59-5	100	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5000.0*	5000.0*	5000.0*	5000.0*	100	100	...	...	No	Yes
Lead 210(+D) (radionuclide)	014255-04-0	10000	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	5.0*	5000.0	50000.0*	5000.0	10000	10000	...	...	No	Yes
Manganese 54 (radionuclide)	013966-31-9	1000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	50000.0*	50000.0*	50000.0	50000.0	1000	1000	...	...	No	Yes
Nickel 59 (radionuclide)	014336-70-0	100	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	0.5	500.0	500.0	500.0	100	100	...	...	No	Yes
Nickel 63 (radionuclide)	013981-37-8	100	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	0.5	500.0	500.0	500.0	100	100	...	...	No	Yes
Plutonium 236 (radionuclide)	015411-92-4	10000	1.00E+00	1.00E-04	...	...	1.0000	1.0000	500.0*	500.0*	500.0*	500.0*	10000	10000	...	...	No	Yes
Plutonium 238 (radionuclide)	013981-16-3	10000	1.00E+00	1.00E-04	...	...	1.0000	1.0000	500.0*	500.0*	500.0*	500.0*	10000	10000	...	...	No	Yes
Plutonium 239 (radionuclide)	015117-48-3	10000	1.00E+00	1.00E-04	...	...	1.0000	1.0000	500.0*	500.0*	500.0*	500.0*	10000	10000	...	...	No	Yes
Plutonium 240 (radionuclide)	014119-33-6	10000	1.00E+00	1.00E-04	...	...	1.0000	1.0000	500.0*	500.0*	500.0*	500.0*	10000	10000	...	...	No	Yes

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			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Plutonium 241(+D) (radionuclide)	014119-32-5	10000	1.00E+00	1.00E-04	...	...	1.0000	1.0000	500.0*	500.0*	500.0*	500.0*	10000	10000	...	...	No	Yes
Plutonium 242 (radionuclide)	013982-10-0	10000	1.00E+00	1.00E-04	...	...	1.0000	1.0000	500.0*	500.0*	500.0*	500.0*	10000	10000	...	...	No	Yes
Plutonium 243 (radionuclide)	015706-37-3	100	1.00E+00	1.00E-04	...	...	0.0700	0.0700	500.0*	500.0*	500.0*	500.0*	100	100	...	...	No	Yes
Plutonium 244(+D) (radionuclide)	014119-34-7	10000	1.00E+00	1.00E-04	...	...	1.0000	1.0000	500.0*	500.0*	500.0*	500.0*	10000	10000	...	...	No	Yes
Radium 226(+D) (radionuclide)	013982-63-3	10000	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes
Radium 228(+D) (radionuclide)	015262-20-1	10000	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes
Radon 222 (+D)(radionuclide)	014859-67-7	1000	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	0.4000	0.5	0.5	0.5	0.5	1000	1000	17	1.0000	Yes	No
Silver 108m(+D) (radionuclide)	014391-65-2	1000*	1.00E+00	1.00E+00	1.00E+00*	1.00E+00*	1.0000	1.0000	50.0	50000.0*	50.0	50000.0*	1000*	1000*	...	...	No	Yes
Silver 110m (radionuclide)	014391-76-5	1000*	1.00E+00	1.00E+00	1.00E+00*	1.00E+00*	1.0000	1.0000	50.0	50000.0*	50.0	50000.0*	1000*	1000*	...	...	No	Yes
Strontium 90(+D) (radionuclide)	010098-97-2	10000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	5.0*	5.0*	5.0*	5.0*	10000	10000	...	...	No	Yes
Technetium 99 (radionuclide)**	014133-76-7	1000	1.00E+00	1.00E+00	...	...	1.0000	1.0000	0.5	0.5	0.5	0.5	1000	1000	...	...	No	Yes
Thallium 204 (radionuclide)	013968-51-9	1000*	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	1.0000	1.0000	500.0	50.0	500.0	50.0	1000*	1000*	...	...	No	Yes
Thorium 227 (radionuclide)	015623-47-9	10000	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	1.0000	0.4000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes
Thorium 228(+D) (radionuclide)	014274-82-9	10000	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).
** Indicates new hazardous substance in current version of chemical data (JAN04).
† See December 2011 SCDM update for volatile substances.

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Thorium 229(+D) (radionuclide)	015594-54-4	10000	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes
Thorium 230 (radionuclide)	014269-63-7	10000	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes
Thorium 231 (radionuclide)	014932-40-2	1000*	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	0.4000	0.0700	0.5*	0.5*	0.5*	0.5*	1000*	1000*	...	...	No	Yes
Thorium 232 (radionuclide)	007440-29-1	10000	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes
Thorium 234 (radionuclide)	015065-10-8	10000*	1.00E+00	1.00E-02*	1.00E+00	1.00E-02*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000*	10000*	...	...	No	Yes
Tritium	010028-17-8	100	1.00E+00	1.00E+00	...	...	1.0000	1.0000	0.5	0.5	0.5	0.5	100	100	17	1.0000	Yes	No
Uranium 232 (radionuclide)	014158-29-3	10000	1.00E+00	1.00E+00*	2.00E-01*	2.00E-01*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes
Uranium 233 (radionuclide)	013968-55-3	10000	1.00E+00	1.00E+00*	2.00E-01*	2.00E-01*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes
Uranium 234 (radionuclide)	013966-29-5	10000	1.00E+00	1.00E+00*	2.00E-01*	2.00E-01*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes
Uranium 235(+D) (radionuclide)	015117-96-1	10000	1.00E+00	1.00E+00*	2.00E-01*	2.00E-01*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes
Uranium 236(+D) (radionuclide)	013982-70-2	10000	1.00E+00	1.00E+00*	2.00E-01*	2.00E-01*	1.0000	1.0000	0.5*	0.5*	0.5*	0.5*	10000	10000	...	...	No	Yes
Uranium 238(+D) (radionuclide)	007440-61-1	10000	1.00E+00	1.00E+00*	2.00E-01*	2.00E-01*	1.0000	1.0000	5000.0*	5000.0*	5000.0*	5000.0*	10000	10000	...	...	No	Yes
Zinc 65 (radionuclide)	013982-39-3	1000	1.00E+00	1.00E-02	1.00E+00*	1.00E-02*	1.0000	1.0000	5.0*	50000.0	50000.0*	50000.0	1000	1000	...	...	No	Yes

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).
** Indicates new hazardous substance in current version of chemical data (JAN04).
† See December 2011 SCDM update for volatile substances.

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Asbestos	001332-21-4	10000	1.00E+00	1.00E-04	...	...	1.0000	1.0000	0.5	0.5	0.5	0.5	0	0	...	...	No	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L)		Chronic CCC (µg/L)	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Asbestos	001332-21-4	7.0 million fibers/L									

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Asbestos	001332-21-4			4.5E-6 fibers/cc *nn		

* Indicates difference between previous version of chemical data (JAN 04) and current version of chemical data (MAY 08).

** Indicates new hazardous substance in current version of chemical data (MAY 08).

BI

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SCDM Data Version : 5/6/2025 Hazardous Substance Factor Values

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Atrazine	001912-24-9	100	1.00E+00	1.00E-02*	2.0E-1	2.0E-2*	0.0007	0.0700	50.0	50.0	50000.0*	50000.0*	1000	10000	6	0.0020	Yes	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Atrazine	001912-24-9	3.0E-3	1.3E+0	3.8E-4	...	4.7E+1	1.4E-2	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Atrazine	001912-24-9	...	...	...	2.7E+3	2.9E+0

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).

** Indicates new hazardous substance in current version of chemical data (JAN04).

BI

SCDM Data Version : 12/29/2010

Hazardous Substance Factor Values

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Dibutyltin **	001002-53-5	10,000	1.0E+00	1.0E+00	1.0E+00	1.0E+00	0.4000	1.0000	5.0	5.0	5.0	5.0	0	0	17	1.0000	Yes	No

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Dibutyltin**	001002-53-5	...	1.1E-2	...	...	4.1E-1	...	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Dibutyltin**	001002-53-5	...	...	...	2.3E+1	...

* Indicates difference between previous version of chemical data (JAN 04) and current version of chemical data (DEC10).

** Indicates new hazardous substance in current version of chemical data (DEC10).

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Dibutyltin dichloride**	000683-18-1	10000	1.00E+00	1.00E+00	2.00E-01	2.00E-01	1.0000	1.0000	50.0	50.0	50.0	50.0	1000	1000	17	0.2000	Yes	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Dibutyltin dichloride**	000683-18-1	...	1.4E-2	...	...	5.3E-1	...	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Dibutyltin dichloride**	000683-18-1	...	...	...	3.1E+1	...

* Indicates difference between previous version of chemical data (JAN04) and current version of chemical data (DEC10).

** Indicates new hazardous substance in current version of chemical data (DEC10).

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Furfural	000098-01-1	1000	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	1.0000	0.5	0.5	0.5	0.5	100*	100*	11	1.0000	Yes	No

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Furfural	000098-01-1	...	1.1E-1	...	...	4.1E+0	...	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Furfural	000098-01-1	...	5.2E-2	...	2.3E+2	...

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).

** Indicates new hazardous substance in current version of chemical data (JAN04).

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
2-Methyl-4-chlorophenoxyacetic acid (MCPA) **	000094-74-6	1000	1.0E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	0.4000	500.0	500.0	500.0	500.0	10000	1	6	0.0200	Yes	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
2-Methyl-4-chlorophenoxyacetic acid (MCPA)**	000094-74-6	...	1.8E-2	...	...	6.8E-1	...	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
2-Methyl-4-chlorophenoxyacetic acid (MCPA)**	000094-76-6	...	...	...	3.9E+1	...

* Indicates difference between previous version of chemical data (JAN 2004) and current version of chemical data (SEP 2010).

** Indicates new hazardous substance in current version of chemical data (SEP 2010).

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Methylchlorophenoxypropionic acid (MCPP)**	000093-65-2	1000	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	0.4000	50.0	50.0	50.0	50.0	100	100	6	0.0200	Yes	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Methylchlorophenoxypropionic acid (MCPP)**	000093-65-2	...	3.6E-2	...	...	1.4E+0	...	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Methylchlorophenoxypropionic acid (MCPP)**	000093-65-2	...	...	...	7.8E+1	...

* Indicates difference between previous version of chemical data (JAN 2004) and current version of chemical data (SEP 2010).

** Indicates new hazardous substance in current version of chemical data (SEP 2010).

HAZARD RANKING SYSTEM
Hazardous Substance Factor Values

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Nitrobenzene	000098-95-3	1000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.0000	1.0000	50.0*	50.0*	50.0*	50.0*	100	100*	11	1.0000	Yes	No

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Nitrobenzene	000098-95-3	...	1.8E-2	...	...	6.8E-1	...	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Nitrobenzene	000098-95-3	...	9.4E-3 †	6.1E-5†	3.9E+1	...

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).

** Indicates new hazardous substance in current version of chemical data (JAN04).

† See December 2011 SCDM update for volatile substances.

HAZARD RANKING SYSTEM
15 Nov 2004

Interim SCDM Data Version : 11/10/2004
Hazardous Substance Factor Values

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Nitrosodimethylamine, N –	000062-75-9	10000	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.0007	0.0700	0.5	0.5	0.5	0.5	1	1	11	1.0000	Yes	No

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Nitrosodimethylamine, N –	000062-75-9	...	2.9E-4*	1.7E-6	...	1.1E-2*	6.2E-5	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Nitrosodimethylamine, N –	000062-75-9	...	...	1.7E-7	6.3E-1*	1.3E-2

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).
** Indicates new hazardous substance in current version of chemical data (JAN04).

BI

SCDM Data Version : 09/01/2010

Hazardous Substance Factor Values

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Octachlorodibenzo-p-Dioxin 1,2,3,4,6,7,8,9- (OCDD)**	003268-87-9	10000	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	5000.0	5000.0	50000.0	50000.0	0	0	...	...	No	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Octachlorodibenzo-p-Dioxin 1,2,3,4,6,7,8,9- (OCDD)**	003268-87-9	...	...	1.9E-6	...	...	7.0E-5	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Octachlorodibenzo-p-Dioxin 1,2,3,4,6,7,8,9- (OCDD)**	003268-87-9	...	...	1.9E-7	...	1.4E-2

* Indicates difference between previous version of chemical data (JAN 2004) and current version of chemical data (SEP 2010).

** Indicates new hazardous substance in current version of chemical data (SEP 2010).

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Octachlorodibenzofuran 1,2,3,4,6,7,8,9- (OCDF)**	039001-02-0	10000	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	5000.0	5000.0	0	0	...	...	No	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Octachlorodibenzofuran 1,2,3,4,6,7,8,9- (OCDF)**	039001-02-0	...	...	1.9E-6	...	...	7.0E-5	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Octachlorodibenzofuran 1,2,3,4,6,7,8,9- (OCDF)**	039001-02-0	...	...	1.97E-7	...	1.4E-2

* Indicates difference between previous version of chemical data (JAN 2004) and current version of chemical data (SEP 2010).

** Indicates new hazardous substance in current version of chemical data (SEP 2010).

BI

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SCDM Data Version : 3/16/2005 Hazardous Substance Factor Values

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Perchlorate**	014797-73-0	1000	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	0.0700	0.5	0.5	0.5	0.5	0	0	...	...	No	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Perchlorate**	014797-73-0	...	2.6E-2	...	...	9.5E-1	...	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).

** Indicates new hazardous substance in current version of chemical data (JAN04).

Substance Name	CAS Number	AIR PATHWAY NAAQS NESHAPS (ug/m^3)	AIR PATHWAY Reference Dose Screen Conc (mg/m^3)	AIR PATHWAY Cancer Risk Screen Conc (mg/m^3)	SOIL PATHWAY Reference Dose Screen Conc (mg/kg)	SOIL PATHWAY Cancer Risk Screen Conc (mg/kg)
Perchlorate**	014797-73-0	...	...	...	5.5E+1	...

Footnote Code	Footnote Description
A	This recommended water quality criterion was derived from data for arsenic (III), but is applied here to total arsenic, which might imply that arsenic (III) and arsenic (V) are equally toxic to aquatic life and that their toxicities are additive. In the arsenic criteria document (EPA 440/5-84-033, January 1985), Species Mean Acute Values are given for both arsenic (III) and arsenic (V) for five species and the ratios of the SMAVs for each species range from 0.6 to 1.7. Chronic values are available for both arsenic (III) and arsenic (V) for one species; for the fathead minnow, the chronic value for arsenic (V) is 0.29 times the chronic value for arsenic (III). No data are known to be available concerning whether the toxicities of the forms of arsenic to aquatic organisms are additive.
B	This criterion has been revised to reflect The Environmental Protection Agency's q1* or RfD, as contained in the Integrated Risk Information System (IRIS) as of May 17, 2002. The fish tissue bioconcentration factor (BCF) from the 1980 Ambient Water Quality Criteria document was retained in each case.
C	This criterion is based on carcinogenicity of 10^{-6} risk. Alternate risk levels may be obtained by moving the decimal point (e.g., for a risk level of 10^{-5}, move the decimal point in the recommended criterion one place to the right).
D	Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. The recommended water quality criteria value was calculated by using the previous 304(a) aquatic life criteria expressed in terms of total recoverable metal, and multiplying it by a conversion factor (CF). The term "Conversion Factor" (CF) represents the recommended conversion factor for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column. (Conversion Factors for saltwater CCCs are not currently available. Conversion factors derived for saltwater CMCs have been used for both saltwater CMCs and CCCs). See "Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria," October 1, 1993, by Martha G. Prothro, Acting Assistant Administrator for Water, available from the Water Resource center, USEPA, 401 M St., SW, mail code RC4100, Washington, DC 20460; and 40CFR§131.36(b)(1). Conversion Factors applied in the table can be found in Appendix A to the Preamble- Conversion Factors for Dissolved Metals (which is attached below).
E	The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. The value given here corresponds to a hardness of 100 mg/L. Criteria values for other hardness may be calculated from the following: CMC (dissolved) = $\exp\{m_A [\ln(\text{hardness})]+ b_A\}$ (CF), or CCC (dissolved) = $\exp\{m_C [\ln (\text{hardness})]+ b_C\}$ (CF) and the parameters specified in Appendix B- Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent (which is attached below).
F	Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: CMC = exp(1.005(pH)-4.869); CCC = exp(1.005(pH)-5.134). Values displayed in table correspond to a pH of 7.8.

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).

** Indicates new hazardous substance in current version of chemical data (JAN04).

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Tetrahydrothiophene, 1,1-dioxide **	000126-33-0	1	1.00E+0	1.00E+0	1.00E+0	1.00E+0	1.0000	1.0000	0.5	0.5	0.5	0.5	1	1	11	0.2000	Yes	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Tetrahydrothiophene, 1,1-dioxide**	000126-33-0	...	...	...	...	...	...	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Tetrahydrothiophene, 1,1-dioxide**	000126-33-0	...	...	...	...	...

* Indicates difference between previous version of chemical data (JAN 2004) and current version of chemical data (JUN 2010).

** Indicates new hazardous substance in current version of chemical data (JUN 2010).

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Tributyltin**	000688-73-3	10000	1.00E+00	1.00E-04	2.00E-05	2.00E-09	1.0000	1.0000	50000.0	50000.0	50000.0	50000.0	10000	10000	17	0.2000	Yes	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Tributyltin**	000688-73-3		1.1E-2			4.1E-1		4.6E-1	4.2E-1	7.2E-2	7.4E-3

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Tributyltin**	000688-73-3				2.3E+1	

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).
** Indicates new hazardous substance in current version of chemical data (JAN04).

BI

Substance Name	CAS Number	Toxicity	Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity		Air Gas Migration	Air Gas Mobility	Gas	Part
			Liquid		Non-Liquid				Food Chain		Environment							
			Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt				
Tributyltin chloride **	001461-22-9	10,000	1.00E+00	1.00E-04	2.00E-01	2.00E-05	1.0000	1.0000	5000	50000	50000	50000	10000	10000	17	0.2000	Yes	Yes

BII

Substance Name	CAS Number	Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
		MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Acute CMC (µg/L)		Chronic CCC (µg/L)	
								Fresh	Salt	Fresh	Salt
Tributyltin chloride **	001461-22-9		1.2E-2			4.6E-1		5.2E-1^{PP}	4.7E-1^{PP}	8.1E-2^{PP}	8.3E-3^{PP}

Substance Name	CAS Number	AIR PATHWAY			SOIL PATHWAY	
		NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Tributyltin chloride **	001461-22-9				2.7E+1	

* Indicates difference between previous version of chemical data (JAN 04) and current version of chemical data (DEC 10).

** Indicates new hazardous substance in current version of chemical data (DEC 10).

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Tributyltin oxide**	0056-35-9	10000	1.00E+00	1.00E-04	2.00E-01	2.00E-05	1.0000	1.0000	500.0	50000.0	5000.0	50000.0	10000	10000	6	0.0020	Yes	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Tributyltin oxide**	0056-35-9	...	1.1E-2	...	...	4.1E-1	...	4.9E-1[ll]	4.4E-1[ll]	7.6E-2[ll]	7.8E-3[ll]

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Tributyltin oxide**	0056-35-9	...	...	...	2.3E+1	...

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).

** Indicates new hazardous substance in current version of chemical data (JAN04).

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Trichloroethylene (TCE)	000079-01-6	1000†	1.00E+00	1.00E+00	1.00E+00	1.00E+00	0.4000	1.0000	50.0	50.0	50.0	50.0	100	10	17	1.0000	Yes	No

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Trichloroethylene (TCE)	000079-01-6	5.0E-3	1.1E-2*	2.1E-4*	...	4.1E-1*	7.9E-3*	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Trichloroethylene (TCE)	000079-01-6	...	2.1E-3 †	5.9E-4 †	2.3E+1*	1.6E+0*

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data.

** Indicates new hazardous substance in current version of chemical data (JAN04).

† See December 2011 SCDM update for volatile substances.

BI

			Ground Water Mobility						Bioaccumulation									
			Liquid		Non-Liquid		Persistence		Food Chain		Environment		Ecotoxicity					
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Trichlorophenoxyacetic acid, 2,4,5- (2,4,5-T) **	000093-76-5	100	1.00E+00	1.00E-02	1.00E+00	1.00E-02	1.0000	1.0000	50.0	50.0	500.0	500.0	10000	100	0	0.0020	Yes	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Trichlorophenoxyacetic acid, 2,4,5- (2,4,5-T)**	000093-76-5	...	3.6E-1	...	...	1.4E+1	...	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Trichlorophenoxyacetic acid, 2,4,5- (2,4,5-T)**	000093-76-5	...	...	...	7.8E+2	...

* Indicates difference between previous version of chemical data (JAN 2004) and current version of chemical data (SEP 2010).

** Indicates new hazardous substance in current version of chemical data (SEP 2010).

BI

			Ground Water Mobility				Persistence		Bioaccumulation				Ecotoxicity					
			Liquid		Non-Liquid				Food Chain		Environment							
Substance Name	CAS Number	Toxicity	Karst	Non-Karst	Karst	Non-Karst	River	Lake	Fresh	Salt	Fresh	Salt	Fresh	Salt	Air Gas Migration	Air Gas Mobility	Gas	Part
Uranium **	007440-61-1	1000	1.00E+00	1.00E+00	2.0E-1	2.0E-1	1.0000	1.0000	5000	5000	5000	5000	10	10	...	...	No	Yes

BII

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Uranium **	007440-61-1	3.0 E-02	1.1E-1	...	...	4.1E+0	...	...	...	...	...

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Uranium **	007440-61-1	...	...	...	2.3E+2	...

* Indicates difference between previous version of chemical data (JAN 2004) and current version of chemical data (APR 2010).

** Indicates new hazardous substance in current version of chemical data (APR 2010).

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
								Fresh	Salt	Fresh	Salt
Acenaphthene	000083-32-9	...	2.2E+0	...	...	8.1E+1	...	...	...	...	...
Acenaphthylene	000208-96-8	...	...	...	...	...	...	...	...	...	...
Acetone	000067-64-1	...	3.3E+1*	...	...	1.2E+3*	...	...	...	...	...
Acrolein	000107-02-8	...	1.8E-2*	...	...	6.8E-1*	...	...	...	...	...
Acrylamide	000079-06-1	...	7.3E-3	1.9E-5	...	2.7E-1	7.0E-4	...	...	...	...
Alachlor**	015972-60-8	2.0E-3	3.6E-1	1.1E-3	...	1.4E+1	3.9E-2	...	...	...	...
Aldrin	000309-00-2	...	1.1E-3	5.0E-6	3.0E-1	4.1E-2	1.9E-4	3.0E+0^{G}	1.3E+0^{G}	...	...
Aluminum	007429-90-5	...	...	...	...	...	...	7.5E+2$^{G2, I2}$	...	8.7E+1$^{G2, I2, L2}$	...
Americium**	007440-35-9	...	...	...	...	...	...	...	...	...	...
Aniline	000062-53-3	...	...	1.5E-2	...	...	5.5E-1	...	...	...	...
Anthracene	000120-12-7	...	1.1E+1	...	...	4.1E+2	...	...	...	...	...
Antimony	007440-36-0	6.0E-3	1.5E-2	...	...	5.4E-1	...	...	...	...	...
Arsenic	007440-38-2	1.0E-2*	1.1E-2	5.7E-5	...	4.1E-1	2.1E-3	3.4E+2$^{A, D, K}$	6.9E+1$^{A, D, bb}$	1.5E+2$^{A, D, K}$	3.6E+1$^{A, D, bb}$
Asbestos	001332-21-4	7.0E+0 million fibers/L	...	...	...	...	...	...	...	...	...
Barium	007440-39-3	2.0E+0	2.6E+0	...	...	9.5E+1	...	...	...	...	...

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).
** Indicates new hazardous substance in current version of chemical data (JAN04).
† See December 2011 SCDM update for volatile substances.
‡ Indicates cancer risk through a mutagenic mode of action.

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute		Chronic	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	CMC (µg/L) *		CCC (µg/L) *	
								Fresh	Salt	Fresh	Salt
Benz(a)anthracene	000056-55-3	...	...	1.2E-4	...	...	4.3E-3	...	...	...	...
Benzene	000071-43-2	5.0E-3	1.5E-1*	1.5E-3	...	5.4E+0*	5.7E-2*	...	...	...	...
Benzidine	000092-87-5	...	1.1E-1	3.7E-7	...	4.1E+0	1.4E-5	...	...	...	...
Benzo(a)pyrene	000050-32-8	2.0E-4	...	1.2E-5	...	...	4.3E-4	...	...	...	...
Benzo(g,h,i)perylene	000191-24-2	...	...	...	...	...	...	...	...	...	...
Benzo(j,k)fluorene (Fluoranthene)	000206-44-0	...	1.5E+0	...	...	5.4E+1	...	...	...	...	...
Benzo(k)fluoranthene	000207-08-9	...	...	1.2E-3	...	...	4.3E-2	...	...	...	...
Beryllium	007440-41-7	4.0E-3	7.3E-2*	...*	...	2.7E+0*	...*	...	...	...	...
Bis (2-ethylhexyl) phthalate	000117-81-7	6.0E-3	7.3E-1	6.1E-3	...	2.7E+1	2.3E-1	...	...	...	...
Boron	007440-42-8	...	3.3E+0	...	...	1.2E+2	...	...	...	...	...
Bromodichloromethane	000075-27-4	...*	7.3E-1	1.4E-3	...	2.7E+1	5.1E-2	...	...	...	...
Butylbenzyl phthalate	000085-68-7	...	7.3E+0	...	...	2.7E+2	...	...	...	...	...
Cadmium	007440-43-9	5.0E-3	1.8E-2	...	...	6.8E-1	...	2.0E+0[D, E, K, bb]	4.0E+1[D, bb]	2.5E-1[D, E, K, bb]	8.8E+0[D, bb]
Carbazole	000086-74-8	...	...	4.3E-3	...	...	1.6E-1	...	...	...	...

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		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
								Fresh	Salt	Fresh	Salt
Carbon disulfide	000075-15-0	...	3.7E+0	...	...	1.4E+2	...	...	...	...	...
Carbon tetrachloride	000056-23-5	5.0E-3	2.6E-2	6.6E-4	...	9.5E-1	2.4E-2	...	...	...	...
Cesium	007440-46-2	...	...	...	...	...	...	...	...	...	...
Chlordane	000057-74-9	2.0E-3	1.8E-2	2.4E-4	3.0E-1	6.8E-1*	9.0E-3	$2.4E+0^{G}$	$9.0E-2^{G}$	$4.3E-3^{G, aa}$	$4.0E-3^{G, aa}$
Chlordane, alpha-	005103-71-9	...	1.8E-2*	2.4E-4*	...	6.8E-1*	9.0E-3*	...	...	...	...
Chlordane, gama-	005566-34-7	...	1.8E-2*	2.4E-4*	...	6.8E-1*	9.0E-3*	...	...	...	...
Chlorobenzene	000108-90-7	1.0E-1	7.3E-1	...	...	2.7E+1	...	...	...	...	...
Chloroform	000067-66-3	...*	3.6E-1	...*	...	1.4E+1	...*	...	...	...	...
Chromium	007440-47-3	1.0E-1	1.1E-1*	...	...	4.1E+0*	...	...	...	...	...
Chromium(III)	016065-83-1	...	5.5E+1*	...	...	2.0E+3*	...	$5.7E+2^{D, E, K}$	...	$7.4E+1^{D, E, K}$	...
Chromium(VI)	018540-29-9	...	1.1E-1*	...	...	4.1E+0*	...	$1.6E+1^{D, K}$	$1.1E+3^{D, bb}$	$1.1E+1^{D, K}$	$5.0E+1^{D, bb}$
Chrysene	000218-01-9	...	...	1.2E-2	...	...	4.3E-1	...	...	...	...
Cobalt	007440-48-4	...	...	...	...	...	...	...	...	...	...
Copper	007440-50-8	1.3E+0	...	...	...	...	...	$1.3E+1^{D, E, K, cc}$	$4.8E+0^{D, cc, ff}$	$9.0E+0^{D, E, K, cc}$	$3.1E+0^{D, cc, ff}$

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		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Cumene	000098-82-8	...	3.7E+0*	...	...	1.4E+2*	...	...	...	...	...
Cyanamide**	000420-04-2	...	...	...	...	...	...	...	...	...	...
Cyanide	000057-12-5	2.0E-1	7.3E-1	...	...	2.7E+1	...	2.2E+1[K, Q]	1.0E+0[Q, bb]	5.2E+0[K, Q]	1.0E+0[Q, bb]
DDD	000072-54-8	...	...	3.5E-4	...*	...	1.3E-2	...	...	...	...
DDE	000072-55-9	...	...	2.5E-4	5.0E+0	...	9.3E-3	...	...	...	...
DDT	000050-29-3	...	1.8E-2	2.5E-4	5.0E+0	6.8E-1	9.3E-3	1.1E+0[G, ii]	1.3E-1[G, ii]	1.0E-3[G, aa, ii]	1.0E-3[G, aa, ii]
Di-n-butyl phthalate	000084-74-2	...	3.7E+0	...	...	1.4E+2	...	...	...	...	...
Di-n-octyl phthalate	000117-84-0	...	7.3E-1	...	...	2.7E+1	...	...	...	...	...
Dibenz(a,h)anthracene	000053-70-3	...	...	1.2E-5	...	...	4.3E-4	...	...	...	...
Dibenzofuran	000132-64-9	...	1.5E-1*	...	...	5.4E+0*	...	...	...	...	...
Dibromo-3-chloropropane, 1,2-	000096-12-8	2.0E-4	...	6.1E-5	...	...	2.3E-3	...	...	...	...
Dibromoethane, 1,2-	000106-93-4	...*	...	1.0E-6	...	...	3.7E-5	...	...	...	...
Dichlorobenzene, 1,4-	000106-46-7	7.5E-2	...	3.5E-3	...	...	1.3E-1	...	...	...	...
Dichloroethane, 1,1-	000075-34-3	...	3.7E+0	...	...	1.4E+2	...	...	...	...	...

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		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
								Fresh	Salt	Fresh	Salt
Dichloroethane, 1,2-	000107-06-2	5.0E-3	...	9.4E-4	...	...	3.5E-2	...	...	...	...
Dichloroethylene, 1,1-	000075-35-4	7.0E-3	1.8E+0*	...*	...	6.8E+1*	...*	...	...	...	...
Dichloroethylene, 1,2-**	000540-59-0	...	3.3E-1	...	...	1.2E+1	...	...	...	...	...
Dichloroethylene, cis-1,2-	000156-59-2	7.0E-2	3.6E-1	...	...	1.4E+1	...	...	...	...	...
Dichloroethylene, trans-1,2-	000156-60-5	1.0E-1	7.3E-1	...	...	2.7E+1	...	...	...	...	...
Dichlorophenol, 2,4-	000120-83-2	...	1.1E-1	...	...	4.1E+0	...	...	...	...	...
Dichloropropane, 1,2-	000078-87-5	5.0E-3	...	1.3E-3	...	...	4.6E-2	...	...	...	...
Dichloropropene, 1,3-	000542-75-6	...	1.1E+0*	8.5E-4	...	4.1E+1*	3.2E-2	...	...	...	...
Dieldrin	000060-57-1	...	1.8E-3	5.3E-6	3.0E-1	6.8E-2	2.0E-4	2.4E-1^{K}	7.1E-1^{G}	5.6E-2$^{K, O}$	1.9E-3$^{G, aa}$
Diethyl phthalate	000084-66-2	...	2.9E+1	...	...	1.1E+3	...	...	...	...	...
Dimethyl phenol, 2,4-	000105-67-9	...	7.3E-1	...	...	2.7E+1	...	...	...	...	...
Dinitrobenzene, 1,3-	000099-65-0	...	3.7E-3	...	...	1.4E-1	...	...	...	...	...
Dioxin 1,4-**	000290-67-5	...	...	...	...	...	...	...	...	...	...
Diphenylhydrazine, 1,2-	000122-66-7	...	...	1.1E-4	...	...	3.9E-3	...	...	...	...
Disulfoton	000298-04-4	...	1.5E-3	...	...	5.4E-2	...	...	...	...	...

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		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Endosulfan (I or II)	000115-29-7	...	2.2E-1	...	...	8.1E+0	...	...	...	...	...
Endosulfan I**	000959-98-8	...	2.2E-1	...	...	8.1E+0	...	2.2E-1[G, Y]	3.4E-2[G, Y]	5.6E-2[G, Y]	8.7E-3[G, Y]
Endosulfan II**	033213-65-9	...	2.2E-1	...	...	8.1E+0	...	2.2E-1[G, Y]	3.4E-2[G, Y]	5.6E-2[G, Y]	8.7E-3[G, Y]
Endrin	000072-20-8	2.0E-3	1.1E-2	...	...	4.1E-1	...	8.6E-2[K]	3.7E-2[G]	3.6E-2[K, O]	2.3E-3[G, aa]
Endrin aldehyde	007421-93-4	...	...	...	...	...	...	...	...	...	...
Ethyl benzene	000100-41-4	7.0E-1	3.7E+0	...	...	1.4E+2	...	...	...	...	...
Ethyl chloride	000075-00-3	...	...	...	...	...	...	...	...	...	...
Ethylene glycol monobutyl ether (EBGE)**	000111-76-2	...	1.8E+1	...	...	6.8E+2	...	...	...	...	...
Fluorene	000086-73-7	...	1.5E+0	...	...	5.4E+1	...	...	...	...	...
Fluorine	007782-41-4	...	2.2E+0	...	...	8.1E+1	...	...	...	...	...
Heptachlor	000076-44-8	4.0E-4	1.8E-2	1.9E-5	3.0E-1	6.8E-1	7.0E-4	5.2E-1[G]	5.3E-2[G]	3.8E-3[G, aa]	3.6E-3[G, aa]
Heptachlor epoxide, alpha, beta, gamma	001024-57-3	2.0E-4	4.7E-4	9.4E-6	3.0E-1	1.8E-2	3.5E-4	5.2E-1[G, V]	5.3E-2[G, V]	3.8E-3[G, V, aa]	3.6E-3[G, V, aa]
Heptachlorodibenzo-p-dioxin**	037871-00-4	...	...	...	...	...	...	...	...	...	...

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		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
								Fresh	Salt	Fresh	Salt
Heptachlorodibenzo-p-dioxin 1,2,3,4,6,7,8-	035822-46-9	...	...	5.7E-7	...	...	2.1E-5	...	...	...	...
Heptachlorodibenzofuran 1,2,3,4,6,7,8-	067562-39-4	...	...	5.7E-7	...	...	2.1E-5	...	...	...	...
Heptachlorodibenzofuran 1,2,3,4,7,8,9-	055673-89-7	...	...	5.7E-7*	...	...	2.1E-5*	...	...	...	...
Hexabromobiphenyl (PBB)**	036355-01-8	...	...	...	...	...	...	...	...	...	...
Hexachlorobenzene	000118-74-1	1.0E-3	2.9E-2	5.3E-5	...	1.1E+0	2.0E-3	...	...	...	...
Hexachlorobutadiene	000087-68-3	...	7.3E-3	1.1E-3	...	2.7E-1	4.0E-2	...	...	...	...
Hexachlorocyclohexane, alpha-	000319-84-6	...	...	1.4E-5	...	...	5.0E-4	...	...	...	...
Hexachlorocyclohexane, beta-	000319-85-7	...	...	4.7E-5	...	...	1.8E-3	...	...	...	...
Hexachlorodibenzo-p-dioxin 1,2,3,4,7,8-	039227-28-6	...	...	1.4E-8	...	...	5.3E-7	...	...	...	...
Hexachlorodibenzo-p-dioxin 1,2,3,6,7,8-	057653-85-7	...	...	1.4E-8	...	...	5.3E-7	...	...	...	...
Hexachlorodibenzo-p-dioxin 1,2,3,7,8,9-	019408-74-3	...	...	1.4E-8	...	...	5.1E-7	...	...	...	...
Hexachlorodibenzofuran 1,2,3,4,7,8-	070648-26-9	...	...	5.7E-8	...	...	2.1E-6	...	...	...	...
Hexachlorodibenzofuran 1,2,3,6,7,8-	057117-44-9	...	...	5.7E-8	...	...	2.1E-6	...	...	...	...
Hexachlorodibenzofuran 1,2,3,7,8,9-	072918-21-9	...	...	5.7E-8	...	...	2.1E-6	...	...	...	...

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		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
								Fresh	Salt	Fresh	Salt
Hexachlorodibenzofuran 2,3,4,6,7,8-	060851-34-5	...	...	5.7E-8	...	...	2.1E-6	...	...	...	...
Hydrazine	000302-01-2	...	...	2.8E-5	...	...	1.1E-3	...	...	...	...
Hydrogen sulfide	007783-06-4	...	1.1E+0*	...	...	4.1E+1*	...	...	...	2.0E+0[F2]	2.0E+0[F2]
Indeno(1,2,3-cd)pyrene	000193-39-5	...	...	1.2E-4	...	...	4.3E-3	...	...	...	...
Iron	007439-89-6	...	...	...	...	...	...	...	...	1.0E+3[F2]	...
Lead	007439-92-1	1.5E-2	...	...	...	...	...	6.5E+1[D, E, bb, gg]	2.1E+2[D, bb]	2.5E+0[D, E, bb, gg]	8.1E+0[D, bb]
Lead chromate**	007758-97-6	...	...	...	...	...	...	...	...	...	...
Lindane	000058-89-9	2.0E-4	1.1E-2	6.6E-5	...	4.1E-1	2.4E-3	9.5E-1[K]	1.6E-1[G]	...	...
Manganese	007439-96-5	...	5.1E+0	...	...	1.9E+2	...	...	...	...	...
Mercury	007439-97-6	2.0E-3	1.1E-2	...	1.0E+0	4.1E-1	...	1.4E+0[D, K, hh]	1.8E+0[D, ee, hh]	7.7E-1[D, K, hh]	9.4E-1[D, ee, hh]
Methoxychlor	000072-43-5	4.0E-2	1.8E-1	...	...	6.8E+0	...	...	...	3.0E-2[F2]	3.0E-2[F2]
Methyl Parathion	000298-00-0	...	9.1E-3	...	...	3.4E-1	...	...	...	...	...
Methyl ethyl ketone	000078-93-3	...	2.2E+1	...	...	8.1E+2	...	...	...	...	...

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Substance Name	CAS Number	Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
		MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
								Fresh	Salt	Fresh	Salt
Methyl isobutyl ketone	000108-10-1	...	2.9E+0	...	...	1.1E+2	...	...	...	...	...
Methyl phenol, 4-	000106-44-5	...	1.8E-1	...	...	6.8E+0	...	...	...	...	...
Methyl tert-butyl ether (MTBE)**	001634-04-4	...	...	...	...	...	...	...	...	...	...
Methylene chloride (dichloromethane)	000075-09-2	5.0E-3	2.2E+0	1.1E-2	...	8.1E+1	4.2E-1	...	...	...	...
Methylnaphthalene, 2-	000091-57-6	...	...	...	...	...	...	...	...	...	...
Naphthalene	000091-20-3	...	1.5E+0	...	...	5.4E+1	...	...	...	...	...
Nickel	007440-02-0	...	7.3E-1	...	...	2.7E+1	...	4.7E+2[D, E, K]	7.4E+1[D, bb]	5.2E+1[D, E, K]	8.2E+0[D, bb]
Nitrosodiphenylamine, N-	000086-30-6	...	...	1.7E-2	...	...	6.4E-1	...	...	...	...
Pentachlorodibenzo-p-dioxin 1,2,3,7,8-	040321-76-4	...	...	1.1E-9	...	...	4.2E-8	...	...	...	...
Pentachlorodibenzofuran 1,2,3,7,8-	057117-41-6	...	...	...*	...	...	...*	...	...	...	...
Pentachlorodibenzofuran 2,3,4,7,8-**	057117-31-4	...	...	5.7E-9	...	...	2.1E-7	...	...	...	...
Pentachlorophenol (PCP)	000087-86-5	1.0E-3	1.1E+0	7.1E-4	...	4.1E+1	2.6E-2	1.9E+1[F, K]	1.3E+1[bb]	1.5E+1[F, K]	7.9E+0[bb]
Perchlorate**	014797-73-0	...	3.7E-3	...	...	1.4E-1	...	...	...	...	...
Phenanthrene	000085-01-8	...	...	...	...	...	...	...	...	...	...
Phenol	000108-95-2	...	1.1E+1*	...	...	4.1E+2*	...	...	...	...	...

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		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Plutonium	007440-07-5	...	...	...	...	...	...	...	...	...	...
Polychlorinated biphenyls (PCBs)	001336-36-3	5.0E-4	7.3E-4	4.3E-5	...	2.7E-2	1.6E-3	...	...	1.4E-2[N, aa]	3.0E-2[N, aa]
Pyrene	000129-00-0	...	1.1E+0	...	...	4.1E+1	...	...	...	...	...
Radium	007440-14-4	...	...	...	...	...	...	...	...	...	...
Radon	010043-92-2	...	...	...	...	...	...	...	...	...	...
Selenium	007782-49-2	5.0E-2	1.8E-1	...	...	6.8E+0	...	...[L, R, T]	2.9E+2[D, bb, dd]	5.0E+0[T]	7.1E+1[D, bb, dd]
Silver	007440-22-4	...	1.8E-1	...	...	6.8E+0	...	3.2E+0[D, E, G]	1.9E+0[D, G]	...	...
Strontium	007440-24-6	...	...	...	...	...	...	...	...	...	...
Styrene	000100-42-5	1.0E-1	7.3E+0	...	...	2.7E+2	...	...	...	...	...
Tetrachlorobenzene, 1,2,4,5-	000095-94-3	...	1.1E-2	...	...	4.1E-1	...	...	...	...	...
Tetrachlorodibenzo-p-dioxin**	041903-57-5	...	...	...	...	...	...	...	...	...	...
Tetrachlorodibenzo-p-dioxin 2,3,7,8- (TCDD)	001746-01-6	3.0E-8	...	5.7E-10	...	...	2.1E-8	...	...	...	...
Tetrachlorodibenzofuran 2,3,7,8-	051207-31-9	...	...	5.7E-9	...	...	2.1E-7	...	...	...	...

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		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Tetrachloroethane, 1,1,2,2-	000079-34-5	...	...	4.3E-4	...	...	1.6E-2	...	...	...	...
Tetrachloroethylene	000127-18-4	5.0E-3	3.6E-1	1.6E-3	...	1.4E+1	6.1E-2	...	...	...	...
Thallium	007440-28-0	5.0E-4	...	...	...	...	...	...	...	...	...
Toluene	000108-88-3	1.0E+0	7.3E+0	...	...	2.7E+2	...	...	...	...	...
Toxaphene	008001-35-2	3.0E-3	...	7.7E-5	...	...	2.9E-3	7.3E-1	2.1E-1	2.0E-4[aa]	2.0E-4[aa]
Trichlorobenzene, 1,2,4-	000120-82-1	7.0E-2	3.6E-1	...	...	1.4E+1	...	...	...	...	...
Trichloroethane, 1,1,1-	000071-55-6	2.0E-1	...	...	...	...	...	...	...	...	...
Trichloroethane, 1,1,2-	000079-00-5	3.0E-3	1.5E-1	1.5E-3	...	5.4E+0	5.5E-2	...	...	...	...
Trichloroethylene (TCE)	000079-01-6	Refer to Trichloroethylene (TCE) Appendix BII Interim Report, 10/23/2006									
Trichlorofluoromethane	000075-69-4	...	1.1E+1	...	...	4.1E+2	...	...	...	...	...
Trichlorophenol, 2,4,6-	000088-06-2	...	...	7.7E-3	...	...	2.9E-1	...	...	...	...
Trichloropropane, 1,2,3-	000096-18-4	...	2.2E-1	1.2E-5	...	8.1E+0	4.5E-4	...	...	...	...
Trifluralin (Treflan)	001582-09-8	...	2.7E-1	1.1E-2	...	1.0E+1	4.1E-1	...	...	...	...
Trinitrobenzene, 1,3,5-	000099-35-4	...	1.1E+0*	...	...	4.1E+1*	...	...	...	...	...
Vanadium	007440-62-2	...	2.6E-1	...	...	9.5E+0	...	...	...	...	...

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† See December 2011 SCDM update for volatile substances.
‡ Indicates cancer risk through a mutagenic mode of action.

		Ground Water/Surface Water Pathway Drinking Water			Surface Water Pathway Food Chain			Surface Water Pathway Environmental			
								Acute CMC (µg/L) *		Chronic CCC (µg/L) *	
Substance Name	CAS Number	MCL/MCLG (mg/L)	Reference Dose Screen Conc (mg/L)	Cancer Risk Screen Conc (mg/L)	FDAAL (ppm)	Ref. Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)	Fresh	Salt	Fresh	Salt
Vinyl acetate	000108-05-4	...	3.7E+1	...	...	1.4E+3	...	...	...	...	...
Vinyl chloride	000075-01-4	2.0E-3	1.1E-1*	5.7E-5	...	4.1E+0*	2.1E-3	...	...	...	...
Xylene**	001330-20-7	...	7.3E+0	...	...	2.7E+2	...	...	...	...	...
Xylene, m-	000108-38-3	1.0E+1	7.3E+1	...	...	2.7E+3	...	...	...	...	...
Xylene, o-	000095-47-6	1.0E+1	7.3E+1	...	...	2.7E+3	...	...	...	...	...
Xylene, p-	000106-42-3	1.0E+1	...	...	...	...	...	...	...	...	...
Zinc	007440-66-6	...	1.1E+1	...	...	4.1E+2	...	$1.2E+2^{D, E, K}$	$9.0E+1^{D, bb}$	$1.2E+2^{D, E, K}$	$8.1E+1^{D, bb}$

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‡ Indicates cancer risk through a mutagenic mode of action.

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Acenaphthene	000083-32-9	...	...†	...†	4.7E+3	...
Acenaphthylene	000208-96-8	...	...	...	...	...
Acetone	000067-64-1	...	3.2E+1†	...†	7.0E+4*	...
Acrolein	000107-02-8	...	2.1E-5†	...†	3.9E+1*	...
Acrylamide	000079-06-1	...	...	1.9E-6	1.6E+1	1.4E-1
Alachlor**	015972-60-8	...	...	...	7.8E+2	8.0E+0
Aldrin	000309-00-2	...	...	5.0E-7	2.3E+0	3.8E-2
Aluminum	007429-90-5	...	...	...	...	...
Americium**	007440-35-9	...	...	...	...	...
Aniline	000062-53-3	...	1.0E-3	...	...	1.1E+2*
Anthracene	000120-12-7	...	...†	...†	2.3E+4*	...
Antimony	007440-36-0	...	4.2E-4*	...	3.1E+1	...
Arsenic	007440-38-2	...	...	5.7E-7	2.3E+1	4.3E-1
Asbestos	001332-21-4	...	...	Inhal Unit Risk: 2.3E-1 fibers/mL*	...	...
Barium	007440-39-3	...	5.2E-4	...	5.5E+3	...

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		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Benz(a)anthracene	000056-55-3	...	...	...	...	8.8E-1
Benzene	000071-43-2	...	3.1E-2*†	3.1E-4†	3.1E+2*	1.2E+1*
Benzidine	000092-87-5	...	...	3.6E-8	2.3E+2	2.8E-3
Benzo(a)pyrene	000050-32-8	...	...	...	...	8.8E-2
Benzo(g,h,i)perylene	000191-24-2	...	...	...	...	...
Benzo(j,k)fluorene (Fluoranthene)	000206-44-0	...	...	...	3.1E+3	...
Benzo(k)fluoranthene	000207-08-9	...	...	...	...	8.8E+0
Beryllium	007440-41-7	1.0E-2	2.1E+1*	1.0E-6	1.6E+2*	...*
Bis (2-ethylhexyl) phthalate	000117-81-7	...	...	...	1.6E+3	4.6E+1*
Boron	007440-42-8	...	2.1E-2	...	7.0E+3	...
Bromodichloromethane	000075-27-4	...	...†	6.6E-5†	1.6E+3	1.0E+1
Butylbenzyl phthalate	000085-68-7	...	...	...	1.6E+4*	...
Cadmium	007440-43-9	...	9.4E-4*	1.4E-6	3.9E+1	...
Carbazole	000086-74-8	...	...	...	...	3.2E+1*

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		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Carbon disulfide	000075-15-0	...	7.3E-1†	...†	7.8E+3	...
Carbon tetrachloride	000056-23-5	...	1.0E-1†	4.1E-4†	5.5E+1	4.9E+0
Cesium	007440-46-2	...	...	...	...	...
Chlordane	000057-74-9	...	7.3E-4*	2.4E-5	3.9E+1*	1.8E+0*
Chlordane, alpha-	005103-71-9	...	7.3E-4*	2.4E-5*	3.9E+1*	1.8E+0*
Chlordane, gama-	005566-34-7	...	7.3E-4*	2.4E-5*	3.9E+1*	1.8E+0*
Chlorobenzene	000108-90-7	...	5.2E-2†	...†	1.6E+3	...
Chloroform	000067-66-3	...	1.0E-1†	1.1E-4†	7.8E+2	...*
Chromium	007440-47-3	...	8.3E-6*	...*	2.3E+2*	...
Chromium(III)	016065-83-1	...	...	...	1.2E+5*	...
Chromium(VI)	018540-29-9	...	8.3E-6*	2.0E-7	2.3E+2*	...
Chrysene	000218-01-9	...	...	...	...	8.8E+1*
Cobalt	007440-48-4	...	...	...	...	...
Copper	007440-50-8	...	...	...	...	...
Cumene	000098-82-8	...	4.2E-1*†	...†	7.8E+3*	...

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Substance Name	CAS Number	AIR PATHWAY NAAQS NESHAPS (ug/m^3)	AIR PATHWAY Reference Dose Screen Conc (mg/m^3)	AIR PATHWAY Cancer Risk Screen Conc (mg/m^3)	SOIL PATHWAY Reference Dose Screen Conc (mg/kg)	SOIL PATHWAY Cancer Risk Screen Conc (mg/kg)
Cyanamide**	000420-04-2	...	...	...	...	...
Cyanide	000057-12-5	...	...	...	1.6E+3	...
DDD	000072-54-8	...	...	...	...	2.7E+0
DDE	000072-55-9	...	...	...	...	1.9E+0
DDT	000050-29-3	...	...	2.5E-5	3.9E+1	1.9E+0
Di-n-butyl phthalate	000084-74-2	...	...	...	7.8E+3	...
Di-n-octyl phthalate	000117-84-0	...	...	...	1.6E+3	...
Dibenz(a,h)anthracene	000053-70-3	...	...	...	...	8.8E-2
Dibenzofuran	000132-64-9	...	...†	...†	3.1E+2*	...
Dibromo-3-chloropropane, 1,2-	000096-12-8	...	2.1E-4†	1.6E-7†‡	...	4.6E-1
Dibromoethane, 1,2-	000106-93-4	...	9.4E-3†	4.1E-6†	...	7.5E-3
Dichlorobenzene, 1,4-	000106-46-7	...	8.3E-1†	2.2E-4†	...	2.7E+1*
Dichloroethane, 1,1-	000075-34-3	...	...†	1.5E-3†	7.8E+3	...
Dichloroethane, 1,2-	000107-06-2	...	7.3E-3†	9.4E-5†	...	7.0E+0

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‡ Indicates cancer risk through a mutagenic mode of action.

		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Dichloroethylene, 1,1-	000075-35-4	...	2.1E-1*†	...†	3.9E+3*	...*
Dichloroethylene, 1,2-**	000540-59-0	...	...†	...†	7.0E+2	...
Dichloroethylene, cis-1,2-	000156-59-2	...	...†	...†	7.8E+2	...
Dichloroethylene, trans-1,2-	000156-60-5	...	6.3E-2†	...†	1.6E+3	...
Dichlorophenol, 2,4-	000120-83-2	...	...	...	2.3E+2	...
Dichloropropane, 1,2-	000078-87-5	...	4.2E-3†	2.4E-4†	...	9.4E+0
Dichloropropene, 1,3-	000542-75-6	...	2.1E-2†	6.1E-4†	2.3E+3*	6.4E+0*
Dieldrin	000060-57-1	...	...	5.3E-7	3.9E+0	4.0E-2
Diethyl phthalate	000084-66-2	...	...	...	6.3E+4*	...
Dimethyl phenol, 2,4-	000105-67-9	...	...	...	1.6E+3	...
Dinitrobenzene, 1,3-	000099-65-0	...	...	...	7.8E+0	...
Dioxin 1,4-**	000290-67-5	...	...	...	...	...
Diphenylhydrazine, 1,2-	000122-66-7	...	...	1.1E-5	...	8.0E-1
Disulfoton	000298-04-4	...	...	...	3.1E+0	...

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		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Endosulfan (I or II)	000115-29-7	...	...	...	4.7E+2	...
Endosulfan I**	000959-98-8	...	...	...	4.7E+2	...
Endosulfan II**	033213-65-9	...	...	...	4.7E+2	...
Endrin	000072-20-8	...	...	...	2.3E+1	...
Endrin aldehyde	007421-93-4	...	...	...	...	...
Ethyl benzene	000100-41-4	...	1.0E+0†	9.7E-4†	7.8E+3	...
Ethyl chloride	000075-00-3	...	1.0E+1	...	...	...
Ethylene glycol monobutyl ether (EBGE)**	000111-76-2	...	2.1E-1	...	3.9E+4	...
Fluorene	000086-73-7	...	...†	...†	3.1E+3	...
Fluorine	007782-41-4	...	...	...	4.7E+3	...
Heptachlor	000076-44-8	...	...	1.9E-6	3.9E+1	1.4E-1
Heptachlor epoxide, alpha, beta, gamma	001024-57-3	...	...	9.4E-7	1.0E+0	7.0E-2
Heptachlorodibenzo-p-dioxin**	037871-00-4	...	...	...	...	...
Heptachlorodibenzo-p-dioxin 1,2,3,4,6,7,8-	035822-46-9	...	...	5.7E-8	...	4.3E-3
Heptachlorodibenzofuran 1,2,3,4,6,7,8-	067562-39-4	...	...	5.7E-8	...	4.3E-3

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‡ Indicates cancer risk through a mutagenic mode of action.

Substance Name	CAS Number	AIR PATHWAY NAAQS NESHAPS (ug/m^3)	AIR PATHWAY Reference Dose Screen Conc (mg/m^3)	AIR PATHWAY Cancer Risk Screen Conc (mg/m^3)	SOIL PATHWAY Reference Dose Screen Conc (mg/kg)	SOIL PATHWAY Cancer Risk Screen Conc (mg/kg)
Heptachlorodibenzofuran 1,2,3,4,7,8,9-	055673-89-7	...	...	5.7E-8*	...	4.3E-3*
Hexabromobiphenyl (PBB)**	036355-01-8	...	...	...	...	...
Hexachlorobenzene	000118-74-1	...	...	5.3E-6	6.3E+1	4.0E-1
Hexachlorobutadiene	000087-68-3	...	...	1.1E-4	1.6E+1	8.2E+0
Hexachlorocyclohexane, alpha-	000319-84-6	...	...	1.4E-6	...	1.0E-1
Hexachlorocyclohexane, beta-	000319-85-7	...	...	4.6E-6	...	3.5E-1
Hexachlorodibenzo-p-dioxin 1,2,3,4,7,8-	039227-28-6	...	...	1.4E-9	...	1.1E-4
Hexachlorodibenzo-p-dioxin 1,2,3,6,7,8-	057653-85-7	...	...	1.4E-9	...	1.1E-4
Hexachlorodibenzo-p-dioxin 1,2,3,7,8,9-	019408-74-3	...	...	1.9E-9	...	1.0E-4
Hexachlorodibenzofuran 1,2,3,4,7,8-	070648-26-9	...	...	5.7E-9	...	4.3E-4
Hexachlorodibenzofuran 1,2,3,6,7,8-	057117-44-9	...	...	5.7E-9	...	4.3E-4
Hexachlorodibenzofuran 1,2,3,7,8,9-	072918-21-9	...	...	5.7E-9	...	4.3E-4
Hexachlorodibenzofuran 2,3,4,6,7,8-	060851-34-5	...	...	5.7E-9	...	4.3E-4
Hydrazine	000302-01-2	...	...	5.0E-7	...	2.1E-1

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		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Hydrogen sulfide	007783-06-4	...	2.1E-3	...	2.3E+3*	...
Indeno(1,2,3-cd)pyrene	000193-39-5	...	...	...	...	8.8E-1
Iron	007439-89-6	...	...	...	...	...
Lead	007439-92-1	1.5E+0	...	...	...	...
Lead chromate**	007758-97-6	...	...	...	...	...
Lindane	000058-89-9	...	...	...	2.3E+1	4.9E-1
Manganese	007439-96-5	...	5.2E-5	...	1.1E+4	...
Mercury	007439-97-6	...	3.1E-4†	...†	2.3E+1	...
Methoxychlor	000072-43-5	...	...	...	3.9E+2	...
Methyl Parathion	000298-00-0	...	...	...	2.0E+1	...
Methyl ethyl ketone	000078-93-3	...	5.2E+0*†	...†	4.7E+4*	...
Methyl isobutyl ketone	000108-10-1	...	3.1E+0*	...	6.3E+3	...
Methyl phenol, 4-	000106-44-5	...	...	...	3.9E+2	...
Methyl tert-butyl ether (MTBE)**	001634-04-4	...	3.1E+0†	9.4E-3†	...	...
Methylene chloride (dichloromethane)	000075-09-2	...	1.1E+0†	5.2E-3†	4.7E+3	8.5E+1*

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		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Methylnaphthalene, 2-	000091-57-6	...	...†	...†	...	...
Naphthalene	000091-20-3	...	3.1E-3*†	7.2E-5†	3.1E+3	...
Nickel	007440-02-0	...	...	...	1.6E+3	...
Nitrosodiphenylamine, N-	000086-30-6	...	...	...	...	1.3E+2*
Pentachlorodibenzo-p-dioxin 1,2,3,7,8-	040321-76-4	...	...	1.1E-10	...	8.5E-6
Pentachlorodibenzofuran 1,2,3,7,8-	057117-41-6	...	...	...*	...	...*
Pentachlorodibenzofuran 2,3,4,7,8-**	057117-31-4	...	...	5.7E-10	...	4.3E-5
Pentachlorophenol (PCP)	000087-86-5	...	...	...	2.3E+3	5.3E+0
Perchlorate**	014797-73-0	...	...	...	7.8E+0	...
Phenanthrene	000085-01-8	...	...	...	...	...
Phenol	000108-95-2	...	...	...	2.3E+4*	...
Plutonium	007440-07-5	...	...	...	...	...
Polychlorinated biphenyls (PCBs)	001336-36-3	...	...	2.4E-5*	1.6E+0	3.2E-1*
Pyrene	000129-00-0	...	...†	...†	2.3E+3	...

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		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Radium	007440-14-4	...	...	...	...	...
Radon	010043-92-2	...	...	...	...	...
Selenium	007782-49-2	...	...	...	3.9E+2	...
Silver	007440-22-4	...	...	...	3.9E+2	...
Strontium	007440-24-6	...	...	...	4.7E+4*	...
Styrene	000100-42-5	...	1.0E+0†	...†	1.6E+4*	...
Tetrachlorobenzene, 1,2,4,5-	000095-94-3	...	...	...	2.3E+1	...
Tetrachlorodibenzo-p-dioxin**	041903-57-5	...	...	...	...	...
Tetrachlorodibenzo-p-dioxin 2,3,7,8- (TCDD)	001746-01-6	...	...	5.7E-11	...	4.3E-6
Tetrachlorodibenzofuran 2,3,7,8-	051207-31-9	...	...	5.7E-10	...	4.3E-5
Tetrachloroethane, 1,1,2,2-	000079-34-5	...	...†	4.2E-5†	...	3.2E+0
Tetrachloroethylene	000127-18-4	...	2.8E-1†	4.1E-4†	7.8E+2	1.2E+1
Thallium	007440-28-0	...	...	...	...	...
Toluene	000108-88-3	...	5.2E+0†	...†	1.6E+4*	...

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† See December 2011 SCDM update for volatile substances.
‡ Indicates cancer risk through a mutagenic mode of action.

Substance Name	CAS Number	AIR PATHWAY NAAQS NESHAPS (ug/m^3)	AIR PATHWAY Reference Dose Screen Conc (mg/m^3)	AIR PATHWAY Cancer Risk Screen Conc (mg/m^3)	SOIL PATHWAY Reference Dose Screen Conc (mg/kg)	SOIL PATHWAY Cancer Risk Screen Conc (mg/kg)
Toxaphene	008001-35-2	...	...	7.6E-6	...	5.8E-1
Trichlorobenzene, 1,2,4-	000120-82-1	...	2.1E-3†	...†	7.8E+2	...
Trichloroethane, 1,1,1-	000071-55-6	...	5.2E+0†	...†	...	...
Trichloroethane, 1,1,2-	000079-00-5	...	2.1E-4†	1.5E-4†	3.1E+2	1.1E+1
Trichloroethylene (TCE)	000079-01-6	Refer to Trichloroethylene (TCE) Appendix BII Interim Report, 10/23/2006				
Trichlorofluoromethane	000075-69-4	...	7.3E-1†	...†	2.3E+4*	...
Trichlorophenol, 2,4,6-	000088-06-2	...	...	7.8E-4	...	5.8E+1*
Trichloropropane, 1,2,3-	000096-18-4	...	3.1E-4†	...†‡	4.7E+2	9.1E-2
Trifluralin (Treflan)	001582-09-8	...	...	...	5.9E+2	8.3E+1*
Trinitrobenzene, 1,3,5-	000099-35-4	...	...	...	2.3E+3*	...
Vanadium	007440-62-2	...	...	...	5.5E+2	...
Vinyl acetate	000108-05-4	...	2.1E-1†	...†	7.8E+4*	...
Vinyl chloride	000075-01-4	...	1.0E-1*†	1.6E-4†‡	2.3E+2*	4.3E-1*
Xylene**	001330-20-7	...	1.0E-1†	...†	1.6E+4	...
Xylene, m-	000108-38-3	...	1.0E-1†	...†	1.6E+5*	...

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		AIR PATHWAY			SOIL PATHWAY	
Substance Name	CAS Number	NAAQS NESHAPS (ug/m^3)	Reference Dose Screen Conc (mg/m^3)	Cancer Risk Screen Conc (mg/m^3)	Reference Dose Screen Conc (mg/kg)	Cancer Risk Screen Conc (mg/kg)
Xylene, o-	000095-47-6	...	1.0E-1†	...†	1.6E+5*	...
Xylene, p-	000106-42-3	...	1.0E-1†	...	...	...
Zinc	007440-66-6	...	...	...	2.3E+4*	...

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Substance Name	CAS Number	DRINKING WATER		FOOD CHAIN	AIR	SOIL		
		MCL (pCi/L)	Cancer Risk Screen Conc (pCi/L)	Cancer Risk Screen Conc (pCi/kg)	Cancer Risk Screen Conc (pCi/m3)	UMTRCA (pCi/kg)	Cancer Risk Soil Ing (pCi/kg)	Cancer Risk Soil Gam (pCi/kg)
Americium 241	014596-10-2	1.5E+1*	4.6E-1*	1.3E+1*	1.7E-4*	...	3.7E+3*	...
Antimony 125(+D) (radionuclide)	014234-35-6	3.0E+2*	9.3E+0*	2.4E+2*	2.5E-1*	...	6.0E+4*	...
Cadmium 109 (radionuclide)	014109-32-1	6.0E+2*	9.5E+0*	2.6E+2*	2.2E-1*	...	7.0E+4*	...
Cesium 137(+D) (radionuclide)	010045-97-3	2.0E+2*	1.6E+0*	4.7E+1*	4.0E-1*	...	1.8E+4*	...
Cobalt 57 (radionuclide)	013981-50-5	1.0E+3*	4.6E+1*	1.2E+3*	2.3E+0*	...	2.9E+5*	...
Cobalt 60 (radionuclide)	010198-40-0	1.0E+2*	3.0E+0*	7.9E+1*	1.3E-1*	...	2.0E+4*	...
Iron 55 (radionuclide)	014681-59-5	2.0E+3*	5.5E+1*	1.5E+3*	6.0E+0*	...	3.8E+5*	...
Lead 210(+D) (radionuclide)	014255-04-0	...	3.7E-2	5.1E-1*	3.4E-4	...	3.0E+2*	...
Manganese 54 (radionuclide)	013966-31-9	3.0E+2*	2.1E+1*	5.7E+2*	8.1E-1*	...	1.5E+5*	...
Nickel 59 (radionuclide)	014336-70-0	3.0E+2*	1.8E+2*	4.5E+3*	1.0E+1*	...	1.1E+6*	...
Nickel 63 (radionuclide)	013981-37-8	5.0E+1*	7.1E+1*	1.9E+3*	2.9E+0*	...	4.4E+5*	...
Plutonium 236 (radionuclide)	015411-92-4	...	6.4E-1	1.8E+1*	2.1E-4*	...	4.6E+3*	...
Plutonium 238 (radionuclide)	013981-16-3	1.5E+1*	3.6E-1*	1.0E+1*	1.4E-4*	...	2.9E+3*	...
Plutonium 239 (radionuclide)	015117-48-3	1.5E+1*	3.5E-1*	1.0E+1*	1.4E-4*	...	2.9E+3*	...
Plutonium 240 (radionuclide)	014119-33-6	1.5E+1*	3.5E-1*	1.0E+1*	1.4E-4*	...	2.9E+3*	...

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‡ Indicates cancer risk through a mutagenic mode of action.

Substance Name	CAS Number	DRINKING WATER		FOOD CHAIN	AIR	SOIL		
		MCL (pCi/L)	Cancer Risk Screen Conc (pCi/L)	Cancer Risk Screen Conc (pCi/kg)	Cancer Risk Screen Conc (pCi/m3)	UMTRCA (pCi/kg)	Cancer Risk Soil Ing (pCi/kg)	Cancer Risk Soil Gam (pCi/kg)
Plutonium 241(+D) (radionuclide)	014119-32-5	...	2.7E+1*	7.7E+2*	1.4E-2*	...	2.4E+5*	...
Plutonium 242 (radionuclide)	013982-10-0	1.5E+1*	3.7E-1*	1.1E+1*	1.5E-4*	...	3.0E+3*	...
Plutonium 243 (radionuclide)	015706-37-3	...	1.0E+2*	2.5E+3*	1.6E+1*	...	5.9E+5*	...
Plutonium 244(+D) (radionuclide)	014119-34-7	1.5E+1*	3.5E-1*	9.8E+0*	1.6E-4*	...	2.7E+3*	...
Radium 226(+D) (radionuclide)	013982-63-3	5.0E+0*	1.2E-1	3.4E+0*	4.1E-4	...	1.1E+3*	...
Radium 228(+D) (radionuclide)	015262-20-1	5.0E+0*	4.6E-2*	1.2E+0*	9.1E-4*	...	3.5E+2*	...
Radon 222 (+D)(radionuclide)	014859-67-7	...	...	...	6.3E-1	...	...	...
Silver 108m(+D) (radionuclide)	014391-65-2	...	5.8E+0*	1.6E+2*	1.8E-1*	...	4.1E+4*	...
Silver 110m (radionuclide)	014391-76-5	9.0E+1*	4.8E+0*	1.3E+2*	1.7E-1*	...	3.4E+4*	...
Strontium 90(+D) (radionuclide)	010098-97-2	8.0E+0*	6.4E-1*	1.8E+1*	4.2E-2*	...	5.5E+3*	...
Technetium 99 (radionuclide)**	014133-76-7	9.0E+2	1.7E+1	4.4E+2	3.4E-1*	...	1.0E+5	...
Thallium 204 (radionuclide)	013968-51-9	3.0E+2*	8.1E+0*	2.1E+2*	1.9E+0*	...	5.2E+4*	...
Thorium 227 (radionuclide)	015623-47-9	...	1.0E+0*	2.5E+1*	1.4E-4*	...	5.8E+3*	...
Thorium 228(+D) (radionuclide)	014274-82-9	1.5E+1*	1.6E-1	4.2E+0*	3.3E-5*	...	9.8E+2*	...

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Substance Name	CAS Number	DRINKING WATER		FOOD CHAIN	AIR	SOIL		
		MCL (pCi/L)	Cancer Risk Screen Conc (pCi/L)	Cancer Risk Screen Conc (pCi/kg)	Cancer Risk Screen Conc (pCi/m3)	UMTRCA (pCi/kg)	Cancer Risk Soil Ing (pCi/kg)	Cancer Risk Soil Gam (pCi/kg)
Thorium 229(+D) (radionuclide)	015594-54-4	1.5E+1*	9.0E-2	2.5E+0*	2.1E-5*	...	6.2E+2*	...
Thorium 230 (radionuclide)	014269-63-7	1.5E+1*	5.2E-1*	1.5E+1*	1.7E-4*	...	3.9E+3*	...
Thorium 231 (radionuclide)	014932-40-2	...	2.2E+1*	5.4E+2*	3.1E+0*	...	1.2E+5*	...
Thorium 232 (radionuclide)	007440-29-1	1.5E+1*	4.7E-1*	1.3E+1*	1.1E-4*	...	3.4E+3*	...
Thorium 234 (radionuclide)	015065-10-8	...	2.1E+0*	5.8E+1*	1.6E-1*	...	1.2E+4*	...
Tritium	010028-17-8	...	4.3E+2*	1.2E+4*	2.4E+1*	...	3.6E+6*	...
Uranium 232 (radionuclide)	014158-29-3	2.0E+1*	1.6E-1*	4.6E+0*	2.4E-4*	...	1.4E+3*	...
Uranium 233 (radionuclide)	013968-55-3	2.0E+1*	6.6E-1*	1.8E+1*	4.1E-4*	...	5.0E+3*	...
Uranium 234 (radionuclide)	013966-29-5	2.0E+1*	6.7E-1*	1.8E+1*	4.2E-4*	...	5.0E+3*	...
Uranium 235(+D) (radionuclide)	015117-96-1	2.0E+1*	6.6E-1*	1.8E+1*	4.7E-4*	...	4.9E+3*	...
Uranium 236(+D) (radionuclide)	013982-70-2	2.0E+1*	7.1E-1*	1.9E+1*	4.5E-4*	...	5.3E+3*	...
Uranium 238(+D) (radionuclide)	007440-61-1	2.0E+1*	5.5E-1*	1.5E+1*	5.1E-4*	...	3.8E+3*	...
Zinc 65 (radionuclide)	013982-39-3	3.0E+2*	4.1E+0*	1.1E+2*	8.2E-1*	...	3.2E+4*	...

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Footnote Code	Footnote Description
A	This recommended water quality criterion was derived from data for arsenic (III), but is applied here to total arsenic, which might imply that arsenic (III) and arsenic (V) are equally toxic to aquatic life and that their toxicities are additive. In the arsenic criteria document (EPA 440/5-84-033, January 1985), Species Mean Acute Values are given for both arsenic (III) and arsenic (V) for five species and the ratios of the SMAVs for each species range from 0.6 to 1.7. Chronic values are available for both arsenic (III) and arsenic (V) for one species; for the fathead minnow, the chronic value for arsenic (V) is 0.29 times the chronic value for arsenic (III). No data are known to be available concerning whether the toxicities of the forms of arsenic to aquatic organisms are additive.
B	This criterion has been revised to reflect The Environmental Protection Agency's q1* or RfD, as contained in the Integrated Risk Information System (IRIS) as of May 17, 2002. The fish tissue bioconcentration factor (BCF) from the 1980 Ambient Water Quality Criteria document was retained in each case.
C	This criterion is based on carcinogenicity of 10^{-6} risk. Alternate risk levels may be obtained by moving the decimal point (e.g., for a risk level of 10^{-5}, move the decimal point in the recommended criterion one place to the right).
D	Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. The recommended water quality criteria value was calculated by using the previous 304(a) aquatic life criteria expressed in terms of total recoverable metal, and multiplying it by a conversion factor (CF). The term "Conversion Factor" (CF) represents the recommended conversion factor for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column. (Conversion Factors for saltwater CCCs are not currently available. Conversion factors derived for saltwater CMCs have been used for both saltwater CMCs and CCCs). See "Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria," October 1, 1993, by Martha G. Prothro, Acting Assistant Administrator for Water, available from the Water Resource center, USEPA, 401 M St., SW, mail code RC4100, Washington, DC 20460; and 40CFR§131.36(b)(1). Conversion Factors applied in the table can be found in Appendix A to the Preamble- Conversion Factors for Dissolved Metals (which is attached below).
E	The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. The value given here corresponds to a hardness of 100 mg/L. Criteria values for other hardness may be calculated from the following: CMC (dissolved) = exp$\{m_A$ [ln(hardness)]+ $b_A\}$ (CF), or CCC (dissolved) = exp$\{m_C$ [ln (hardness)]+ $b_C\}$ (CF) and the parameters specified in Appendix B- Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent (which is attached below).
F	Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: CMC = exp(1.005(pH)-4.869); CCC = exp(1.005(pH)-5.134). Values displayed in table correspond to a pH of 7.8.
G	This Criterion is based on 304(a) aquatic life criterion issued in 1980, and was issued in one of the following documents: Aldrin/Dieldrin (EPA 440/5-80-019), Chlordane (EPA 440/5-80-027), DDT (EPA 440/5-80-038), Endosulfan (EPA 440/5-80-046), Endrin (EPA 440/5-80-047), Heptachlor (EPA 440/5- 80-052), Hexachlorocyclohexane (EPA 440/5-80-054), Silver (EPA 440/5-80-071). The Minimum Data Requirements and derivation procedures were different in the 1980 Guidelines than in the 1985 Guidelines. For example, a "CMC" derived using the 1980 Guidelines was derived to be used as an instantaneous maximum. If assessment is to be done using an averaging period, the values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.
H	No criterion for protection of human health from consumption of aquatic organisms excluding water was presented in the 1980 criteria document or in the *1986 Quality Criteria for Water*. Nevertheless, sufficient information was presented in the 1980 document to allow the calculation of a criterion, even though the results of such a calculation were not shown in the document.
I	This criterion for asbestos is the Maximum Contaminant Level (MCL) developed under the Safe Drinking Water Act (SDWA).
J	This fish tissue residue criterion for methylmercury is based on a total fish consumption rate of 0.0175 kg/day.

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Footnote Code	Footnote Description
K	This recommended criterion is based on a 304(a) aquatic life criterion that was issued in the *1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water*, (EPA-820-B-96-001, September 1996). This value was derived using the GLI Guidelines (60FR15393-15399, March 23, 1995; 40CFR132 Appendix A); the difference between the 1985 Guidelines and the GLI Guidelines are explained on page iv of the 1995 Updates. None of the decisions concerning the derivation of this criterion were affected by any considerations that are specific to the Great Lakes.
L	The CMC = 1/[(f1/CMC1) + (f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 µg/l and 12.82 µg/l, respectively.
M	EPA is currently reassessing the criteria for arsenic.
N	This criterion applies to total pcbs, (e.g., the sum of all congener or all isomer or homolog or Aroclor analyses.)
O	The derivation of the CCC for this pollutant (Endrin) did not consider exposure through the diet, which is probably important for aquatic life occupying upper trophic levels.
P	Although a new RfD is available in IRIS, the surface water criteria will not be revised until the National Primary Drinking Water Regulations: Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) is completed, since public comment on the relative source contribution (RSC) for chloroform is anticipated.
Q	This recommended water quality criterion is expressed as µg free cyanide (as CN)/L.
R	This value for selenium was announced (61FR58444-58449, November 14, 1996) as a proposed GLI 303(c) aquatic life criterion. EPA is currently working on this criterion and so this value might change substantially in the near future.
S	This recommended water quality criterion for arsenic refers to the inorganic form only.
T	This recommended water quality criterion for selenium is expressed in terms of total recoverable metal in the water column. It is scientifically acceptable to use the conversion factor (0.996- CMC or 0.922- CCC) that was used in the GLI to convert this to a value that is expressed in terms of dissolved metal.
U	The organoleptic effect criterion is more stringent than the value for priority toxic pollutants.
V	This value was derived from data for heptachlor and the criteria document provides insufficient data to estimate the relative toxicities of heptachlor and heptachlor epoxide.
W	Although EPA has not published a completed criteria document for butylbenzyl phthalate it is EPA's understanding that sufficient data exist to allow calculation of aquatic criteria. It is anticipated that industry intends to publish in the peer reviewed literature draft aquatic life criteria generated in accordance with EPA Guidelines. EPA will review such criteria for possible issuance as national WQC.
X	There is a full set of aquatic life toxicity data that show that DEHP is not toxic to aquatic organisms at or below its solubility limit.
Y	This value was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.
Z	A more stringent MCL has been issued by EPA. Refer to drinking water regulations (40 CFR 141) or Safe Drinking Water Hotline (1-800-426-4791) for values.
aa	This criterion is based on a 304(a) aquatic life criterion issued in 1980 or 1986, and was issued in one of the following documents: Aldrin/Dieldrin (EPA 440/5-80-019), Chlordane (EPA 440/5-80-027), DDT (EPA 440/5-80- 038), Endrin (EPA 440/5-80-047), Heptachlor (EPA 440/5-80-052), Polychlorinated biphenyls (EPA 440/5-80-068), Toxaphene (EPA 440/5-86-006). This CCC is currently based on the Final Residue Value (FRV) procedure. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60FR15393-15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria. Therefore, the Agency anticipates that future revisions of this CCC will not be based on the FRV procedure.

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Footnote Code	Footnote Description
bb	This water quality criterion is based on a 304(a) aquatic life criterion that was derived using the 1985 Guidelines (*Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, PB85-227049, January 1985) and was issued in one of the following criteria documents: Arsenic (EPA 440/5-84-033), Cadmium (EPA 882-R-01-001), Chromium (EPA 440/5-84-029), Copper (EPA 440/5-84-031), Cyanide (EPA 440/5- 84-028), Lead (EPA 440/5-84-027), Nickel (EPA 440/5-86-004), Pentachlorophenol (EPA 440/5-86-009), Toxaphene, (EPA 440/5-86-006), Zinc (EPA 440/5-87- 003).
cc	When the concentration of dissolved organic carbon is elevated, copper is substantially less toxic and use of Water-Effect Ratios might be appropriate.
dd	The selenium criteria document (EPA 440/5-87-006, September 1987) provides that if selenium is as toxic to saltwater fishes in the field as it is to freshwater fishes in the field, the status of the fish community should be monitored whenever the concentration of selenium exceeds 5.0 µg/L in salt water because the saltwater CCC does not take into account uptake via the food chain.
ee	This recommended water quality criterion was derived on page 43 of the mercury criteria document (EPA 440/5- 84-026, January 1985). The saltwater CCC of 0.025 ug/L given on page 23 of the criteria document is based on the Final Residue Value procedure in the 1985 Guidelines. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60FR15393-15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria.
ff	This recommended water quality criterion was derived in *Ambient Water Quality Criteria Saltwater Copper Addendum* (Draft, April 14, 1995) and was promulgated in the Interim final National Toxics Rule (60FR22228- 222237, May 4, 1995).
gg	EPA is actively working on this criterion and so this recommended water quality criterion may change substantially in the near future.
hh	This recommended water quality criterion was derived from data for inorganic mercury (II), but is applied here to total mercury. If a substantial portion of the mercury in the water column is methylmercury, this criterion will probably be under protective. In addition, even though inorganic mercury is converted to methylmercury and methylmercury bioaccumulates to a great extent, this criterion does not account for uptake via the food chain because sufficient data were not available when the criterion was derived.
ii	This criterion applies to DDT and its metabolites (i.e., the total concentration of DDT and its metabolites should not exceed this value).
F2	The derivation of this value is presented in the Red Book (EPA 440/9-76-023, July, 1976).
G2	This value is based on a 304(a) aquatic life criterion that was derived using the 1985 Guidelines (*Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*, PB85-227049, January 1985) and was issued in one of the following criteria documents: Aluminum (EPA 440/5-86-008); Chloride (EPA 440/5-88-001); Chloropyrifos (EPA 440/5-86-005).
I2	This value for aluminum is expressed in terms of total recoverable metal in the water column.
L2	There are three major reasons why the use of Water-Effect Ratios might be appropriate. (1) The value of 87 µg/l is based on a toxicity test with the striped bass in water with pH= 6.5-6.6 and hardness <10 mg/L. Data in "Aluminum Water-Effect Ratio for the 3M Plant Effluent Discharge, Middleway, West Virginia" (May 1994) indicate that aluminum is substantially less toxic at higher pH and hardness, but the effects of pH and hardness are not well quantified at this time. (2) In tests with the brook trout at low pH and hardness, effects increased with increasing concentrations of total aluminum even though the concentration of dissolved aluminum was constant, indicating that total recoverable is a more appropriate measurement than dissolved, at least when particulate aluminum is primarily aluminum hydroxide particles. In surface waters, however, the total recoverable procedure might measure aluminum associated with clay particles, which might be less toxic than aluminum associated with aluminum hydroxide. (3) EPA is aware of field data indicating that many high quality waters in the U.S. contain more than 87 µg aluminum/L, when either total recoverable or dissolved is measured.

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Conversion Factors for Dissolved Metals				
Metal	**Conversion Factor Freshwater CMC**	**Conversion Factor Freshwater CCC**	**Conversion Factor Saltwater CMC**	**Conversion Factor Saltwater CMC**
Arsenic	1.000	1.000	1.000	1.000
Cadmium	1.136672-[(ln hardness)(0.041838)]	1.101672-[(ln hardness)(0.041838)]	0.994	0.994
ChromiumIII	0.316	0.860	--	--
Chromium VI	0.982	0.962	0.993	0.993
Copper	0.960	0.960	0.83	0.83
Lead	1.46203-[(ln hardness)(0.145712)]	1.46203-[ln hardness)(0.145712)]	0.951	0.951
Mercury	0.85	0.85	0.85	0.85
Nickel	0.998	0.997	0.990	0.990
Selenium	--	--	0.998	0.998
Silver	0.85	--	0.85	--
Zinc	0.978	0.986	0.946	0.946

---

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).
** Indicates new hazardous substance in current version of chemical data (JAN04).
† See December 2011 SCDM update for volatile substances.
‡ Indicates cancer risk through a mutagenic mode of action.

Parameters for Calculating Freshwater Dissolved Metals That are Hardness Dependent						
					Conversion Factors (CF)	
Chemical	**m_A**	**b_A**	**m_C**	**b_C**	**CMC**	**CCC**
Cadmium	1.0166	-3.924	0.7409	-4.719	1.136672-[(ln hardness)(0.041838)]	1.101672-[(ln hardness)(0.041838)]
Chromium III	0.8190	3.7256	0.8190	0.6848	0.316	0.860
Copper	0.9422	-1.700	0.8545	-1.702	0.960	0.960
Lead	1.273	-1.460	1.273	-4.705	1.46203-[(ln hardness)(0.145712)]	1.46203-[(ln hardness)(0.145712)]
Nickel	0.8460	2.255	0.8460	0.0584	0.998	0.997
Silver	1.72	-6.59	--	--	0.85	--
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986

Hardness-dependent metals' criteria may be calculated from the following:

CMC (dissolved) = $\exp \{m_A [\ln(\text{hardness})] + b_A\}$ (CF)
CCC (dissolved) = $\exp \{m_C [\ln(\text{hardness})] + b_C\}$ (CF)

---

* Indicates difference between previous version of chemical data (JUN 96) and current version of chemical data (JAN04).
** Indicates new hazardous substance in current version of chemical data (JAN04).
† See December 2011 SCDM update for volatile substances.
‡ Indicates cancer risk through a mutagenic mode of action.

CAS Number	Chemical Name	Synonyms
000083-32-9	Acenaphthene	Acenaphthylene, 1,2-dihydro
000067-64-1	Acetone	2-Propanone
000107-02-8	Acrolein	Propenal
000079-06-1	Acrylamide	Propenamide
000062-53-3	Aniline	Benzeneamine
000120-12-7	Anthracene	Paranaphthalene
000056-55-3	Benz(a)anthracene	Benzanthrene
000071-43-2	Benzene	Coal naptha
000092-87-5	Benzidine	(1,1'-biphenyl)-4,4'-diamine
000050-32-8	Benzo(a)pyrene	Benz(a)pyrene
000206-44-0	Benzo(j,k)fluorene (Fluoranthene)	Fluoranthene
000207-08-9	Benzo(k)fluoranthene	Dibenzo(b,j,k)fluorene
000117-81-7	Bis (2-ethylhexyl) phthalate	Benzenedicarboxylic acid, bis (2-ethylhexyl) ester, 1,2-
000075-27-4	Bromodichloromethane	Dichlorobromomethane
000085-68-7	Butylbenzyl phthalate	1,2-benzenedicarboxylic acid, butyl phenylmethyl ester
000075-15-0	Carbon disulfide	Dithiocarbonic anhydride
000056-23-5	Carbon tetrachloride	Tetrachloromethane
000057-74-9	Chlordane	Octachloro-4,7-methanotetrahydroindane
005103-71-9	Chlordane, alpha-	cis-Chlordane
005566-34-7	Chlordane, gama-	trans-Chlordane
000108-90-7	Chlorobenzene	Phenyl chloride
000067-66-3	Chloroform	Trichloromethane
007440-47-3	Chromium	Chrome
000218-01-9	Chrysene	Benzophenanthrene, 1,2-
000098-82-8	Cumene	Methylethylbenzene, 1-
000057-12-5	Cyanide	Hydrocyanic acid
000072-54-8	DDD	Dichlorodiphenyl dichloroethane
000072-55-9	DDE	Dichlorodiphenyldichloroethylene, p,p-
000050-29-3	DDT	Dichlorodiphenyltrichloroethane, 4,4-
000084-74-2	Di--butyl phthalate	Benzenedicarboxylic acid, dibutyl ester, 1,2-
000117-84-0	Di--octyl phthalate	Benzenedicarboxylic acid, dioctyl ester, 1,2-
000053-70-3	Dibenz(a,h)anthracene	Dibenz(a)anthracene, 1,2:5,6-
000132-64-9	Dibenzofuran	Diphenylene Oxide
000096-12-8	Dibromo-3-chloropropane, 1,2-	Nemazon
000106-93-4	Dibromoethane, 1,2-	Ethylene dibromide (EDB)
000106-46-7	Dichlorobenzene, 1,4-	Chlorophenyl chloride, p-
000075-34-3	Dichloroethane, 1,1-	Ethylidene chloride
000107-06-2	Dichloroethane, 1,2-	Ethylene chloride

CAS Number	Chemical Name	Synonyms
000075-35-4	Dichloroethylene, 1,1-	Dichloroethene, 1,1-
000156-59-2	Dichloroethylene, cis-1,2-	cis 1,2-dichloroethene
000156-60-5	Dichloroethylene, trans-1,2-	1,2-dichloroethylene
000120-83-2	Dichlorophenol, 2,4-	Dichlorophenol, 4,6-
000078-87-5	Dichloropropane, 1,2-	Propylene chloride
000542-75-6	Dichloropropene, 1,3-	Dichloropropylene, 1,3-
000060-57-1	Dieldrin	Aldrin epoxide
000084-66-2	Diethyl phthalate	Benzenedicarboxylic acid, didecyl ester, 1,2-
000105-67-9	Dimethyl phenol, 2,4-	1-Hydroxy-2,4-dimethylbenzene
000099-65-0	Dinitrobenzene, 1,3-	Dinitrobenzene, 1,2-
000122-66-7	Diphenylhydrazine, 1,2-	Hydrazodibenzene
000100-41-4	Ethyl benzene	Phenylethane
000075-00-3	Ethyl chloride	Chloroethane
000086-73-7	Fluorene	Methylenebiphenyl, 2,2-
007782-41-4	Fluorine	Fluorine-19
000098-01-1	Furfural	Furancarboxaldehyde, 2-
000076-44-8	Heptachlor	Chlorochlordene, 3-
001024-57-3	Heptachlor epoxide, alpha, beta, gamma	Epoxyheptachlor
000118-74-1	Hexachlorobenzene	Perchlorobenzene
000087-68-3	Hexachlorobutadiene	Perchlorobutadiene
000319-84-6	Hexachlorocyclohexane, alpha-	alpha-BHC
000319-85-7	Hexachlorocyclohexane, beta-	beta-BHC
000302-01-2	Hydrazine	Diamine
007783-06-4	Hydrogen sulfide	Hydrosulfuric acid
000058-89-9	Lindane	Hexachlorocyclohexane- gamma
000072-43-5	Methoxychlor	(2,2,2-trichloroethylidiene)bis(4-methoxy-benzene), 1,1'-
000298-00-0	Methyl Parathion	Dimethyl p-nitrophenyl thiophosphate
000078-93-3	Methyl ethyl ketone	Butanone
000108-10-1	Methyl isobutyl ketone	Methyl-2-pentanone, 4-
000106-44-5	Methyl phenol, 4-	Methyl phenol, 4-
000075-09-2	Methylene chloride (dichloromethane)	Dichloromethane
000091-57-6	Methylnaphthalene, 2-	Methylnaphthalene, 2-
000091-20-3	Naphthalene	Tar camphor
000098-95-3	Nitrobenzene	Nitrobenzol
000062-75-9	Nitrosodimethylamine, –	Methyl-–nitroso-methanamine, –
000086-30-6	Nitrosodiphenylamine, –	Diphenylnitrosamine : Nitrosophenylbenzeneamine, –
000085-01-8	Phenanthrene	Phenanthren

CAS Number	Chemical Name	Synonyms
000108-95-2	Phenol	Phenyl alcohol
001336-36-3	Polychlorinated biphenyls (PCBs)	Polychlorinated biphenyls
000129-00-0	Pyrene	Benzo(def)phenanthrene
000100-42-5	Styrene	Vinylbenzene
000095-94-3	Tetrachlorobenzene, 1,2,4,5-	Tetrachlorobenzene, s-
001746-01-6	Tetrachlorodibenzo-p-dioxin 2,3,7,8- (TCDD)	2,3,7,8-Tetrachlorodibenzo-p-dioxin : Tetrachlorodibenzo-p-dioxin, 2,3,7,8-
000079-34-5	Tetrachloroethane, 1,1,2,2-	Acetylene tetrachloride
000127-18-4	Tetrachloroethylene	Tetrachloroethene
000126-33-0	Tetrahydrothiophene, 1, 1-dioxide	Sulfolane
007440-29-1	Thorium 232 (radionuclide)	Thorium 232
000108-88-3	Toluene	Methyl benzene
008001-35-2	Toxaphene	Chlorinated camphene
001461-22-9	Tributyltin chloride	Tributylchlorostannane
000071-55-6	Trichloroethane, 1,1,1-	Methyl chloroform
000079-00-5	Trichloroethane, 1,1,2-	Vinyl trichloride
000079-01-6	Trichloroethylene (TCE)	Trichloroethene
000075-69-4	Trichlorofluoromethane	Freon 11
001582-09-8	Trifluralin (Treflan)	Treflan
007440-61-1	Uranium 238(+D) (radionuclide)	Uranium 238
000108-05-4	Vinyl acetate	Acetic acid, vinyl ester
000075-01-4	Vinyl chloride	Chloroethene
000108-38-3	Xylene, —	Dimethyl benzene, 1,3-
000095-47-6	Xylene, o-	Methyltoulene, o-
000106-42-3	Xylene, p-	Dimethylbenzene, 1,4-

Legend

▼ PPE 1

June 2011 Sample Locations

- ▲ Wetland Sediment Sample
- △ Background Wetland Sediment Sample

Map Features

- ---- Drainage Ditch 4
- ☐ "Former" Macon Naval Ordnance Plant

Wetland Features

- ▨ Freshwater Emergent Wetland
- ▨ Freshwater Forested/Shrub Wetland
- ▨ Freshwater Pond
- ▨ Lake
- ▨ Other
- ▨ Riverine

Notes:
D - Drainage Ditch
MNOP - Macon Naval Ordnance Plant
NWI - National Wetlands Inventory
SD - Sediment
W - Wetland
Reference 9, pp. 1, 3.

Map Sources:
Wetlands, U.S. Fish & Wildlife Service,
National Wetlands Inventory, Wetlands Digital Data.
USGS Topographic Quadrangles,
Macon West, GA 1985, Macon East, GA 1985,
Warner Robins NW, GA 1986, and Warner Robins NE, GA 1985.

N
W E
S

0 1,000 2,000 4,000 Feet

1:24,000

United States
Environmental Protection Agency

MACON NAVAL ORDNANCE PLANT
MACON,
BIBB COUNTY,
GEORGIA
TDD No. TTEMI-05-003-0127

REFERENCE 3
15-MILE SURFACE WATER MIGRATION PATHWAY WITH NWI WETLANDS

TETRA TECH

Path: C:\GIS_Workspace\TTEMI-05-003-0127_Macon_Naval_Ordnance_Plant\Figures\GIS\MXDs\Wetlands Map with 15mi Surface\MNOP Wetlands 15mi Surface 24x32 PORT 1-16-12.mxd Date Saved: 1/17/2012 9:29:39 AM User: dale.vonbusch

PROJECT NOTE

Date: November 2, 2011

Name: Quinn Kelley
Title: Environmental Scientist
Firm: Tetra Tech

Signature: Quinn Kelley

Subject: Coordinates for Macon Naval Ordnance Plant

PROJECT NOTE SUMMARY

Attached are the coordinates for the Macon Naval Ordnance Plant (MNOP) property (currently Allied Industrial Park). The coordinates were obtained from Google™ Earth and were measured from the approximate location of surface soil sample MNOP-04-SF, collected during the EPA June 2011 Supplemental Sampling Event.

RESPONSE REQUIRED

(x) None ( ) Phone Call ( ) Memo ( ) Letter ( ) Report

cc: File (x) Project Manager ( ) Principal Investigator ( ) Other (specify)


Guy Paine Rd
32°46'39.57"N, 83°38'22.83"W
Ennis Rd
Allied Industrial Blvd
Mead Rd
Old Gault City Rd
Macon
©2010 Google
1009 ft
© 2011 Google
Imagery Date: 10/6/2010
1993
32°46'35.87" N 83°38'36.25" W elev 351 ft
Eye alt 4686 ft
N

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Results are based on data extracted on AUG-15-2011

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Click on the MAPPING INFO value to obtain mapping information for the facility.

Click on the RECORD OF DECISION value for a RODS Site Report.

Click on the "View Facility Information" link to view EPA Facility information for the facility.

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STREET ADDRESS:	600 GUY PAINE ROAD	FACILITY INFORMATION	View facility information
CITY NAME:	MACON		
STATE ABBR:	GA	FEDERAL FACILITY:	N
ZIP CODE:	31206	NPL STATUS:	Not on the NPL
COUNTY NAME:	BIBB		
CORPORATE LINK:	No	RECORD OF DECISION (ROD) INFO:	No
LATITUDE:		EPA REGIONAL LINK:	No
LONGITUDE:		MAPPING INFO:	MAP
SITE SMSA:	4680		

Enforcement and Cleanup Actions

Action	Action ID	Actual Start Date	Actual End Date	Responsibility	Planned Outcome	Urgency
EXPANDED SITE INSPECTION	001		09/29/2009	EPA Fund-Financed	Low priority for further assessment	
PRELIMINARY ASSESSMENT	001	10/01/1991	06/26/1992	State, Fund Financed	Low priority for further assessment	
DISCOVERY	001		09/25/1989	EPA In-House		

Site Description

There were no Site Descriptions reported for this site.

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Macon Naval Ordnance Plant
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Last updated on Wednesday, August 31, 2011

PROJECT NOTE

Date: September 7, 2011

Name: Quinn Kelley
Title: Environmental Scientist
Firm: Tetra Tech

Signature: Quinn Kelley

Subject: Macon-Bibb County Parcel Maps and Property Cards for the Former Macon Naval Ordnance Plant Property

PROJECT NOTE SUMMARY

Attached are the Macon-Bibb County parcel maps and property records for the former Macon Naval Ordnance Plant property (currently the Allied Industrial Park).

This information can be accessed at the following website:

http://www.co.bibb.ga.us/TaxAssessors/index2.html

Zoning code definitions can be accessed online at:

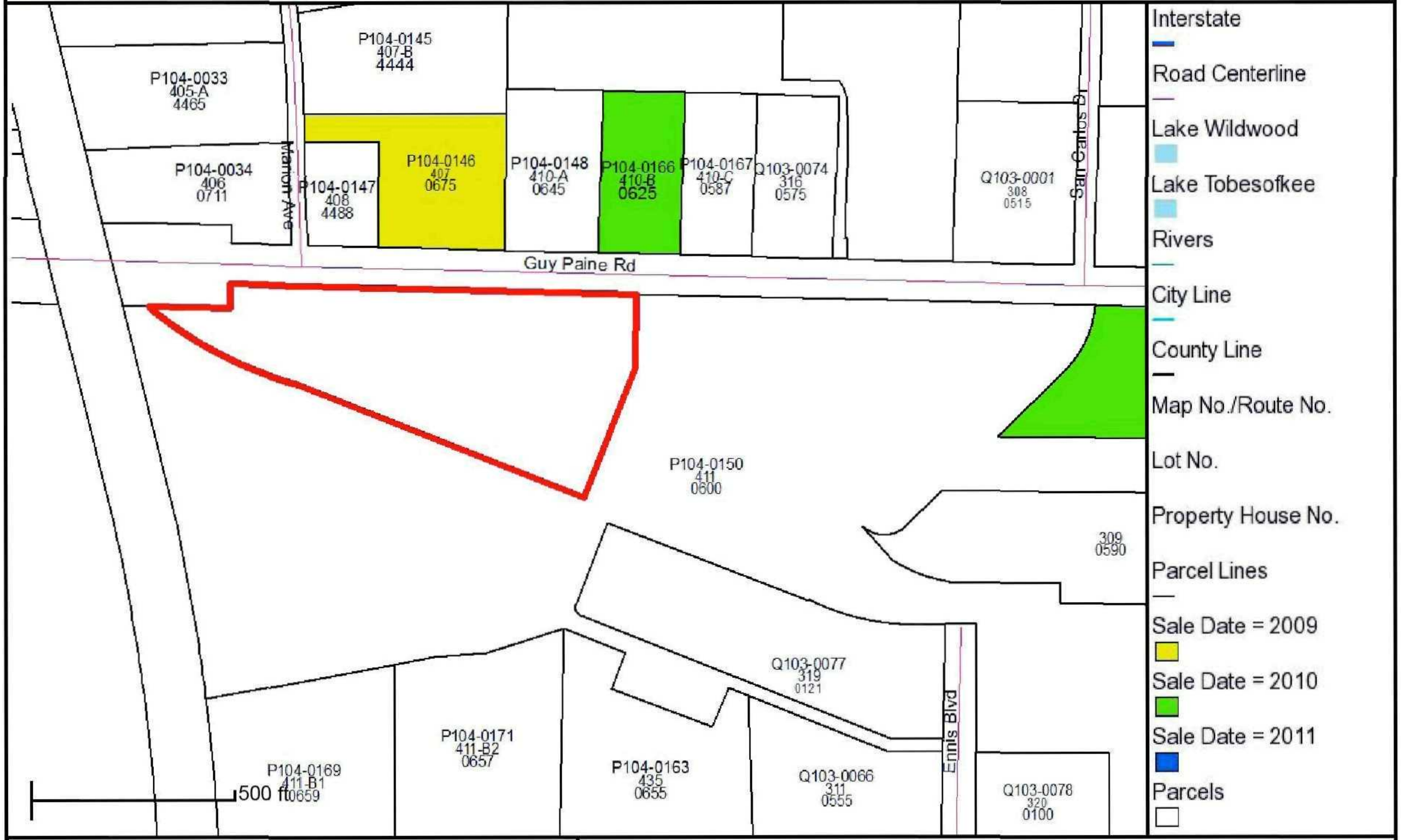
http://library.municode.com/index.aspx?clientID=11190&stateID=10&statename=Georgia

RESPONSE REQUIRED

(x) None ( ) Phone Call ( ) Memo ( ) Letter ( ) Report

cc: File (x) Project Manager ( ) Principal Investigator ( ) Other (specify)

Bibb County



Bibb County GIS

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Macon/Bibb County Board Of Tax Assessors

Andrea Crutchfield
Chief Appraiser
acrutchfield@co.bibb.ga.us

653 Second Street, Macon GA 31201 | Phone (478) 621-6701 | Fax (478) 621-6737

Owner and Parcel Information

Owner Name	**WHITE A C TRANSFER-STO CO**	**Today's Date**	**9/7/2011**
Mailing Address	**670 GUY PAINE RD** **MACON, GA 312062012**	**Parcel Number**	**P104-0164**
		Tax District	**1**
		Acres	**8.43**
		Homestead Exemption	
Location Address	**670 GUY PAINE RD**	**Zoning**	**M-2**
Class Code	**C**	**Neighborhood**	**3348**
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$180,023	**$819,386**	**$60,059**	**$1,059,468**	**$1,059,468**

Land Information

Type	Calculation Method	Acres	Value
Commercial	**Acre**	**8.43**	**$180,023**

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
			None				
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
			None				

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1986	**$706,651**	**30,800**	**Warehouse - Transit**	**Warehouse - Transit**	**Prefab Structural Steel**	**1 Story**	Building Photo	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1986	**$112,735**	**3,500**	**Office Buildings**	**Office Buildings**	**Prefab Structural Steel**	**1 Story**	**Building Photo Not Available**	Building Sketch

Accessory Information

Description	Year Built	Value
ASPH PAVING	**1986**	**$50,827**
Fence-Chain Link 3 SBW	**1986**	**$8,772**
ASPH PAVING	**1986**	**$460**

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
None						

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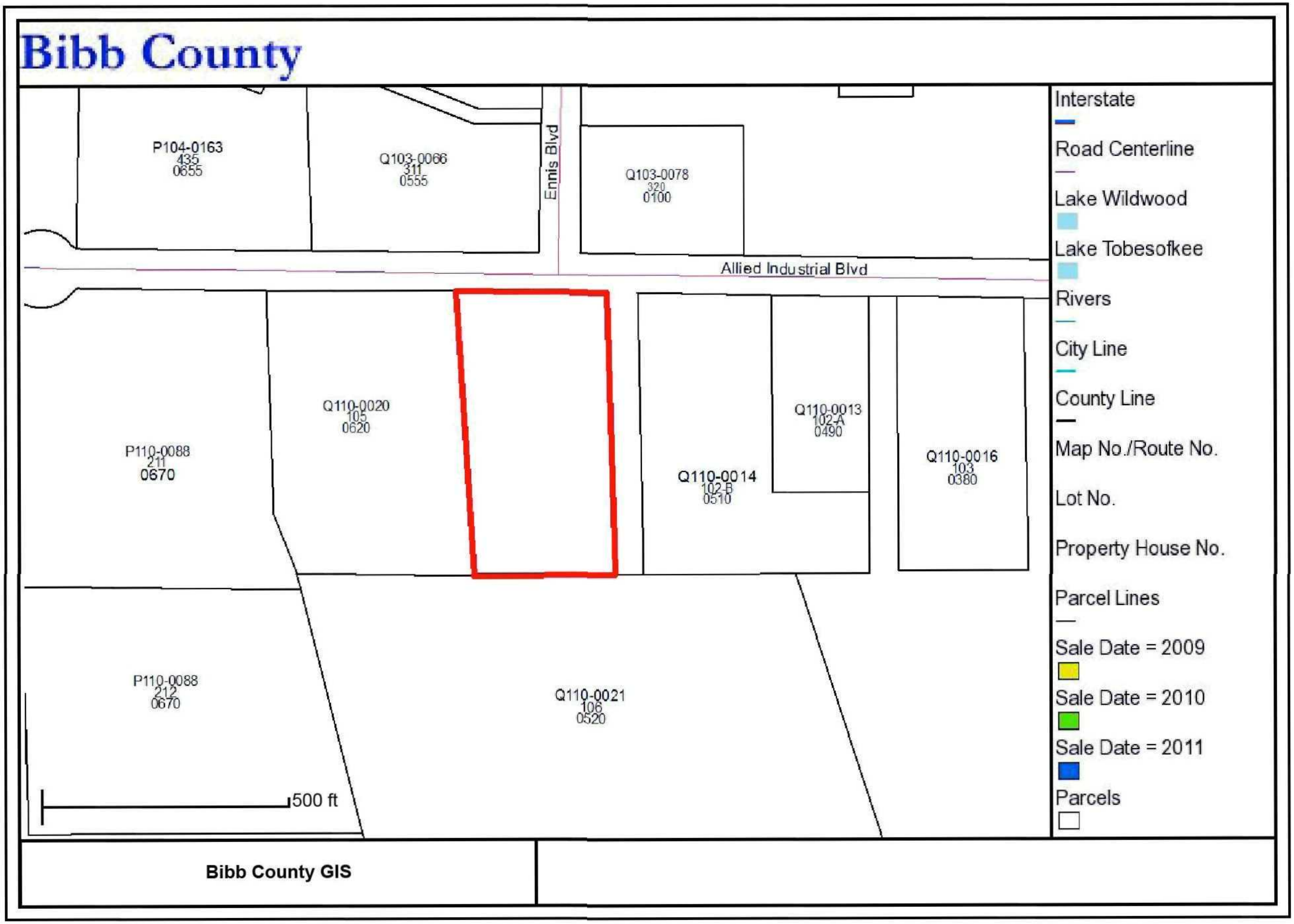
Bibb County
P104-0163
435
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Ennis Blvd
Q103-0078
320
0100
Allied Industrial Blvd
Q110-0020
105
0620
P110-0088
211
0670
Q110-0014
102-B
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Q110-0013
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0380
P110-0088
212
0670
Q110-0021
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500 ft
Interstate
Road Centerline
Lake Wildwood
Lake Tobesofkee
Rivers
City Line
County Line
Map No./Route No.
Lot No.
Property House No.
Parcel Lines
Sale Date = 2009
Sale Date = 2010
Sale Date = 2011
Parcels
Bibb County GIS

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Macon/Bibb County Board Of Tax Assessors

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Chief Appraiser
acrutchfield@co.bibb.ga.us

653 Second Street, Macon GA 31201 | Phone (478) 621-6701 | Fax (478) 621-6737

Owner and Parcel Information

Owner Name	**BLAIR MOVING - STG CO LLLP**	**Today's Date**	**9/7/2011**
Mailing Address	**P O BOX 3005** **MACON, GA 312053005**	**Parcel Number**	**Q110-0015**
		Tax District	**1**
		Acres	**3.77**
		Homestead Exemption	
Location Address	**540 ALLIED INDUSTRIAL BLVD**	**Zoning**	**M-2**
Class Code	**I**	**Neighborhood**	**3348**
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$118,475	$419,926	$46,075	$584,476	$584,476

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	3.77	$118,475

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
			None				
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
			None				

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1989	$52,240	3,300	Warehouse - Storage	Warehouse - Storage	Prefab Structural Steel	1 Story	Building Photo	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1989	$367,686	15,000	Warehouse - Storage	Warehouse - Storage	Prefab Structural Steel	1 Story	Building Photo Not Available	Building Sketch

Accessory Information

Description	Year Built	Value
CONC PAVING	1989	$35,853
Fence-Chain Link w/Top Rail	1989	$10,222

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
05/05/2004	06200/00350		$10	Un-qualified		BLAIR MOVING - STG CO LLLP

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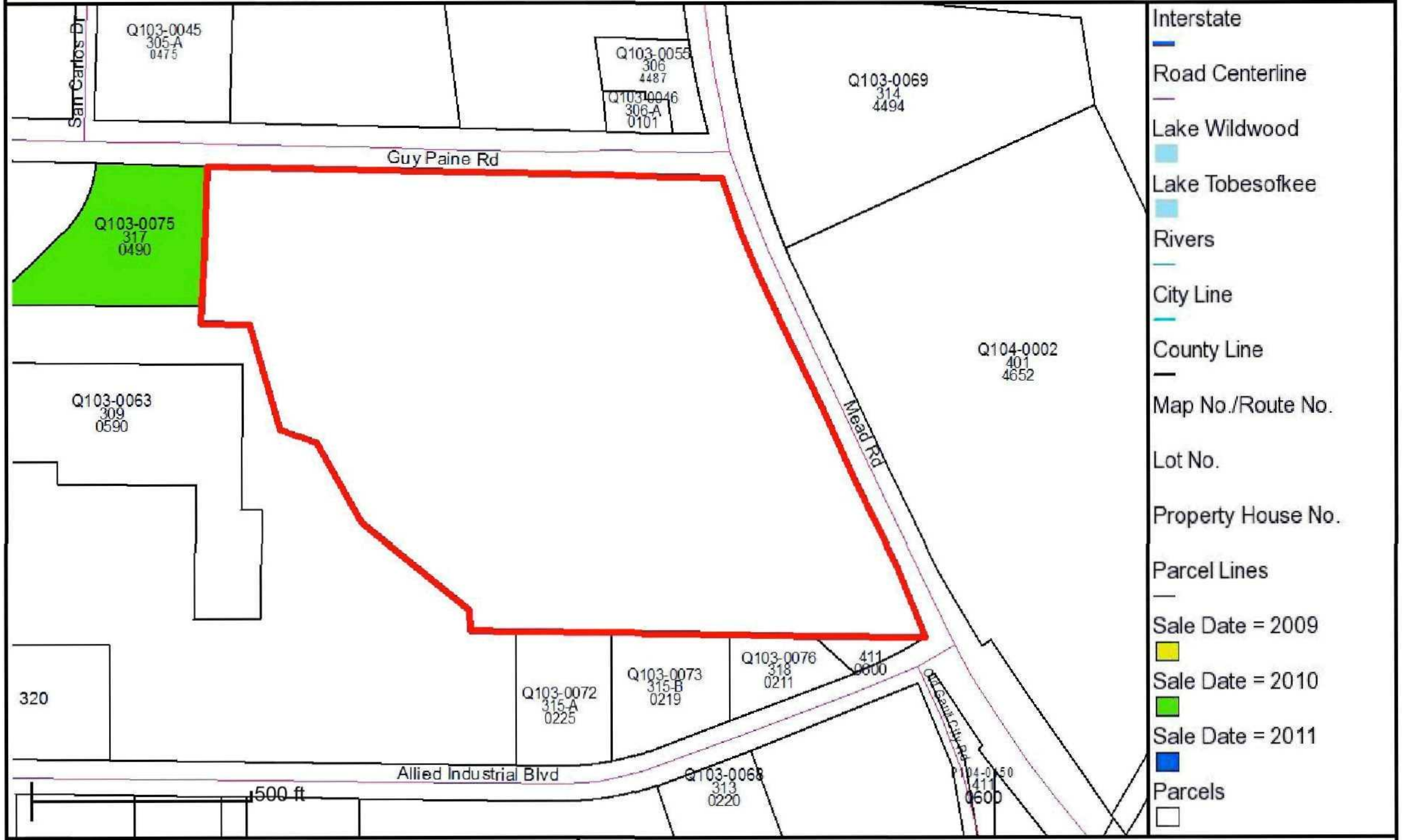
Bibb County



Bibb County GIS

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acrutchfield@co.bibb.ga.us

653 Second Street, Macon GA 31201 | Phone (478) 621-6701 | Fax (478) 621-6737

Owner and Parcel Information

Owner Name	CITY OF MACON	**Today's Date**	9/7/2011
Mailing Address	P O BOX 247 MACON, GA 312010247	**Parcel Number**	Q103-0064
		Tax District	1
		Acres	28.78
		Homestead Exemption	
Location Address	0 GUY PAINE RD	**Zoning**	PDI
Class Code	E	**Neighborhood**	
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$556,150	$0	$0	$556,150	$556,150

Land Information

Type	Calculation Method	Acres	Value
Exempt	Acre	28.78	$556,150

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							

Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
None								

Accessory Information

Description	Year Built	Value
None		

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
None						

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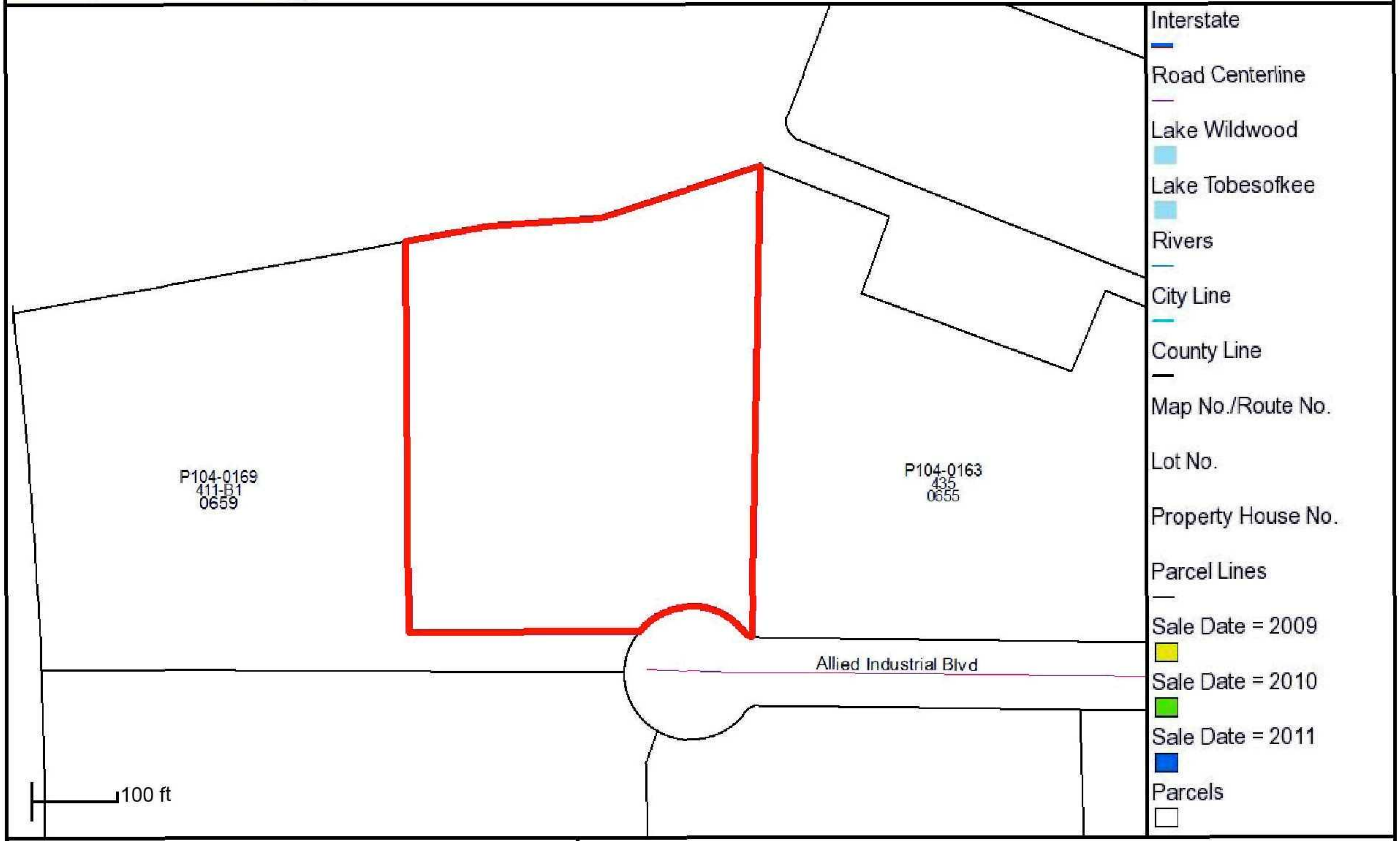

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Chief Appraiser
acrutchfield@co.bibb.ga.us

653 Second Street, Macon GA 31201 | Phone (478) 621-6701 | Fax (478) 621-6737

Owner and Parcel Information

Owner Name	DAMASTE WAREHOUSES LLC	**Today's Date**	9/7/2011
Mailing Address	PO BOX 1915 MACON, GA 312021915	**Parcel Number**	P104-0171
		Tax District	1
		Acres	4.53
		Homestead Exemption	
Location Address	657 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	I	**Neighborhood**	
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$65,888	$0	$2,486	$68,374	$68,374

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	4.53	$65,888

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							

Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
None								

Accessory Information

Description	Year Built	Value
Fence-Chain Link w/No Rail	1980	$2,486

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
None						

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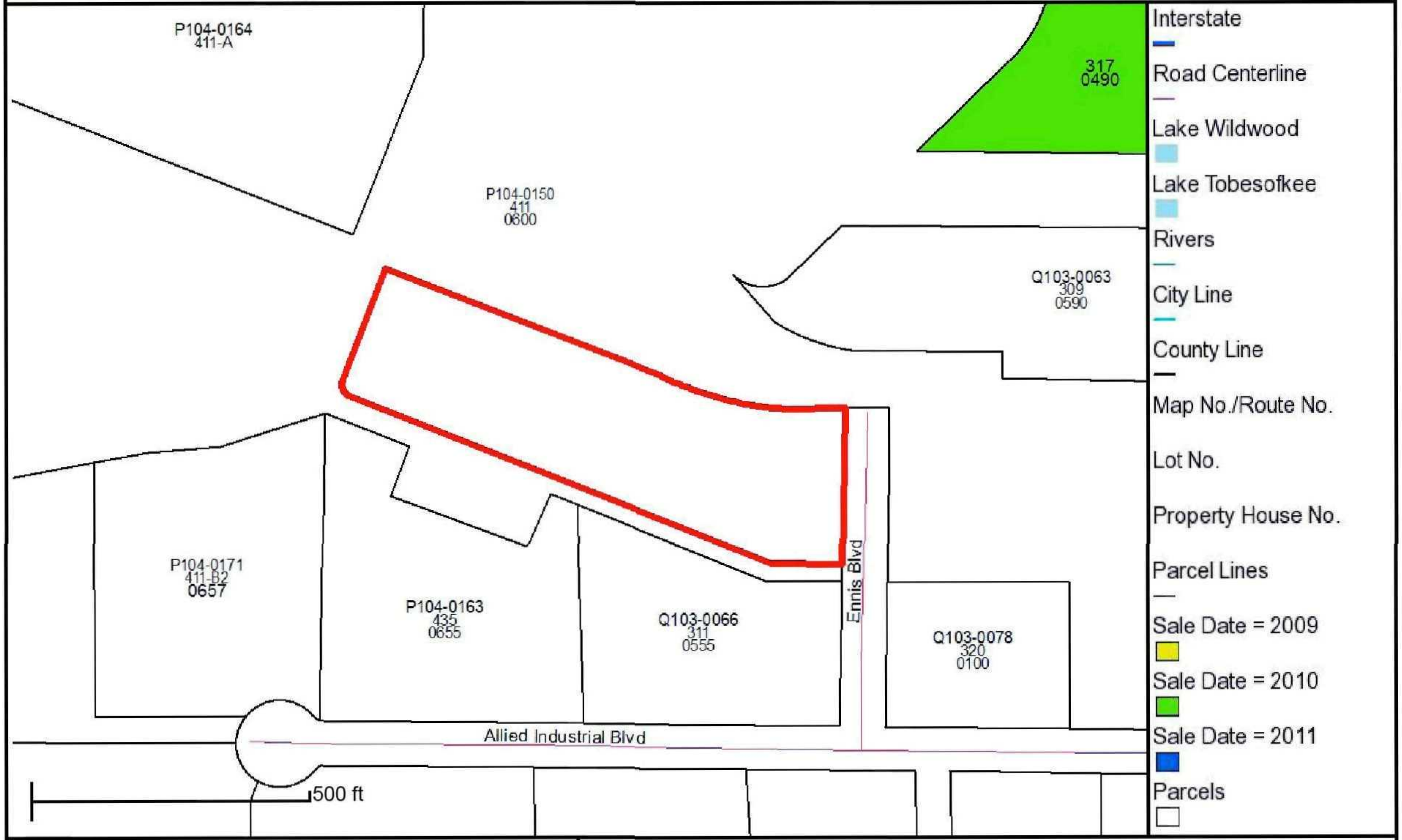

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653 Second Street, Macon GA 31201 | Phone (478) 621-6701 | Fax (478) 621-6737

Owner and Parcel Information

Owner Name	DAMASTE WAREHOUSING LLC	**Today's Date**	9/7/2011
Mailing Address	PO BOX 1915 MACON, GA 312021915	**Parcel Number**	Q103-0077
		Tax District	1
		Acres	5.33
		Homestead Exemption	
Location Address	121 ENNIS BLVD	**Zoning**	M-2
Class Code	I	**Neighborhood**	3347
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$145,775	$599,957	$0	$745,732	$745,732

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	5.33	$145,775

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							

Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$102,572	20,400	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1974	$110,614	24,600	Industrial - Light Manufactur	Industrial - Light Manufactur	Prefab Structural Steel	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$96,979	20,400	Industrial - Light	Industrial - Light	Masonry Load	1	Building Photo Not	Building Sketch

			Manufactur	Manufactur	Bearing Walls	Story	Available	

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1974	$114,921	24,800	Industrial - Light Manufactur	Industrial - Light Manufactur	Prefab Structural Steel	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$101,696	20,400	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1955	$42,864	12,000	Industrial - Light Manufactur	Industrial - Light Manufactur	Prefab Structural Steel	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1955	$30,311	7,960	Industrial - Light Manufactur	Industrial - Light Manufactur	Prefab Structural Steel	1 Story	Building Photo Not Available	Building Sketch

Accessory Information

Description	Year Built	Value
	None	

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
			None			

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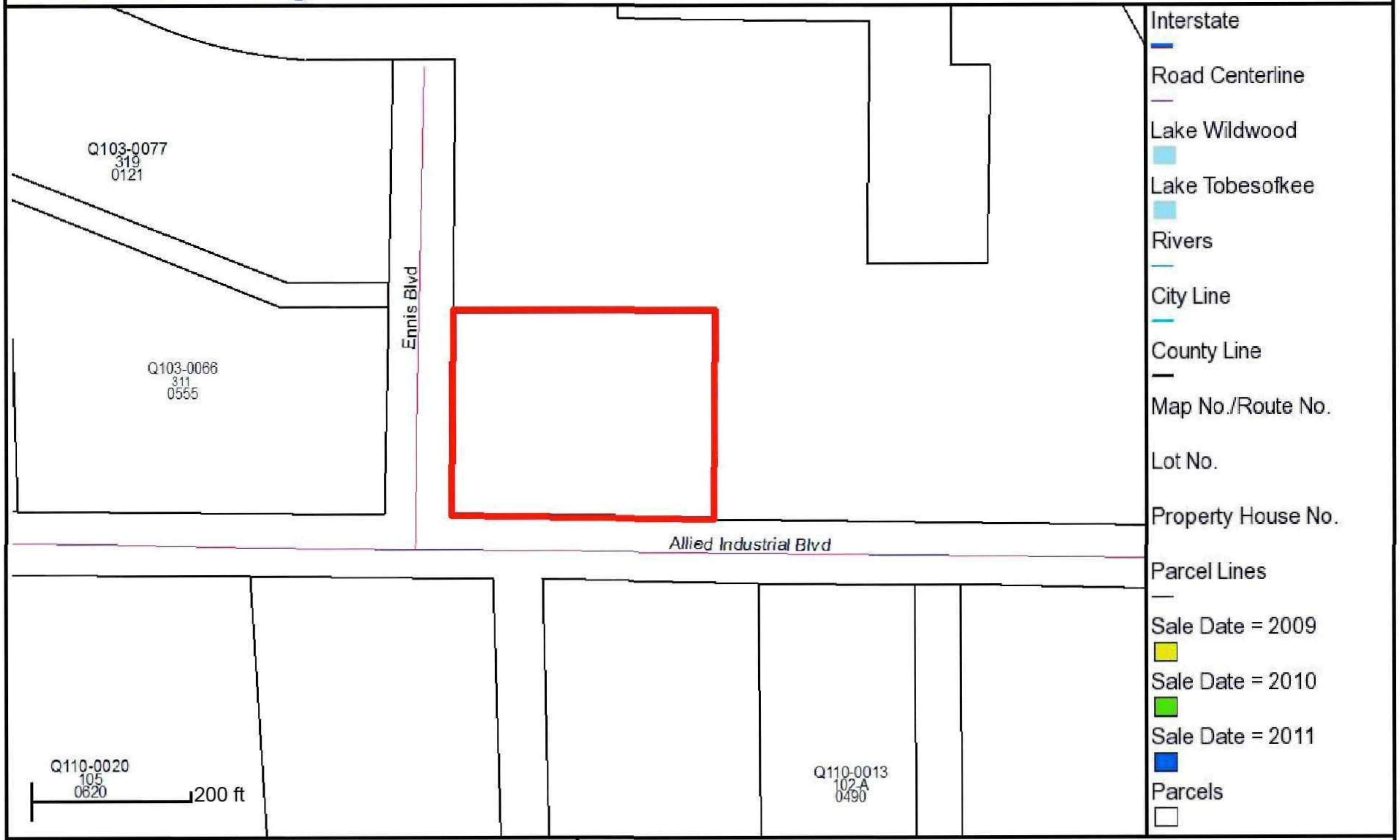

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Owner and Parcel Information

Owner Name	DAMASTE WAREHOUSING LLC	**Today's Date**		9/7/2011
Mailing Address	PO BOX 1915 MACON, GA 312021915	**Parcel Number**		Q103-0078
		Tax District		1
		Acres		2.07
		Homestead Exemption		
Location Address	100 ENNIS BLVD	**Zoning**		M-2
Class Code	I	**Neighborhood**		3348
Parcel Map	Show Parcel Map	Area Sales	Street Sales	

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$72,450	$109,567	$0	$182,017	$182,017

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	2.07	$72,450

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$89,423	15,385	Warehouse - Storage	Warehouse - Storage	Masonry Load Bearing Walls	1 Story	Building Photo	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$20,144	2,534	Warehouse - Storage	Warehouse - Storage	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Accessory Information

Description	Year Built	Value
None		

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Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
None						

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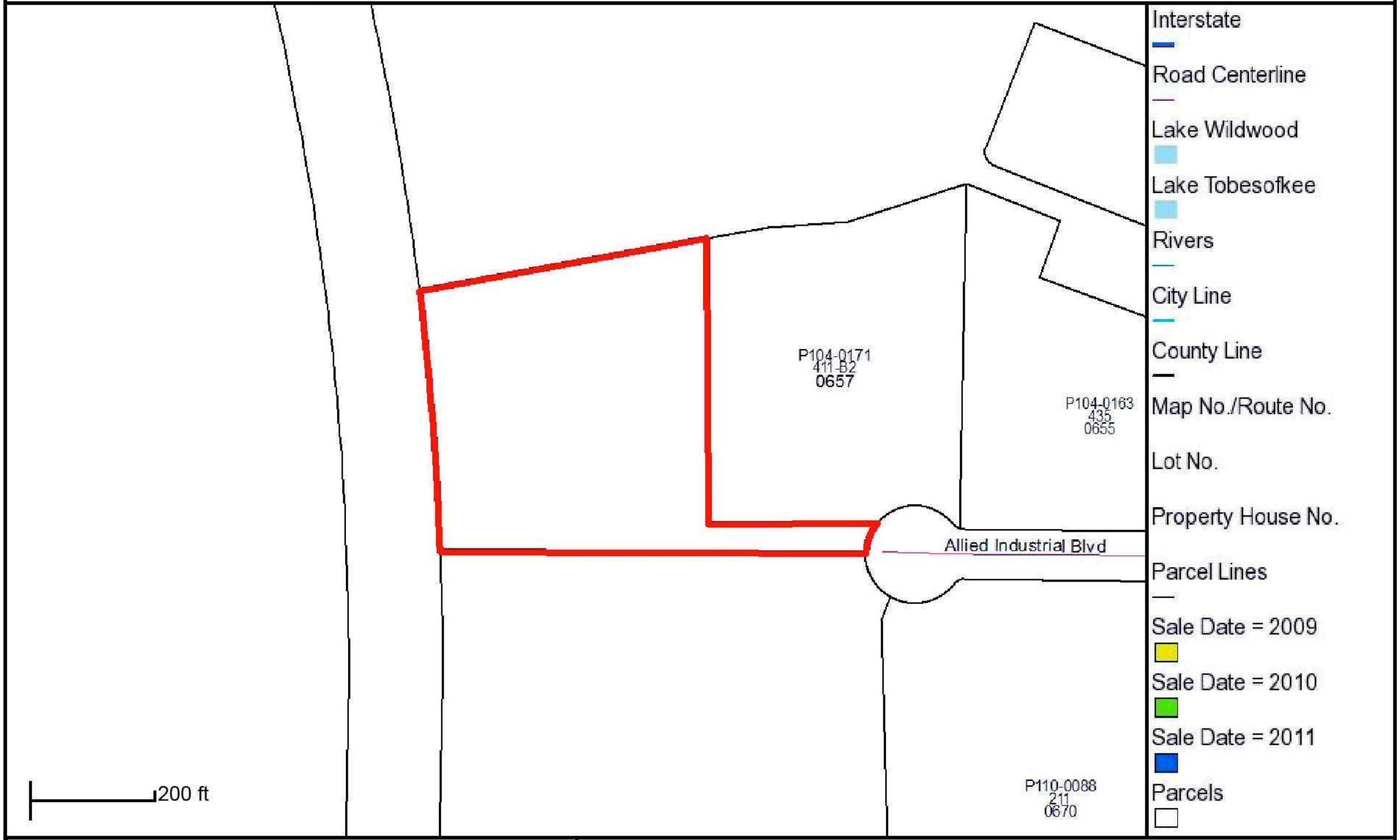

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Owner and Parcel Information

Owner Name	GBTS LLC	**Today's Date**	9/7/2011
Mailing Address	P O BOX 27508 MACON, GA 31221	**Parcel Number**	P104-0169
		Tax District	1
		Acres	5.16
		Homestead Exemption	
Location Address	659 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	I	**Neighborhood**	
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$64,260	$0	$0	$64,260	$64,260

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	5.16	$64,260

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							

Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
None								

Accessory Information

Description	Year Built	Value
None		

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
05/01/2002	05319/00311		$57,500	Fair Market - Vacant		GRAY CHRISTIAN B & EBEN T
03/17/2008	7898 / 89	90 536	$10	Quit-Claim Deed	GRAY CHRISTIAN B & EBEN T	GBTS LLC

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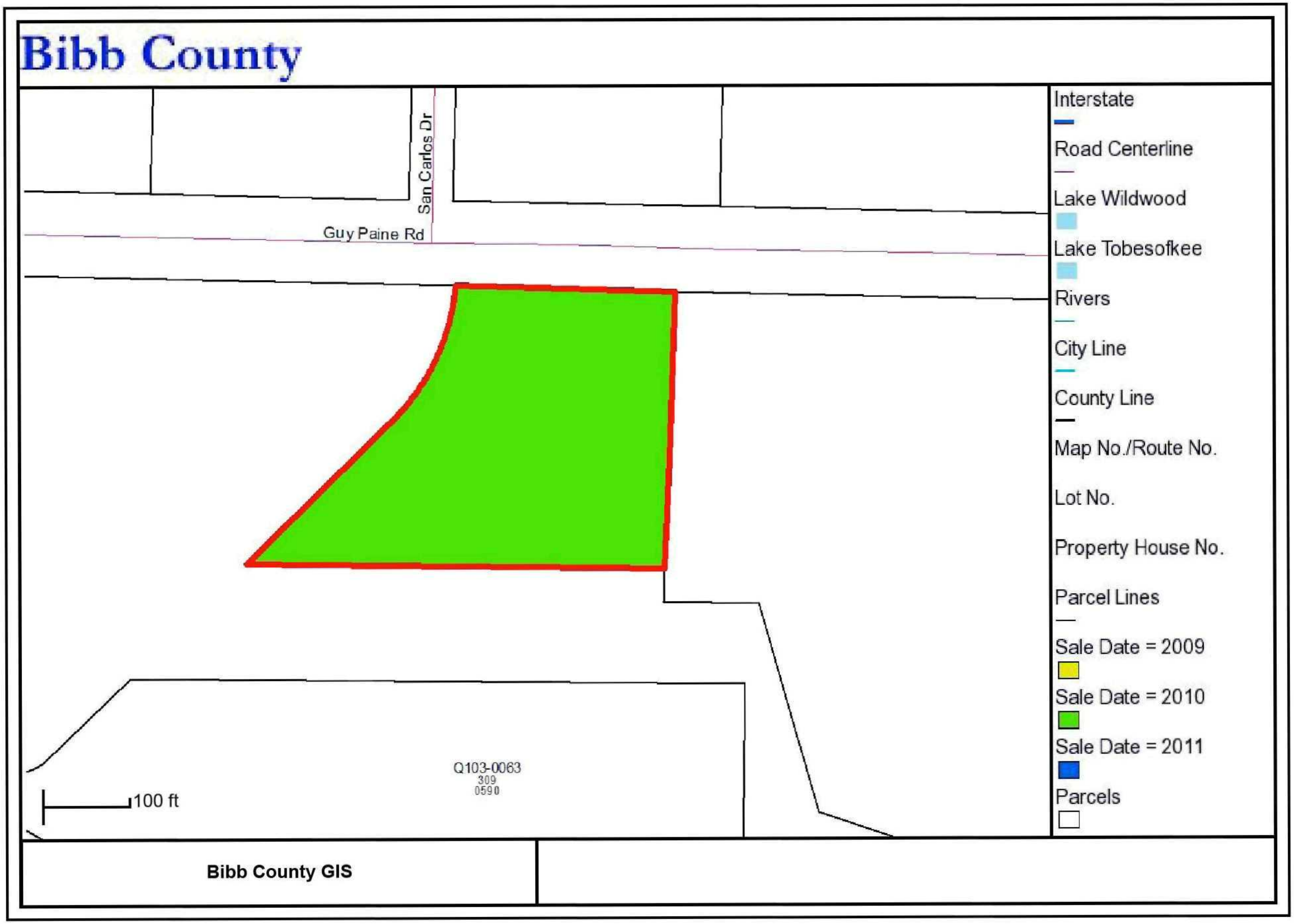

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San Carlos Dr
Guy Paine Rd
Q103-0063
309
0590
100 ft
Interstate
Road Centerline
Lake Wildwood
Lake Tobesofkee
Rivers
City Line
County Line
Map No./Route No.
Lot No.
Property House No.
Parcel Lines
Sale Date = 2009
Sale Date = 2010
Sale Date = 2011
Parcels
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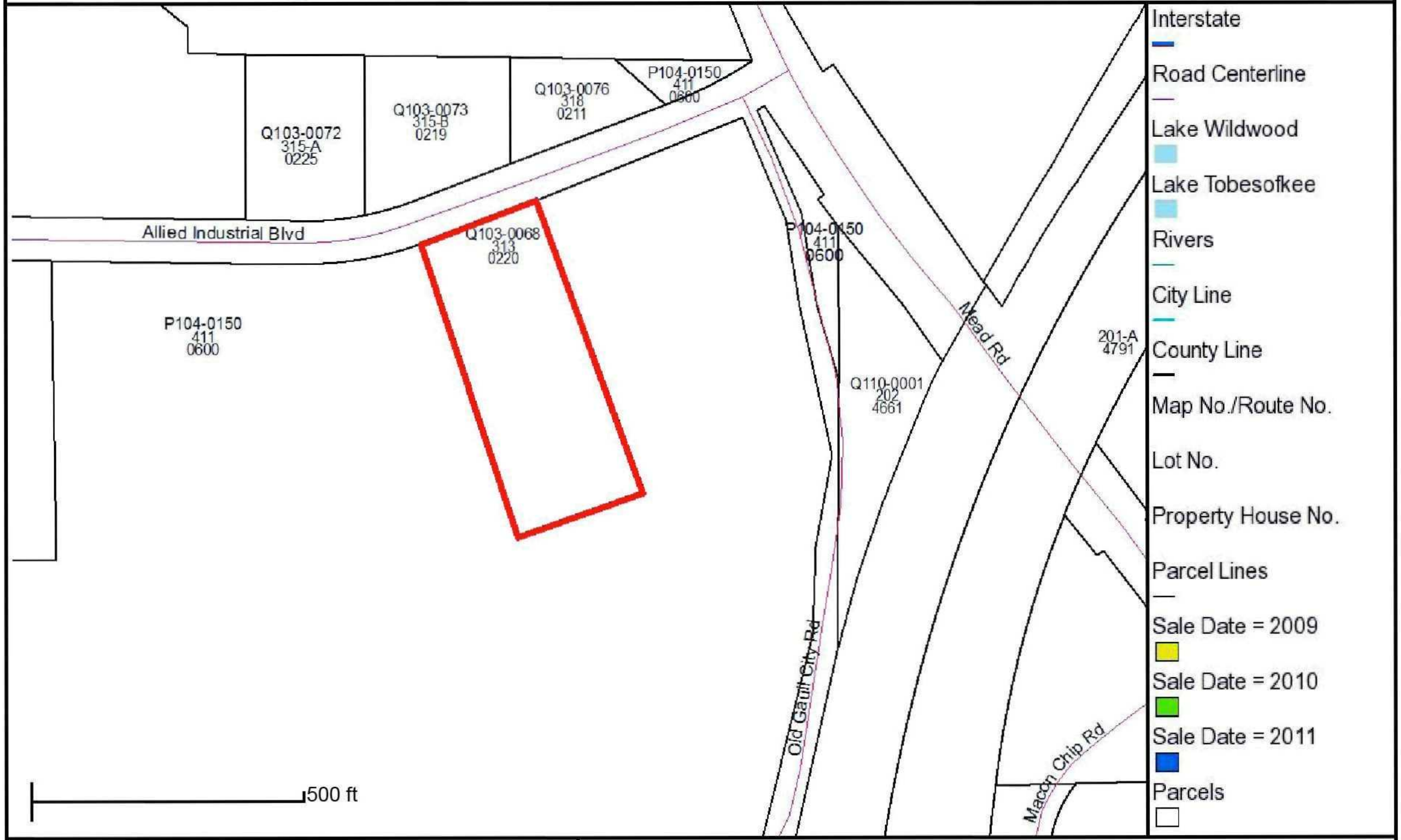

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Owner and Parcel Information

Owner Name	HOX MANAGEMENT L P	**Today's Date**	9/7/2011
Mailing Address	200 COMMONWEALTH DR WARRENDALE, PA 15086	**Parcel Number**	Q103-0068
		Tax District	1
		Acres	3
		Homestead Exemption	
Location Address	220 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	I	**Neighborhood**	3348
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$105,000	$362,264	$0	$467,264	$467,264

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	3	$105,000

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
			None				

Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
			None				

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1986	$303,851	20,000	Warehouse - Storage	Warehouse - Storage	Prefab Structural Steel	1 Story	Building Photo	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1986	$58,413	1,200	Office Buildings	Office Buildings	Prefab Structural Steel	1 Story	Building Photo Not Available	Building Sketch

Accessory Information

Description	Year Built	Value
	None	

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
02/17/2009	8029 / 325	71 35	$0	Assent	SMITH R MICHAEL & ELAINE D	SMITH ELAINE D
05/05/2009	8081 / 346	71 35	$341,610	Un-qualified	SMITH ELAINE D	HOX MANAGEMENT L P

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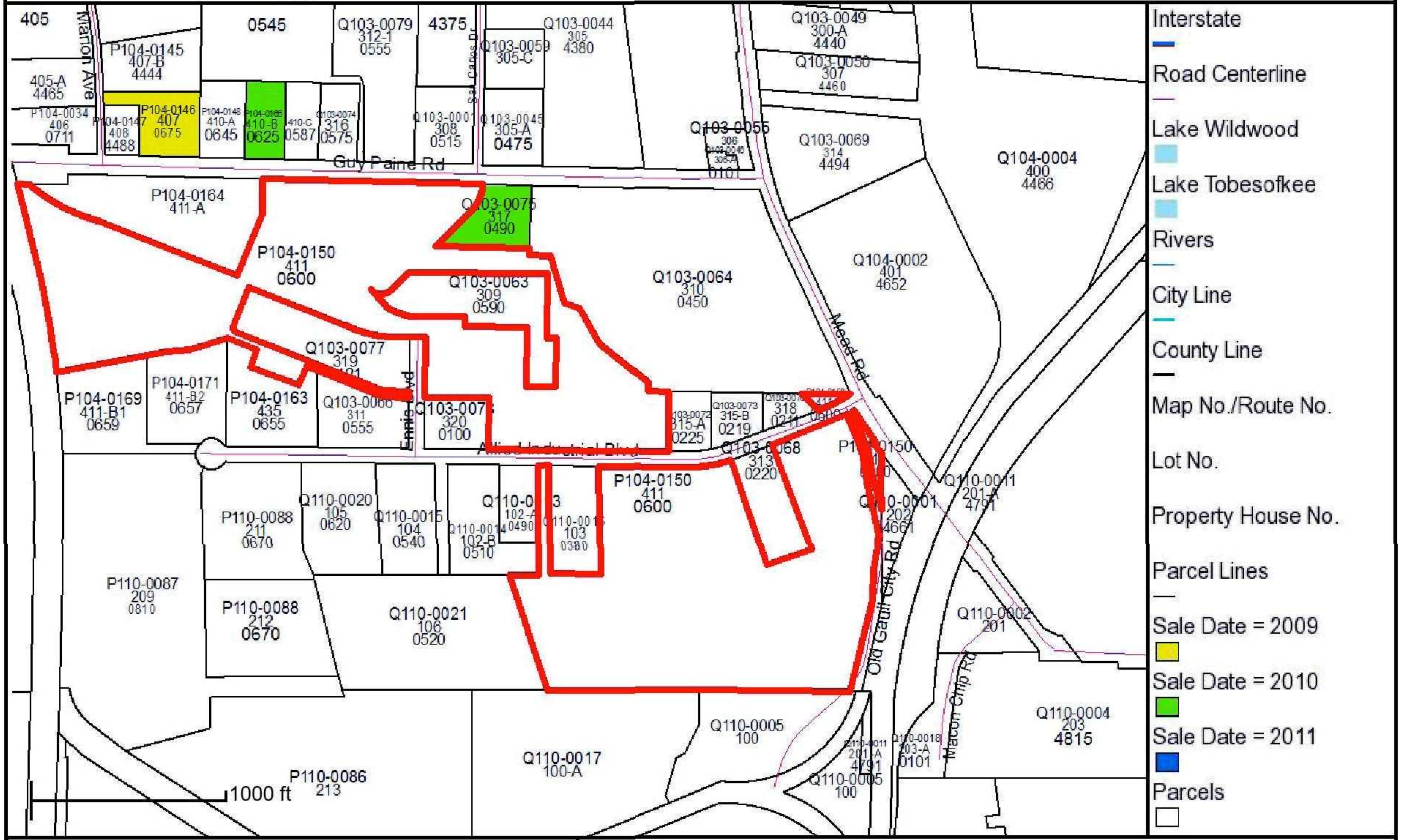

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Owner and Parcel Information

Owner Name	MACON BIBB CO IND AUTHORITY	**Today's Date**		9/7/2011
Mailing Address	PO BOX 207 MACON, GA 312020207	**Parcel Number**		P104-0150
		Tax District		1
		Acres		139.45
		Homestead Exemption		
Location Address	600 GUY PAINE RD	**Zoning**		M-2
Class Code	E	**Neighborhood**		3355
Parcel Map	Show Parcel Map	Area Sales	Street Sales	

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$1,272,688	$1,797,506	$0	$3,070,194	$3,070,194

Land Information

Type	Calculation Method	Acres	Value
Exempt	Acre	139.45	$1,272,688

Residential Improvement Information

Cccupancy Type	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	No. of Bedrooms	Building Picture
One Family	1942	$4,086	2,570	0	0	2.00	0	Building Photo
No. of Full/Half Baths	**Interior Walls**	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
2/0	Plaster	Asphalt Shingles	Wood Joist	Hardwood	Plaster	Cent Heat	Average	Building Sketch

Cccupancy Type	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	No. of Bedrooms	Building Picture
One Family	1942	$4,086	2,570	0	0	2.00	0	Building Photo Not Available
No. of Full/Half Baths	**Interior Walls**	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
2/0	Plaster	Asphalt Shingles	Wood Joist	Hardwood	Plaster	Cent Heat	Average	Building Sketch

Cccupancy Type	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	No. of Bedrooms	Building Picture
One Family	1942	$4,086	2,570	0	0	2.00	0	Building Photo Not Available
No. of Full/Half Baths	**Interior Walls**	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
2/0	Plaster	Asphalt Shingles	Wood Joist	Hardwood	Plaster	Cent Heat	Average	Building Sketch

Cccupancy Type	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	No. of Bedrooms	Building Picture
One Family	1942	$7,950	1,613	0	0	2.00	0	Building Photo Not Available
No. of Full/Half Baths	Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
2/0	Plaster	Asphalt Shingles	Wood Joist	Hardwood	Plaster	Cent Heat	Average	Building Sketch

Cccupancy Type	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	No. of Bedrooms	Building Picture
One Family	1942	$7,950	1,613	0	0	2.00	0	Building Photo Not Available
No. of Full/Half Baths	Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
2/0	Plaster	Asphalt Shingles	Wood Joist	Hardwood	Plaster	Cent Heat	Average	Building Sketch

Cccupancy Type	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	No. of Bedrooms	Building Picture
One Family	1942	$7,950	1,613	0	0	2.00	0	Building Photo Not Available
No. of Full/Half Baths	Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
2/0	Plaster	Asphalt Shingles	Wood Joist	Hardwood	Plaster	Cent Heat	Average	Building Sketch

Cccupancy Type	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	No. of Bedrooms	Building Picture
One Family	1942	$10,821	2,250	0	0	2.00	0	Building Photo Not Available
No. of Full/Half Baths	Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
2/0	Plaster	Asphalt Shingles	Wood Joist	Hardwood	Plaster	Cent Heat	Average	Building Sketch

Cccupancy Type	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	No. of Bedrooms	Building Picture
One Family	1942	$10,821	2,250	0	0	2.00	0	Building Photo Not Available
No. of Full/Half Baths	Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
2/0	Plaster	Asphalt Shingles	Wood Joist	Hardwood	Plaster	Cent Heat	Average	Building Sketch

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$34,930	4,316	Office Buildings	Office Buildings	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
							Building	

1950	$18,805	2,440	Office Buildings	Office Buildings	Wood/Steel Combustible	1 Story	Photo Not Available	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1950	$5,863	638	Office Buildings	Office Buildings	Wood/Steel Combustible	1 Story	Building Photo Not Available	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1942	$34,423	2,360	Office Buildings	Office Buildings	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1942	$127,127	20,000	Office Buildings	Office Buildings	Masonry Load Bearing Walls	2 Story	Building Photo Not Available	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1942	$36,787	5,100	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1942	$5,072	686	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1942	$60,971	9,145	Automotive Service Centers	Automotive Service Centers	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1942	$16,784	1,855	Automotive Service Centers	Automotive Service Centers	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1942	$15,066	2,401	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
			Industrial -	Industrial -	Masonry Load	1	Building Photo	

1942	$1,587	152	Light Manufactur	Light Manufactur	Bearing Walls	Story	Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$8,791	1,240	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$25,688	3,588	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1974	$135,304	24,800	Industrial - Light Manufactur	Industrial - Light Manufactur	Prefab Structural Steel	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$111,454	20,200	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1974	$136,178	25,000	Industrial - Light Manufactur	Industrial - Light Manufactur	Prefab Structural Steel	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$112,903	20,400	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$5,927	517	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$2,970	2,204	Warehouse - Storage	Warehouse - Storage	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$80	52	Warehouse - Storage	Warehouse - Storage	Masonry Load Bearing	1 Story	Building Photo Not	Building Sketch

					Walls		Available	

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$15,526	1,122	Office Buildings	Office Buildings	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$27,335	2,162	Office Buildings	Office Buildings	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$51,958	4,056	Office Buildings	Office Buildings	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$308,668	35,272	Office Buildings	Office Buildings	Masonry Load Bearing Walls	2 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$31,447	4,480	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$117,025	20,200	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$1,029	640	Warehouse - Storage	Warehouse - Storage	Wood/Steel Combustible	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$102,314	17,608	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$5,399	176	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$27,053	4,200	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$7,355	640	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$108,006	17,608	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$11,091	176	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$24,253	2,480	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$3,262	5,580	Warehouse - Storage	Warehouse - Storage	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1970	$712	64	Office Buildings	Office Buildings	Prefab Structural Steel	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$92	252	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$521	270	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Accessory Information		
Description	**Year Built**	**Value**
None		

Sale Information						
Sale Date	**Deed Book/Page**	**Plat Page**	**Price**	**Reason**	**Grantor**	**Grantee**
None						

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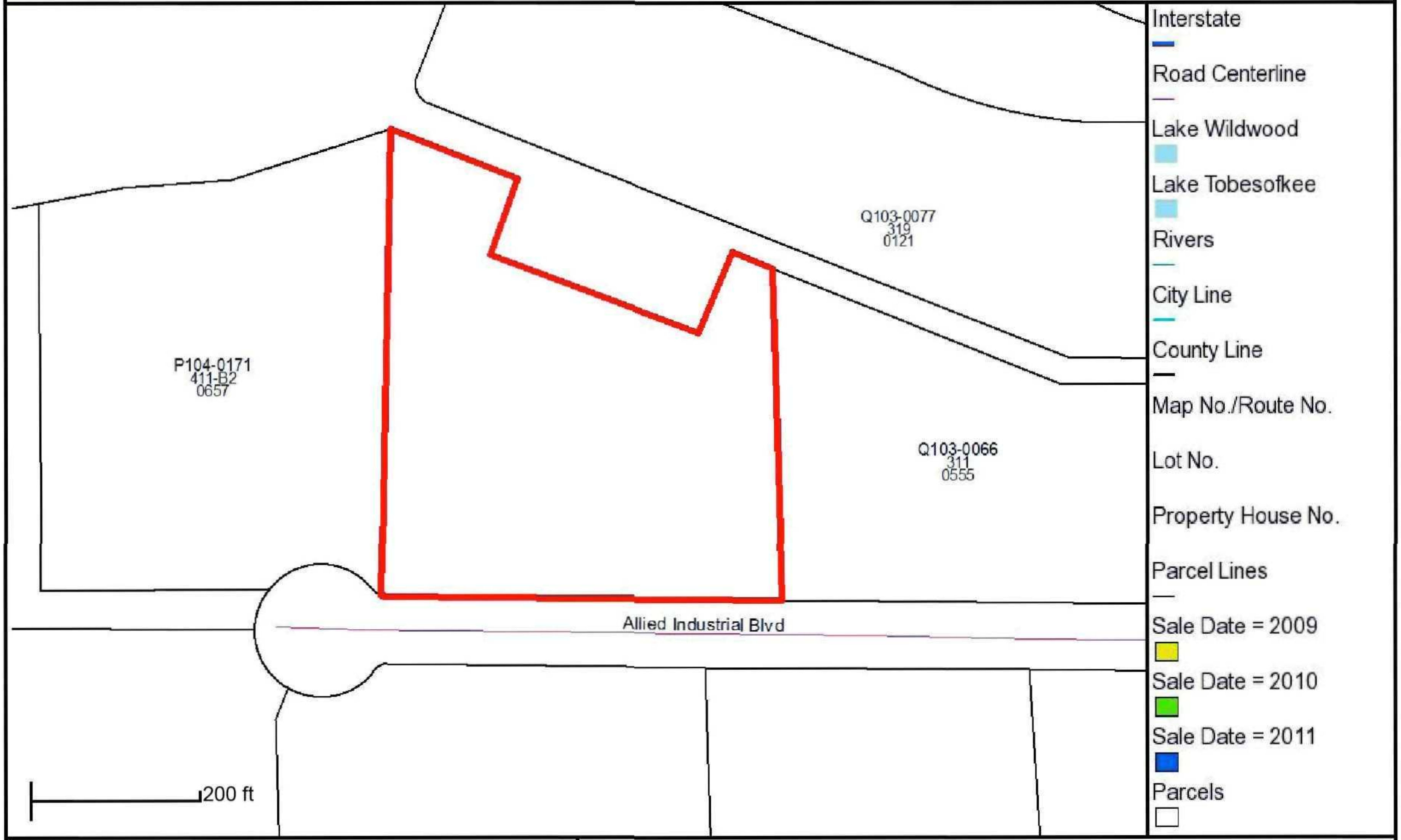

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653 Second Street, Macon GA 31201 | Phone (478) 621-6701 | Fax (478) 621-6737

Owner and Parcel Information

Owner Name	MACON BIBB CO IND AUTHORITY	**Today's Date**	9/7/2011
Mailing Address	PO BOX 207 MACON, GA 312020207	**Parcel Number**	P104-0163
		Tax District	1
		Acres	4.33
		Homestead Exemption	
Location Address	655 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	E	**Neighborhood**	3355
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$128,275	$459,244	$0	$587,519	$587,519

Land Information

Type	Calculation Method	Acres	Value
Exempt	Acre	4.33	$128,275

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
			None				
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
			None				

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$291,627	29,402	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1942	$30,201	2,440	Industrial - Light Manufactur	Industrial - Light Manufactur	Masonry Load Bearing Walls	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch

1942	**$96,198**	**9,399**	**Industrial - Light Manufactur**	**Industrial - Light Manufactur**	**Masonry Load Bearing Walls**	**1 Story**	**Building Photo Not Available**	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1942	**$20,405**	**1,620**	**Industrial - Light Manufactur**	**Industrial - Light Manufactur**	**Masonry Load Bearing Walls**	**1 Story**	**Building Photo Not Available**	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1942	**$13,584**	**820**	**Industrial - Light Manufactur**	**Industrial - Light Manufactur**	**Masonry Load Bearing Walls**	**1 Story**	**Building Photo Not Available**	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1942	**$7,229**	**224**	**Industrial - Light Manufactur**	**Industrial - Light Manufactur**	**Masonry Load Bearing Walls**	**1 Story**	**Building Photo Not Available**	Building Sketch

Accessory Information

Description	Year Built	Value
	None	

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
			None			

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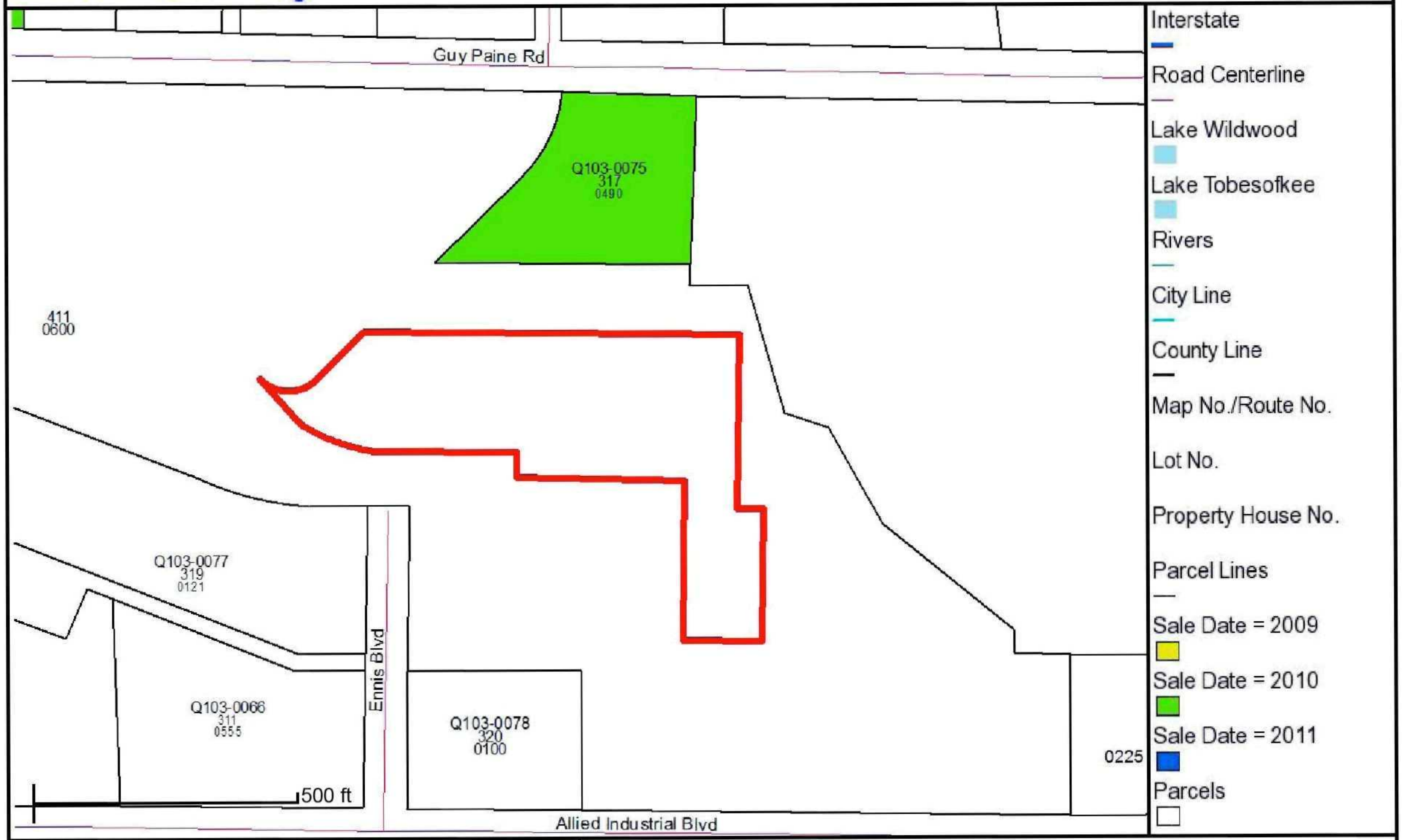

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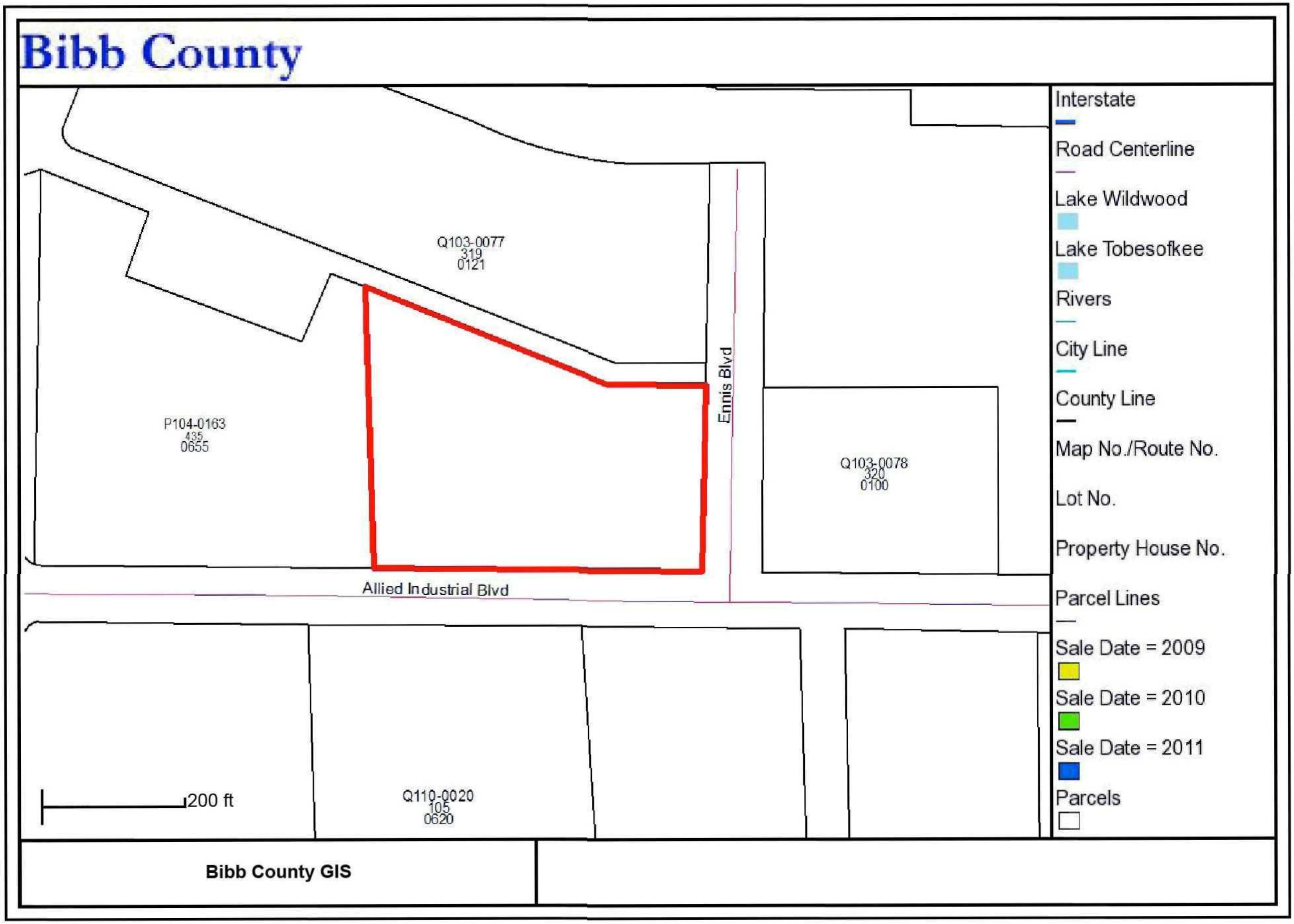
Bibb County
Interstate
Road Centerline
Lake Wildwood
Lake Tobesofkee
Rivers
City Line
County Line
Map No./Route No.
Lot No.
Property House No.
Parcel Lines
Sale Date = 2009
Sale Date = 2010
Sale Date = 2011
Parcels
Q103-0077
319
0121
P104-0163
435
0655
Q103-0078
320
0100
Q110-0020
105
0620
Ennis Blvd
Allied Industrial Blvd
200 ft
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Owner and Parcel Information

Owner Name	MACON BIBB CO IND AUTHORITY	**Today's Date**	9/7/2011
Mailing Address	PO BOX 207 MACON, GA 312020207	**Parcel Number**	Q103-0066
		Tax District	1
		Acres	3.5
		Homestead Exemption	
Location Address	555 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	E	**Neighborhood**	3347
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$113,750	$662,005	$50,988	$826,743	$826,743

Land Information

Type	Calculation Method	Acres	Value
Exempt	Acre	3.5	$113,750

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1990	$401,317	12,440	Industrial - Light Manufactur	Industrial - Light Manufactur	Wood/Steel Combustible	1 Story	Building Photo	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1990	$260,688	7,500	Industrial - Light Manufactur	Industrial - Light Manufactur	Wood/Steel Combustible	1 Story	Building Photo Not Available	Building Sketch

Accessory Information

Description	Year Built	Value
CONC PAVING	1990	$47,403
CANOPY (Poor)	1997	$859

CANOPY (Poor)	**1997**	**$271**
UTILITY BLDG	**1997**	**$1,093**
CONC PAVING	**1997**	**$1,362**

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
			None			

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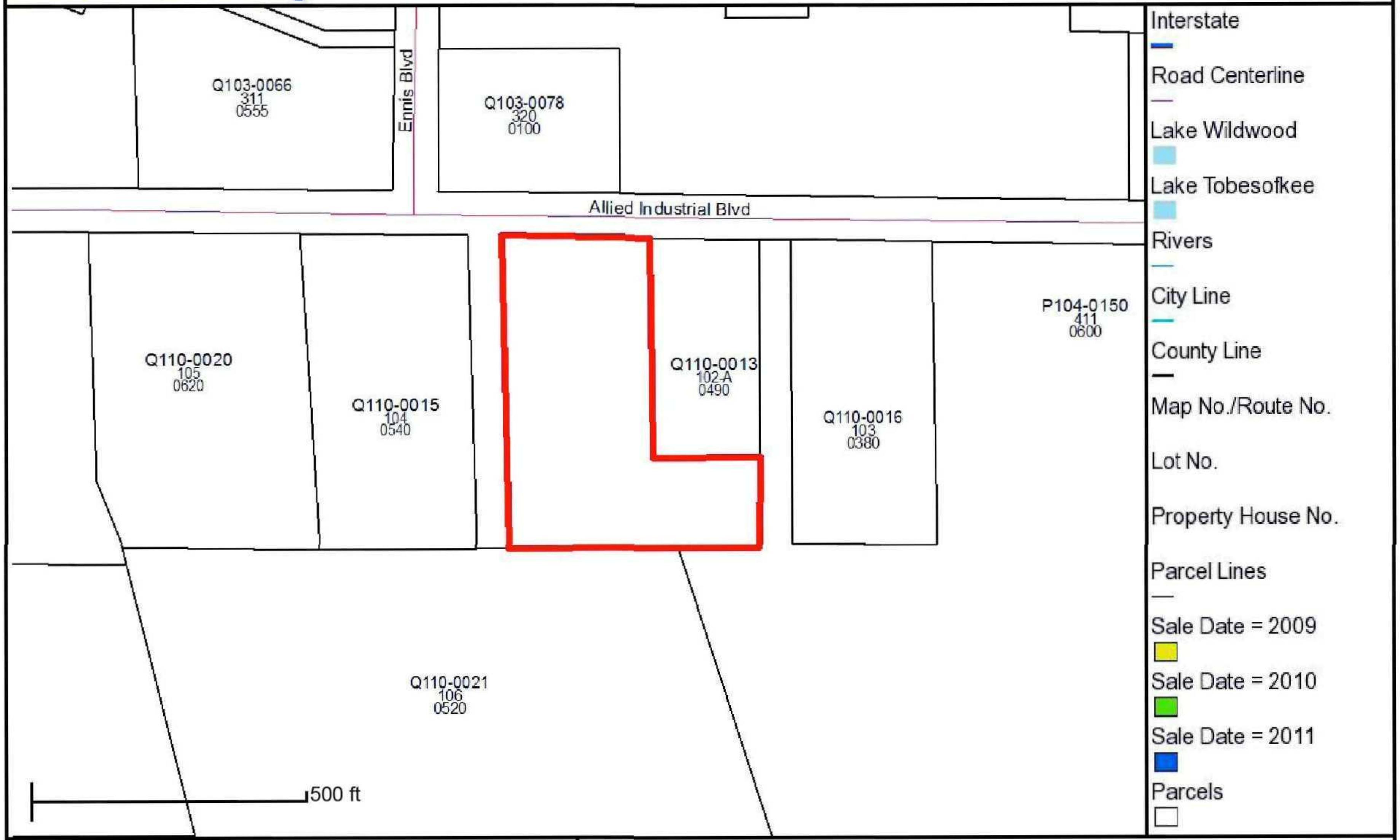

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Owner and Parcel Information

Owner Name	MACON BIBB CO IND AUTHORITY	**Today's Date**	9/7/2011
Mailing Address	PO BOX 207 MACON, GA 312020207	**Parcel Number**	Q110-0014
		Tax District	1
		Acres	4.25
		Homestead Exemption	
Location Address	510 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	E	**Neighborhood**	
Parcel Map	Show Parcel Map	Area Sales Street Sales	

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$76,125	$0	$0	$76,125	$76,125

Land Information

Type	Calculation Method	Acres	Value
Exempt	Acre	4.25	$76,125

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
None								

Accessory Information

Description	Year Built	Value
None		

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
None						

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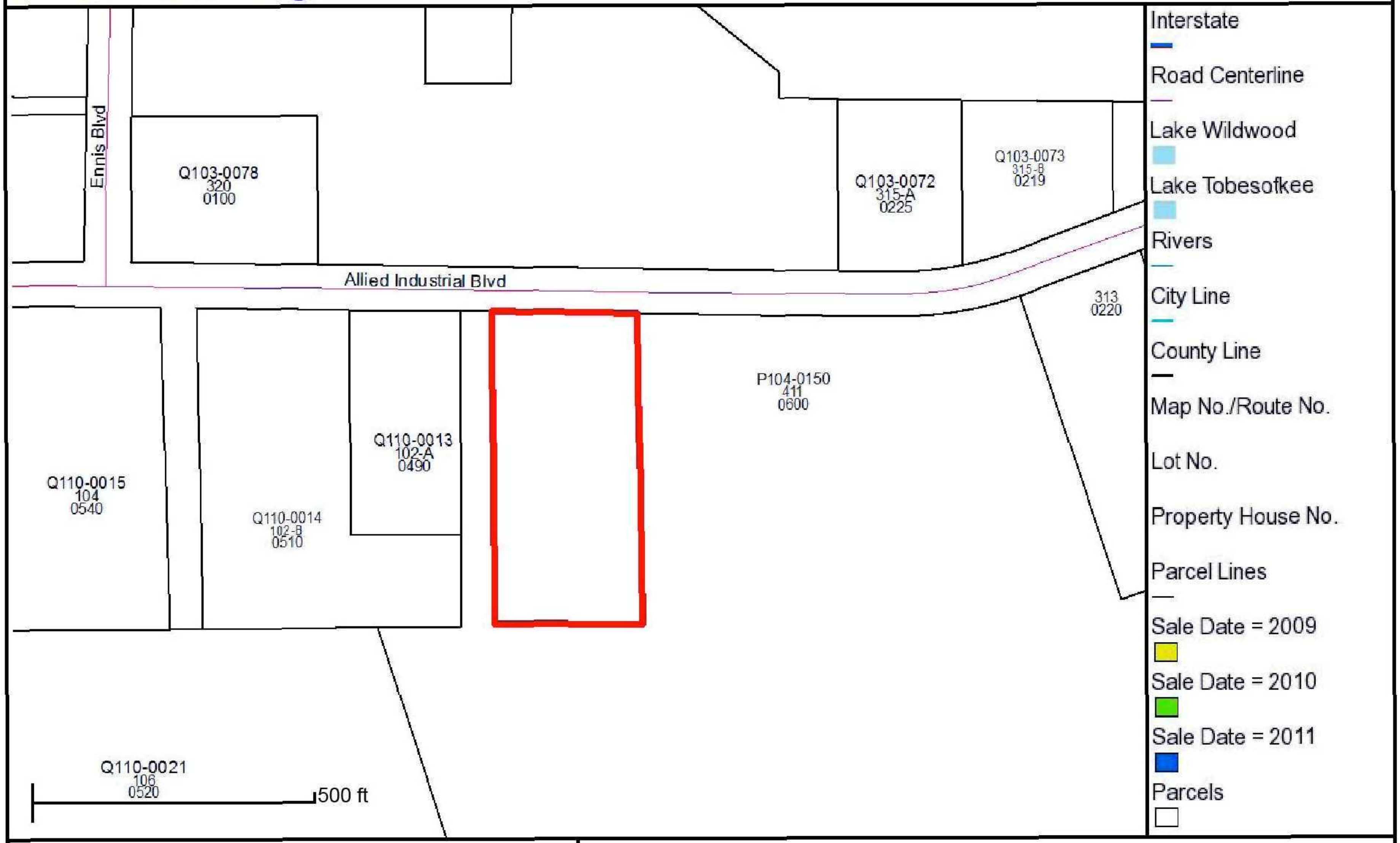

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Owner and Parcel Information

Owner Name	NOTNORTH LLLP	**Today's Date**	9/7/2011
Mailing Address	P O BOX T MACON, GA 312021701	**Parcel Number**	Q110-0016
		Tax District	1
		Acres	3
		Homestead Exemption	
Location Address	380 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	I	**Neighborhood**	3348
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$105,000	$295,122	$13,687	$413,809	$512,184

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	3	$105,000

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							

Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1988	$295,122	20,000	Warehouse - Storage	Warehouse - Storage	Prefab Structural Steel	1 Story	Building Photo	Building Sketch

Accessory Information

Description	Year Built	Value
ASPH PAVING	1988	$13,687

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
09/14/2006	07220/00372		$100	Un-qualified		NOTNORTH LLLP

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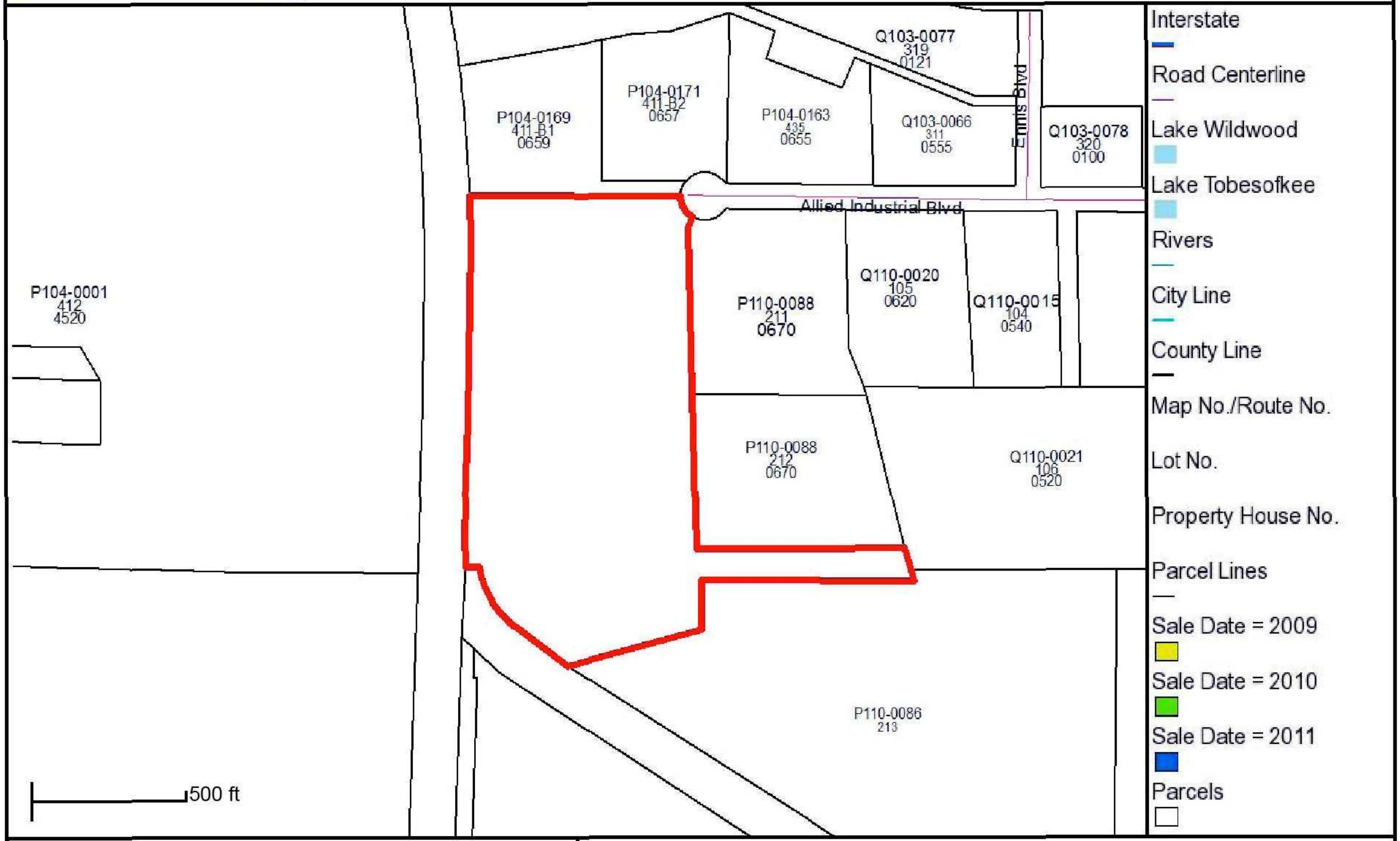

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Owner and Parcel Information

Owner Name	POLITEX U S INC	**Today's Date**	9/7/2011
Mailing Address	660 ALLIED INDUSTRIAL BLVD MACON, GA 31206	**Parcel Number**	P110-0087
		Tax District	1
		Acres	23.6
		Homestead Exemption	
Location Address	810 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	C	**Neighborhood**	3348
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$465,500	$0	$33,274	$498,774	$498,774

Land Information

Type	Calculation Method	Acres	Value
Commercial	Acre	23.6	$465,500

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
			None				
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
			None				

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
				None				

Accessory Information

Description	Year Built	Value
CONC PAVING	2006	$33,274

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
12/29/2006	7342 / 221	87 963	$1	Government Sale	FREUDENBERT TEXBOND	MACON-BIBB CO IND AUTH

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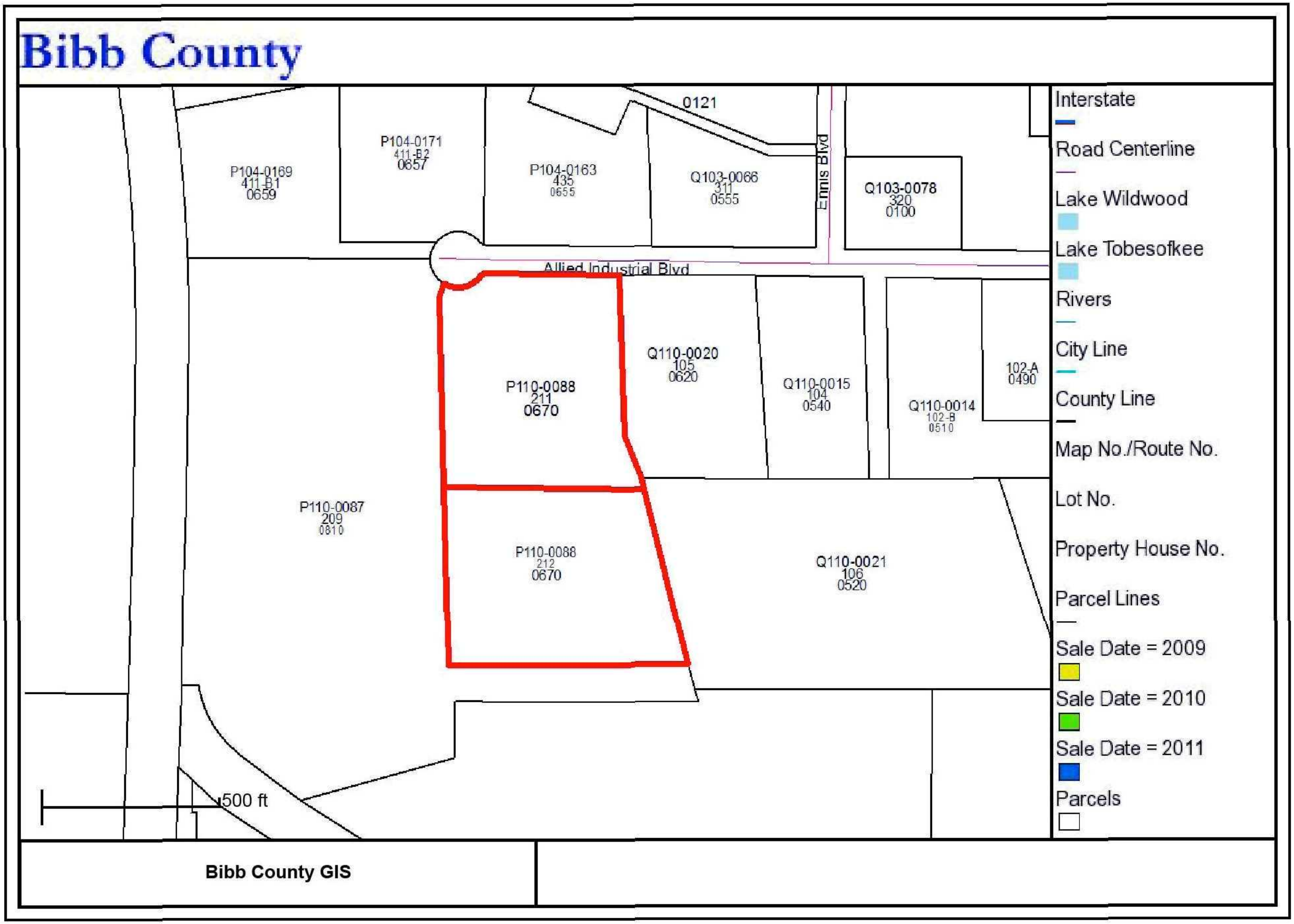
Bibb County
0121
Ennis Blvd
P104-0169 411-B1 0659
P104-0171 411-B2 0657
P104-0163 435 0655
Q103-0066 311 0555
Q103-0078 320 0100
Allied Industrial Blvd
P110-0088 211 0670
Q110-0020 105 0620
Q110-0015 104 0540
Q110-0014 102-B 0510
102-A 0490
P110-0087 209 0810
P110-0088 212 0670
Q110-0021 106 0520
500 ft
Interstate
Road Centerline
Lake Wildwood
Lake Tobesofkee
Rivers
City Line
County Line
Map No./Route No.
Lot No.
Property House No.
Parcel Lines
Sale Date = 2009
Sale Date = 2010
Sale Date = 2011
Parcels
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Owner and Parcel Information

Owner Name	POLITEX U S INC	**Today's Date**	9/7/2011
Mailing Address	660 ALLIED INDUSTRIAL BLVD MACON, GA 31206	**Parcel Number**	P110-0088
		Tax District	1
		Acres	6.65
		Homestead Exemption	
Location Address	670 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	I	**Neighborhood**	3348
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$84,438	$46,212	$0	$130,650	$130,650

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	6.65	$84,438

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							

Interior Walls	Roof Cover	Floor Construction	Floor Finish	Ceiling Finish	Heating	Condition	Sketch
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1968	$46,212	19,800	Warehouse - Storage	Warehouse - Storage	Prefab Structural Steel	1 Story	Building Photo	Building Sketch

Accessory Information

Description	Year Built	Value
None		

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
None						

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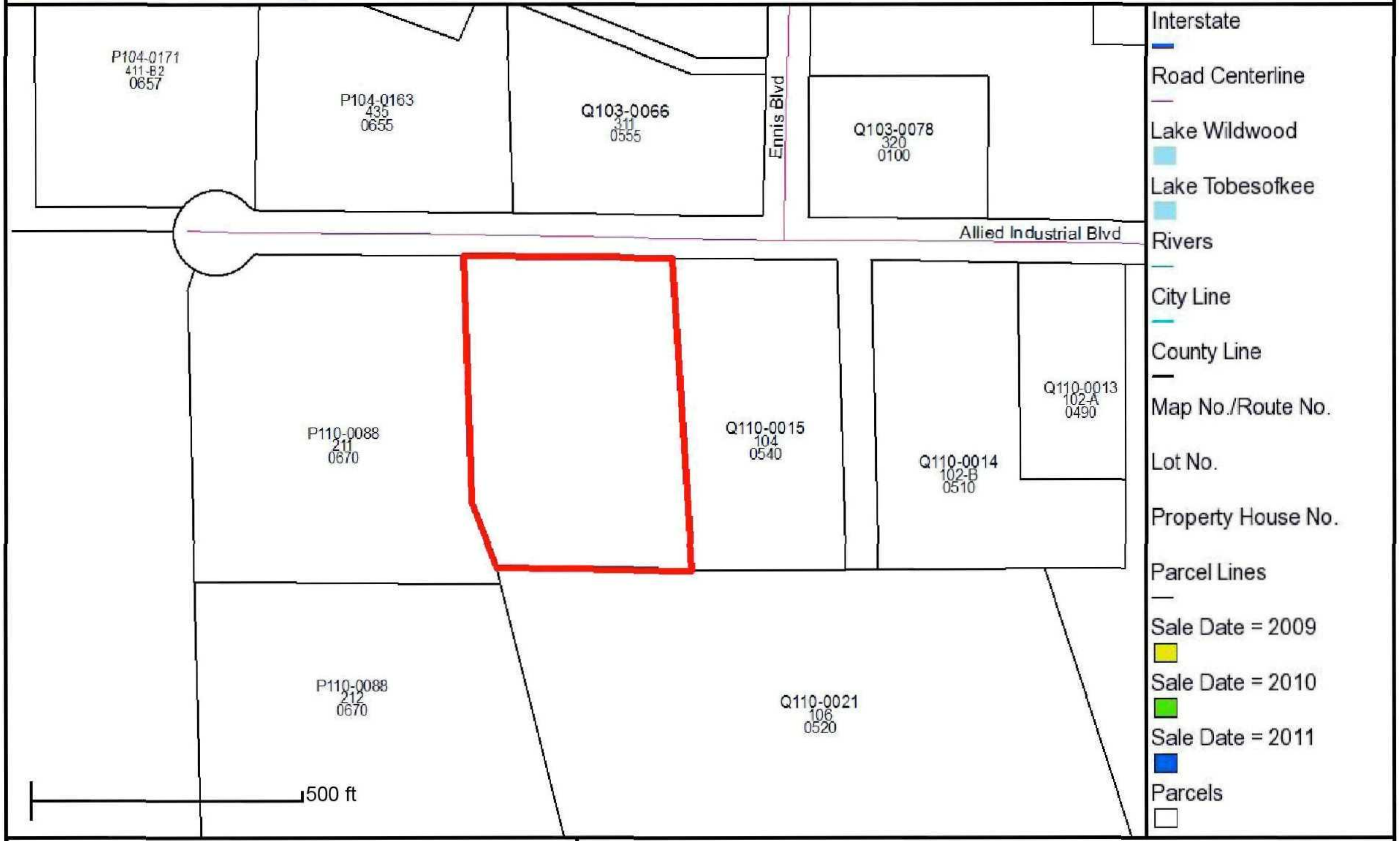

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Owner and Parcel Information

Owner Name	**POLITEX U S INC**	**Today's Date**	**9/7/2011**
Mailing Address	**660 ALLIED INDUSTRIAL BLVD** **MACON, GA 31206**	**Parcel Number**	**Q110-0020**
		Tax District	**1**
		Acres	**4.86**
		Homestead Exemption	
Location Address	**620 ALLIED INDUSTRIAL BLVD**	**Zoning**	**M-2**
Class Code	**I**	**Neighborhood**	**3347**
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$137,550	**$1,790,705**	**$26,542**	**$1,954,797**	**$1,954,797**

Land Information

Type	Calculation Method	Acres	Value
Industrial	**Acre**	**4.86**	**$137,550**

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1996	**$1,790,705**	**59,400**	**Industrial - Light Manufactur**	**Industrial - Light Manufactur**	**Prefab Structural Steel**	**1 Story**	Building Photo	Building Sketch

Accessory Information

Description	Year Built	Value
CONC PAVING	**1996**	**$22,561**
CONC PAVING	**1996**	**$3,981**

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
None						

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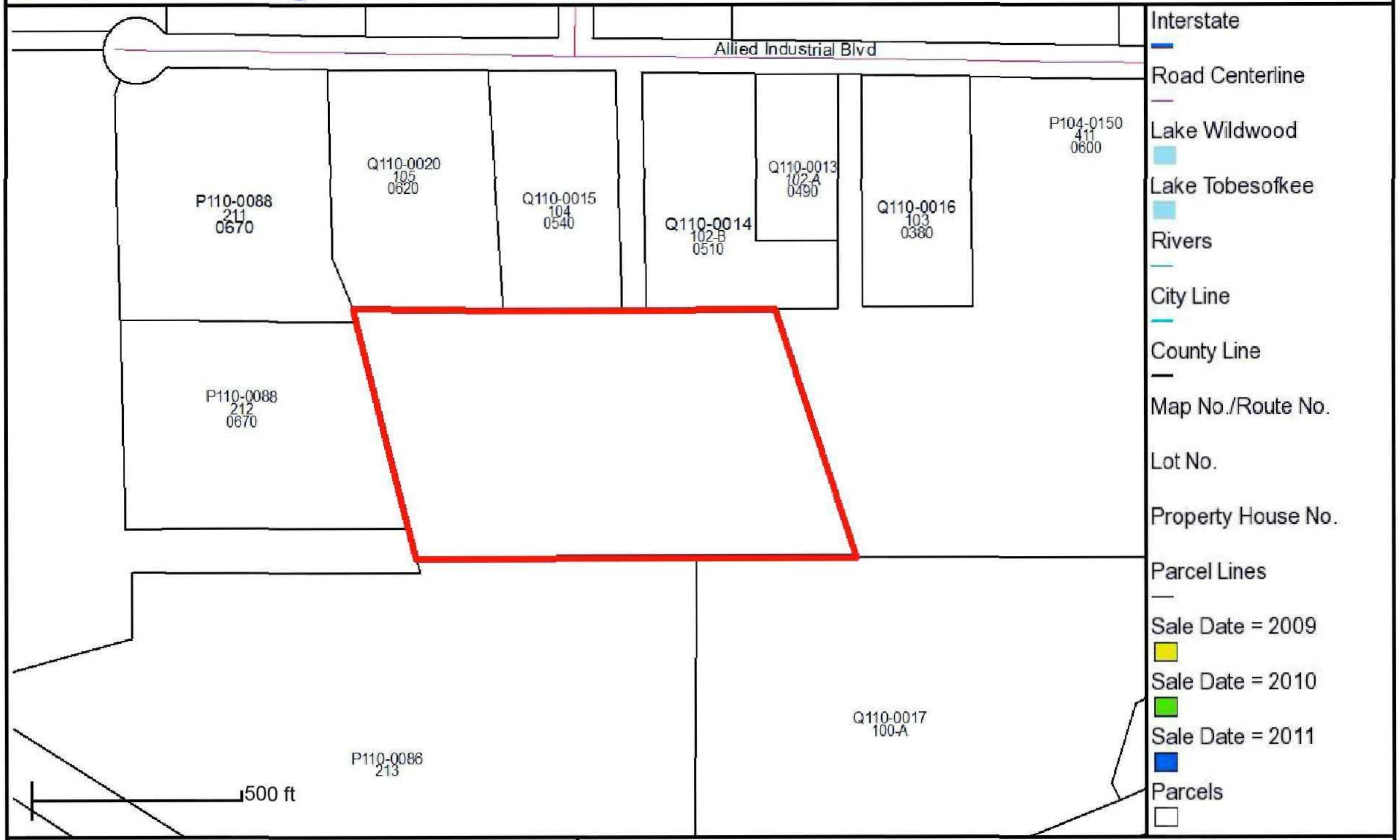

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Owner and Parcel Information

Owner Name	POLITEX U S INC	**Today's Date**		9/7/2011
Mailing Address	660 ALLIED INDUSTRIAL BLVD MACON, GA 31206	**Parcel Number**		Q110-0021
		Tax District		1
		Acres		14.12
		Homestead Exemption		
Location Address	520 ALLIED INDUSTRIAL BLVD	**Zoning**		M-2
Class Code	I	**Neighborhood**		
Parcel Map	Show Parcel Map	Area Sales	Street Sales	

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$269,640	$0	$0	$269,640	$269,640

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	14.12	$269,640

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
			None				
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
			None				

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
				None				

Accessory Information

Description	Year Built	Value
	None	

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
			None			

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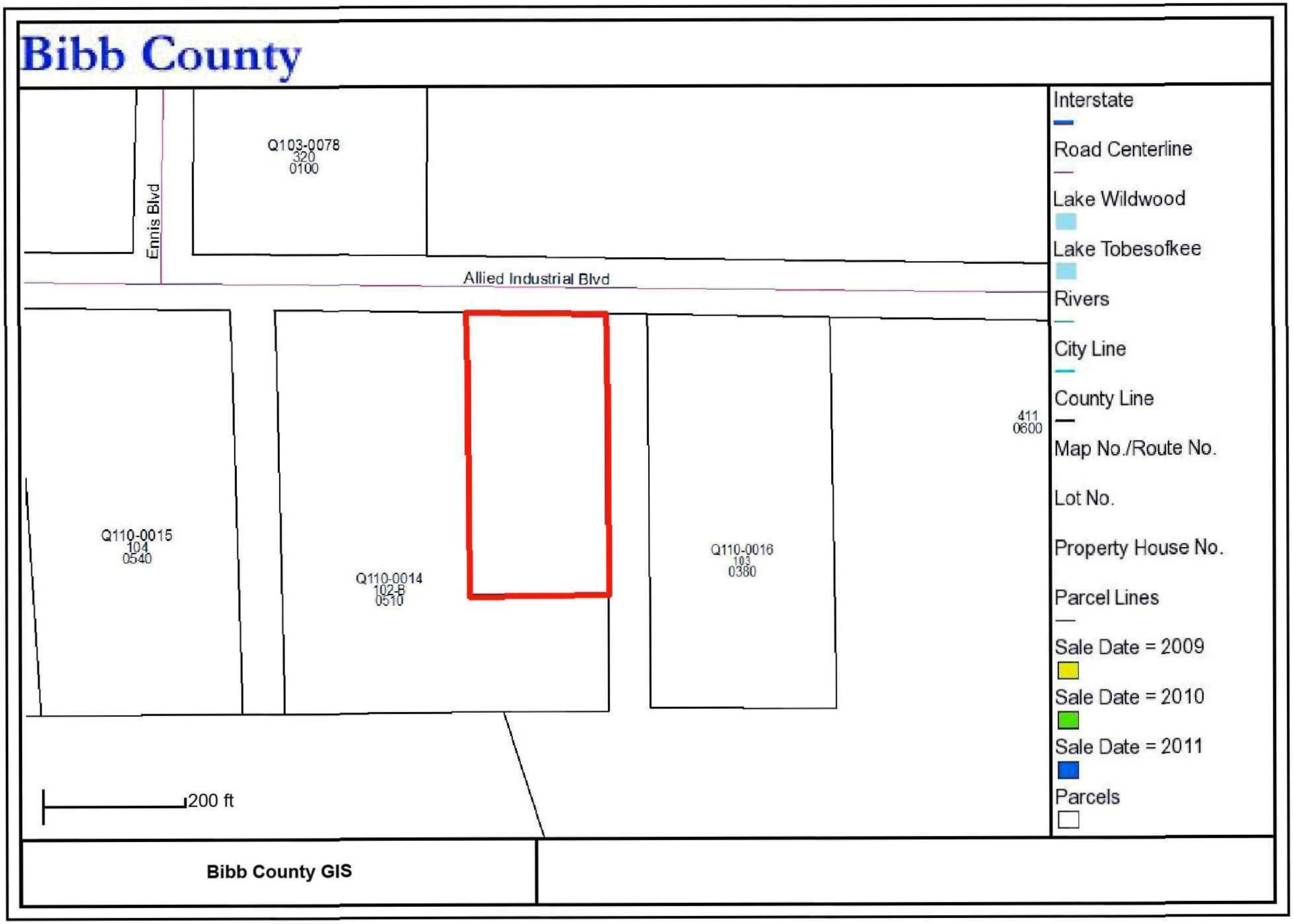
Bibb County
Q103-0078
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Ennis Blvd
Allied Industrial Blvd
Q110-0015
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Q110-0014
102-B
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103
0380
411
0600
200 ft
Interstate
Road Centerline
Lake Wildwood
Lake Tobesofkee
Rivers
City Line
County Line
Map No./Route No.
Lot No.
Property House No.
Parcel Lines
Sale Date = 2009
Sale Date = 2010
Sale Date = 2011
Parcels
Bibb County GIS

William C. Vaughn II
Board Chairman
bvaughn@co.bibb.ga.us

Macon/Bibb County Board Of Tax Assessors

Andrea Crutchfield
Chief Appraiser
acrutchfield@co.bibb.ga.us

653 Second Street, Macon GA 31201 | Phone (478) 621-6701 | Fax (478) 621-6737

Owner and Parcel Information

Owner Name	RESCH JAMES S IRREVOCABLE TR	**Today's Date**	9/7/2011
Mailing Address	C/O SBJ RESCH FAMILY PARTN 501 N REO ST TAMPA, FL 336091012	**Parcel Number**	Q110-0013
		Tax District	1
		Acres	2.01
		Homestead Exemption	
Location Address	490 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	C	**Neighborhood**	3348
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$70,350	$577,272	$14,481	$662,103	$662,103

Land Information

Type	Calculation Method	Acres	Value
Commercial	Acre	2.01	$70,350

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1986	$501,817	21,000	Warehouse - Storage	Warehouse - Storage	Prefab Structural Steel	1 Story	Building Photo	Building Sketch
Actual Year Built	**Value**	**Square Feet**	**Used As**	**Built As**	**Constrcution Type**	**Stories**	**Building Picture**	**Sketch**
1990	$75,455	2,040	Warehouse - Storage	Warehouse - Storage	Masonry Load Bearing Walls	1 Story	Building Photo	Building Sketch

Accessory Information

Description	Year Built	Value
ASPH PAVING	1986	$10,165

Fence-Chain Link w/Top Rail	1986	$4,316

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
04/29/1999	44450/00054		$385,000	Fair Market - Improved		RESCH JAMES S IRREVOCABLE TR

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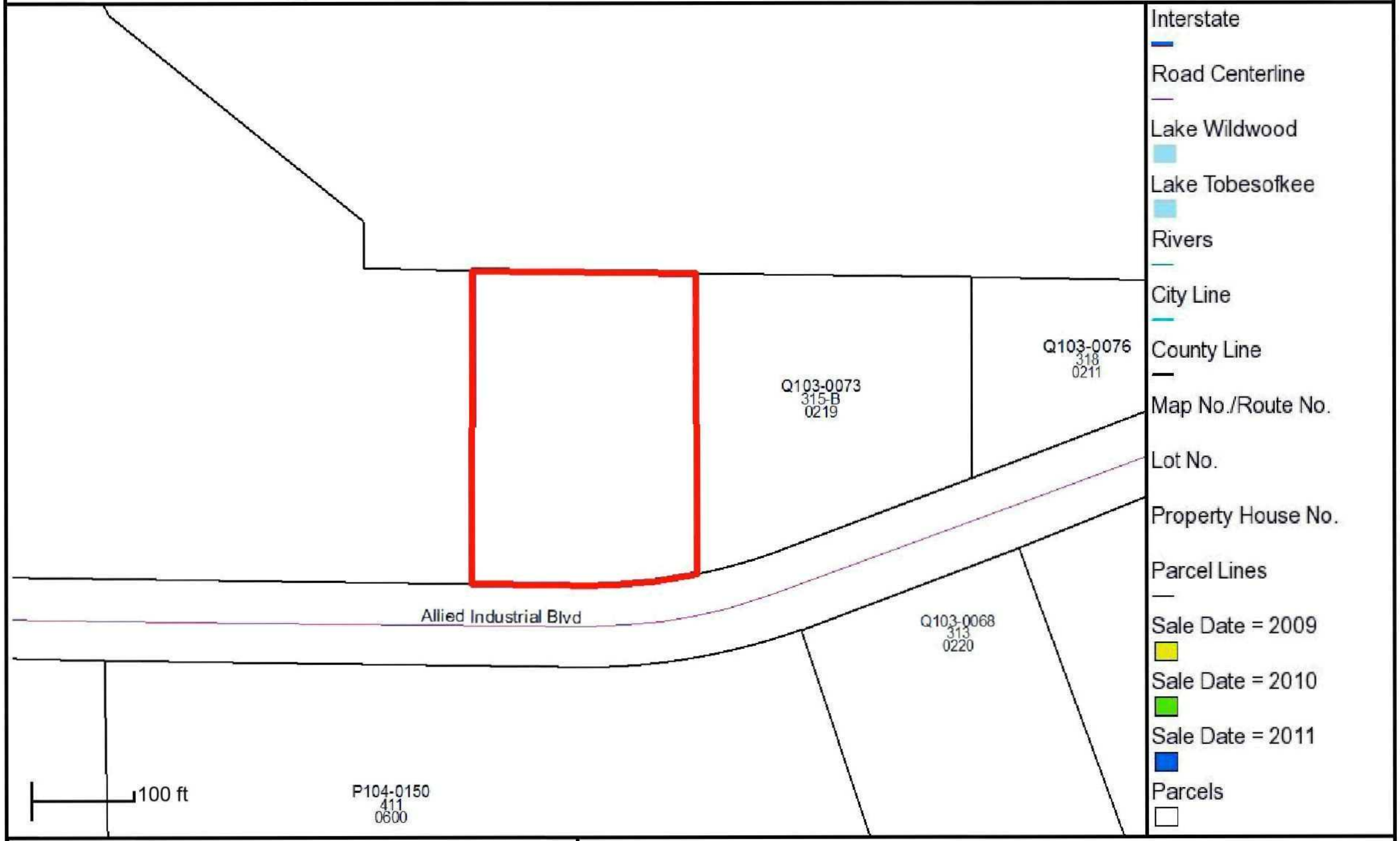

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653 Second Street, Macon GA 31201 | Phone (478) 621-6701 | Fax (478) 621-6737

Owner and Parcel Information

Owner Name	TINDOLS & ALLGOOD LLC	**Today's Date**	9/7/2011
Mailing Address	2385 SATELLITE BLVD DULUTH, GA 30096	**Parcel Number**	Q103-0072
		Tax District	1
		Acres	1.5
		Homestead Exemption	
Location Address	225 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	I	**Neighborhood**	3348
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$52,500	$188,284	$7,612	$248,396	$248,396

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	1.5	$52,500

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1988	$76,983	1,250	Office Buildings	Office Buildings	Prefab Structural Steel	1 Story	Building Photo	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
1988	$63,001	3,076	Warehouse - Storage	Warehouse - Storage	Prefab Structural Steel	1 Story	Building Photo Not Available	Building Sketch

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
2002	$48,300	674	Office Buildings	Warehouse - Storage	Prefab Structural	1 Story	Building Photo Not Available	Building Sketch

					Steel			

Accessory Information

Description	Year Built	Value
ASPH PAVING	1990	$7,612

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
07/17/1998	04218/00330		$166,000	Fair Market - Improved		TINDOLS & ALLGOOD LLC

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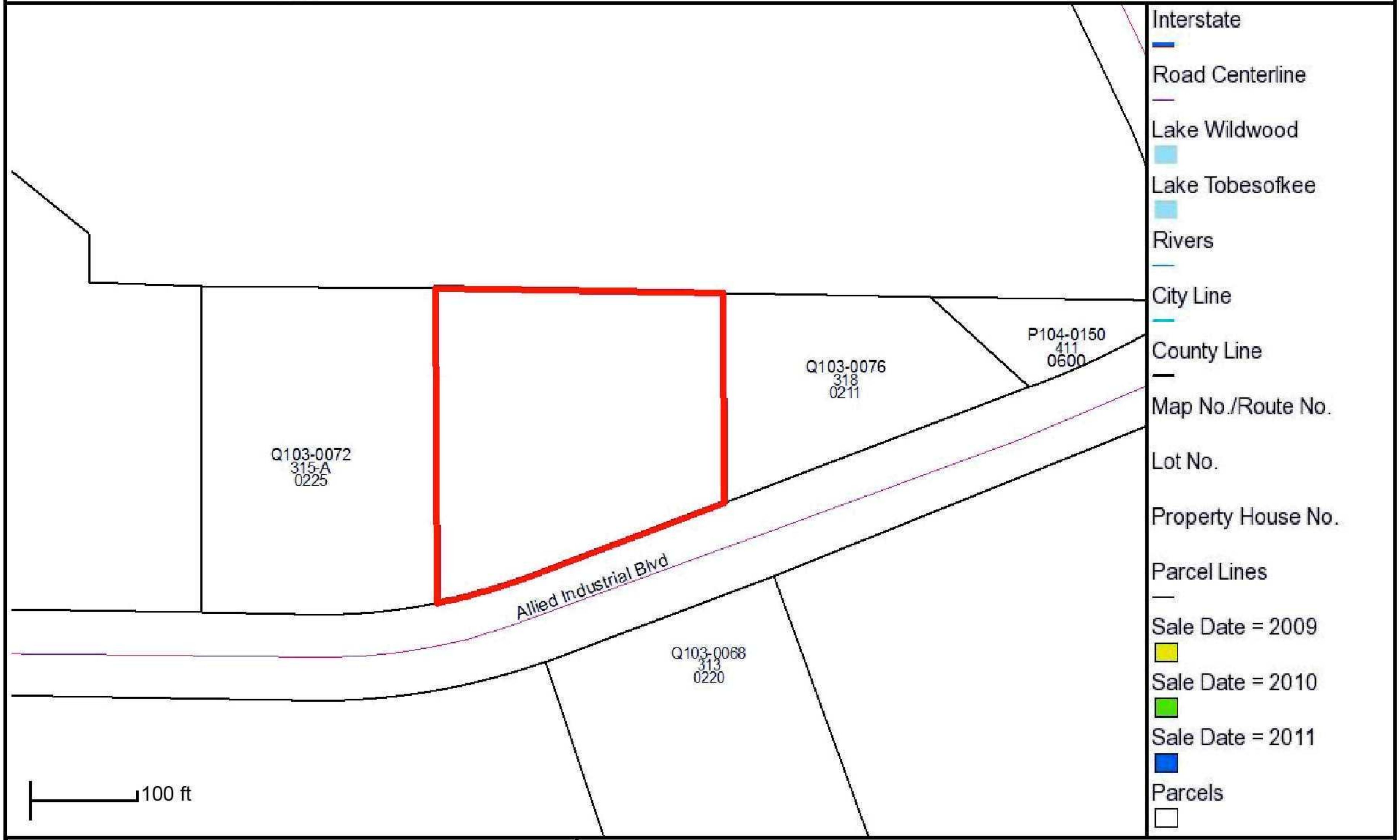
Bibb County



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653 Second Street, Macon GA 31201 | Phone (478) 621-6701 | Fax (478) 621-6737

Owner and Parcel Information

Owner Name	**TINDOLS & ALLGOOD LLC**	**Today's Date**	**9/7/2011**
Mailing Address	**2385 SATELLITE BLVD** **DULUTH, GA 30096**	**Parcel Number**	**Q103-0073**
		Tax District	**1**
		Acres	**1.5**
		Homestead Exemption	
Location Address	**219 ALLIED INDUSTRIAL BLVD**	**Zoning**	**M-2**
Class Code	**I**	**Neighborhood**	
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$52,500	$0	$0	$52,500	$52,500

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	1.5	$52,500

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
None								

Accessory Information

Description	Year Built	Value
None		

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
None						

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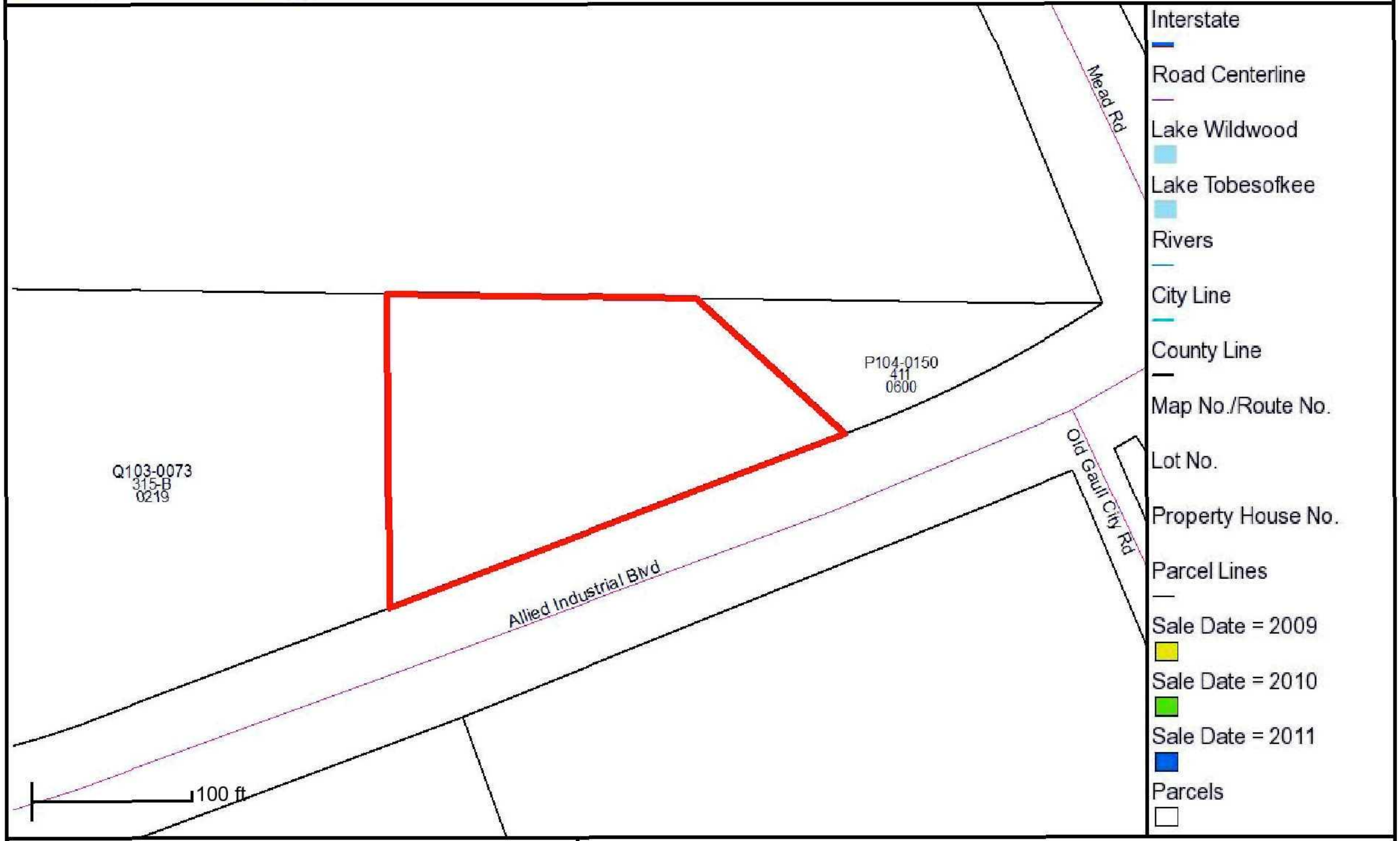

Bibb County GIS

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653 Second Street, Macon GA 31201 | Phone (478) 621-6701 | Fax (478) 621-6737

Owner and Parcel Information

Owner Name	TINDOLS & ALLGOOD LLC	**Today's Date**	9/7/2011
Mailing Address	2385 SATELLITE BLVD DULUTH, GA 30096	**Parcel Number**	Q103-0076
		Tax District	1
		Acres	0.78
		Homestead Exemption	
Location Address	211 ALLIED INDUSTRIAL BLVD	**Zoning**	M-2
Class Code	I	**Neighborhood**	
Parcel Map	Show Parcel Map	Area Sales	Street Sales

Tax Year Value Information

Land Value	Improvement Value	Accessory Value	Total Value	Previous Value
$27,300	$0	$0	$27,300	$27,300

Land Information

Type	Calculation Method	Acres	Value
Industrial	Acre	0.78	$27,300

Residential Improvement Information

Description	Actual Year Built	Value	Heated Square Feet	Basement Area Sq Ft	Attic Area Sq Ft	No. of Stories	Wall Frames
None							
Interior Walls	**Roof Cover**	**Floor Construction**	**Floor Finish**	**Ceiling Finish**	**Heating**	**Condition**	**Sketch**
None							

Commercial Improvement Information

Actual Year Built	Value	Square Feet	Used As	Built As	Constrcution Type	Stories	Building Picture	Sketch
None								

Accessory Information

Description	Year Built	Value
None		

Sale Information

Sale Date	Deed Book/Page	Plat Page	Price	Reason	Grantor	Grantee
None						

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Macon-Bibb County, Georgia, Comprehensive Land Development Resolution >> Chapter 17 - M-2—HEAVY INDUSTRIAL DISTRICT >>

CHAPTER 17 - M-2—HEAVY INDUSTRIAL DISTRICT

Section 17.01.- Intent.

The M-2 Heavy Industrial District is intended to provide appropriate locations for any use which may be obnoxious or offensive by reason of emission of odors, dust, smoke, gas, noise, or vibration. Residential uses are prohibited in this district.

Section 17.02.- Permitted uses.

[1] All permitted uses in M-1 Wholesale and Light Industrial District.

[2] Theaters, including drive-in theaters, provided that for drive-in theaters acceleration and deceleration lanes of at least two hundred (200) feet in length are provided for the use of vehicles entering or leaving the theater and the volume or concentration of traffic will not constitute a safety hazard or unduly impede highway traffic movement, and provided that the screen is not visible from any expressway, freeway, or arterial or collector street located within two thousand (2,000) feet of such area.

[3] Places of assembly including auditoriums, coliseums, and stadiums.

[4] Produce and farmers' markets.

[5] Commercial parking garages or lots, provided that no entrance or exit will be on the same side of the street and within the same block as a school and that curb breaks be limited to two (2) for each one hundred (100) feet of street frontage, each not to exceed thirty (30) feet in width and not located closer than twenty (20) feet to a street intersection.

[6] Truck terminals, provided that acceleration and deceleration lanes of at least two hundred (200) feet long are provided for trucks entering or leaving the site and that the truck traffic so generated will not create a safety hazard or unduly impede traffic movement.

[7] Warehouses.

[8] Auto auctions.

[9] Development of natural resources, including the removal of minerals and natural materials together with necessary buildings, machinery, and appurtenances related thereto, provided the requirements of Section 23.17 are met.

[10] Trade shops, including sheet metal, roofing, upholstering, electrical, plumbing, venetian blind, cabinet making and carpentry, rug and carpet cleaning, and sign painting, provided operations are conducted entirely within a building.

[11] Agriculture, forestry, livestock and poultry production, provided that the operation is conducted on a tract of land not less than ten (10) acres in area and that no structure containing poultry or livestock and no storage of manure or odor- or dust-producing substance or use shall be located within two hundred (200) feet of a property line.

[12] Dwellings, excluding mobile homes, for the exclusive use of a watchman or caretaker when located on the same tract as the industrial use, and subject to all dimensional and area requirements of R-3 Multifamily Residential District.

[13] Food processing plants, such as bakeries, meat packers, or fish and poultry houses.

[14] Frozen dessert and milk processing plants.

[15] Manufacturing, processing, fabrication, repairing and servicing of any product except those conditional uses set forth in Section 17.03[7], or any other use that may endanger the public health, welfare, and safety.

[16] Accessory buildings and uses located either on the same lot or parcel of land as the main structure or an adjoining lot or parcel of land under the same ownership and customarily incidental to the permitted or conditional use, provided that the requirements of Section 4.07 are met. (Amended October 22, 1990, ZA90-10-01)

[17] Communication towers and antennas subject to the requirements of Section 23.27.

(Added October 13, 1997, ZA97-10-01)

Section 17.03.- Conditional uses.

[1] Bus, railroad, and air terminals.

[2] *Reserved.* (Deleted March 23, 2009, ZA09-03-01)

[3] Motels and hotels when located adjacent to a state or federal highway and containing a minimum lot area of forty thousand (40,000) square feet.

[4] Outside aboveground tanks for the storage of gasoline, liquefied petroleum gas, oil, or other inflammable liquids or gases, but not when located within five hundred (500) feet of any residential district.

[5] Junkyards (automobile wrecking yard), provided the following provisions are met:

- **(a)** No such operation shall be permitted to be located closer than three hundred (300) feet to a residential district and no closer than fifty (50) feet to any property line;
- **(b)** No such operation shall be permitted to be located on or facing a state or federal highway;
- **(c)** All such operations, except driveway areas, shall be completely enclosed by an opaque fence or wall, having a minimum height of six (6) feet, but in no case less than such a height as will effectively screen all operations from view; and
- **(d)** The number of vehicular driveways permitted on any single street frontage shall be limited to one (1) per five hundred (500) feet with a maximum of twenty (20) feet driveway width.

[6] Mobile home units for the exclusive use of a watchman or caretaker when located on the same tract as the industrial use and subject to all dimensional and area requirements of the R-3 district, provided the unit meets the requirements of mobile home units located in a mobile home park as specified by the Macon-Bibb County Bureau of Inspections and Fees.

[7] Manufacturing, processing, fabrication, repairing and servicing of any commodity or product such as the following:

- **(a)** Manufacturing of acetylene gas or storage thereof; acid, asbestos, ammonia, bleaching powder or chlorine, asphalt or products thereof; cement, lime gypsum or plaster of Paris, coal tar or derivatives thereof; creosote or creosote treatment, clay, tile or vitrified products, emery cloth or sand paper, explosives or fireworks or storage thereof; fertilizer, glue or gelatine, linoleum, matches, paint, oil, shellac, turpentine or varnish, rubber and soda compounds, and alcohol distillation; and
- **(b)** Petroleum refining, tanning, curing, storage of hides and skins, boiler works, foundry or forge operations, incineration, reduction or dumping of offal, dead animals, garbage or refuse, fat rendering, junk iron, rags, storage and baling, and distillation of bones, coal, or wood.

[8] Sanitary landfills, subject to the requirements of Section 23.14.

[9] Shopping centers, provided that the guidelines contained in Section 23.12 governing the construction of shopping centers are met.

[10] Any retail uses that are consistent with the heavy industrial character of the district, including products manufactured on the premises and the following:

- **(a)** Electrical supplies;
- **(b)** Heating and plumbing equipment;
- **(c)** Dairy products;
- **(d)** Bakeries;
- **(e)** Sporting goods and recreational equipment;
- **(f)** Farm and garden supplies;
- **(g)** Home building supplies;
- **(h)** Appliance stores including repairs and service;
- **(i)** Furniture and home furnishings stores;
- **(j)** Tires, batteries and other automotive accessories, including the installation of accessories sold; and

  - **(k)** Clothing, shoe, millinery, dry good and notion stores.
- **[11]** Auction house. (Amended February 22, 1982, ZA82-02-02)
- **[12]** *Reserved.* (Deleted March 23, 2009, ZA09-03-01)
- **[13]** Trade or business schools, colleges and universities. (Added December 16, 1985, ZA85-12-01)
- **[14]** Mini-warehouses, subject to the following conditions:
  - **(a)** Shall be limited to storage only.
  - **(b)** All storage shall be within the building area.
  - **(c)** No auctions or commercial sales or uses shall be conducted on the site.
  - **(d)** A fencing and landscaping plan shall be approved by the commission. (Added February 13, 1989, ZA89-02-01)
- **[15]** Kindergartens, playschools, and day care centers, provided the requirements in Section 23.13 are met. (Amended July 23, 2007, ZA07-07-03)
- **[16]** Communication towers and antennas subject to the requirements of Section 23.27.

(Added October 13, 1997, ZA97-10-01)

Section 17.03.01.- Special exceptions.

Adult entertainment establishments provided such establishment is in compliance with the performance standards set out in Section 23.25.

(Added July 22, 2002, ZA02-07-03)

Section 17.04.- Lot and area requirements.

None, except that no development or construction shall be located on a tract containing less than ten thousand (10,000) square feet.

Section 17.05.- Yard requirements (building setback distance).

The following minimum setback requirements shall be provided for all buildings or structures, as measured from:

[1] *Arterial and collector right-of-way lines:*

(a)	Front yard	50 feet
(b)	Rear yard	50 feet
(c)	Side yard	50 feet

[2] *Minor street right-of-way lines:*

(a)	Front yard	30 feet
(b)	Rear yard	30 feet
(c)	Side yard	30 feet

[3] *Interior lot lines:*

(a)	Front yard	None, except when abutting a residential district, in which case it shall be twenty (20) feet (where applicable)
(b)	Rear yard	None, except when abutting a residential district, in which case it shall be twenty (20) feet
(c)	Side yard	None, except when abutting a residential district, in which case it shall be twenty (20) feet

[4] *Special setbacks* ..... See Section 32.09

Section 17.06.- Building height requirements.

The maximum permitted height for buildings and structures shall be thirty-five (35) feet, except as allowed by Section 4.03. The commission may, however, allow construction and erection of buildings or structures exceeding thirty-five (35) feet in height, except that any application to exceed the maximum permitted height shall be treated as an application for a conditional use.

Section 17.07.- Off-street parking and loading space regulations.

Spaces for off-street parking and provisions for loading and unloading spaces shall be provided in accordance with the provisions of Chapter 26.

Section 17.08.- Signs.

Signs as allowed in this zoning district shall comply with the provisions of Chapter 25.

TETRA TECH

September 29, 2009

Ms. Jennifer Wendel
Remedial Project Manager
U. S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW, 11th Floor
Atlanta, Georgia 30303

Subject: **Final Expanded Site Inspection Report**
Allied Industrial Park
Macon, Bibb County, Georgia
EPA Identification No. GAD003302676
EPA Contract No. EP-W-05-054
TDD No. TTEMI-05-003-0029

Dear Ms. Wendel:

The Tetra Tech Superfund Technical Assessment and Response Team (START) is submitting the enclosed final expanded site inspection (ESI) report for the Allied Industrial Park located in Macon, Bibb County, Georgia. Also included with this submittal are supporting reference materials and the preliminary Hazard Ranking System (HRS) score prepared in HRS QuickScore, Version 2.

Please call me (Sandra Harrigan) at (678) 775-3088 or Quinn Kelley at (678) 775-3101 if you have any questions or comments regarding this submittal.

Sincerely,

Sandra J Harrigan

Sandra Harrigan
START III Project Manager

Andrew F. Johnson
START III Program Manager

Enclosure

cc: Katrina Jones, EPA Project Officer
Angel Reed, START III Document Control Coordinator

1955 Evergreen Blvd., Suite 300, Duluth, GA 30096
Tel 678.775.3080 Fax 678.775.3138
www.tetratech.com

FINAL
EXPANDED SITE INSPECTION REPORT

ALLIED INDUSTRIAL PARK
MACON, BIBB COUNTY, GEORGIA

U.S. EPA ID NO. GAD003302676

Revision 0

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Region 4
Atlanta, Georgia 30303

Contract No.	:	EP-W-05-054
TDD No.	:	TTEMI-05-003-0029
Date Prepared	:	September 29, 2009
EPA Task Monitor	:	Jennifer Wendel
Telephone No.	:	(404) 562-8799
Prepared by	:	Tetra Tech
START Project Manager	:	Sandra Harrigan
Telephone No.	:	(678) 775-3088

Prepared by	Reviewed by	Approved by
Quinn Kelley	Shanna Davis	
Quinn Kelley START III Site Manager	Shanna Davis START III Technical Reviewer	Andrew F. Johnson START III Program Manager

CONTENTS

CONTENTS (Continued)

APPENDICES

Appendix

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) tasked the Tetra Tech EM Inc. Superfund Technical Assessment and Response Team (START) to conduct an expanded site inspection (ESI) at the Allied Industrial Park (AIP) located in Macon, Bibb County, Georgia (EPA Identification Number [No.] GAD003302676). The ESI was completed under Contract No. EP-W-05-054, Technical Direction Document (TDD) No. TTEMI-05-003-0029.

The primary objective of an ESI is to evaluate whether a site has the potential to be included on the National Priorities List (NPL). The NPL identifies sites where a release, or threatened release, of hazardous substances poses a risk to public health or the environment serious enough to warrant further investigation and possible remediation under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986.

Information gathered during the ESI is used to generate a preliminary Hazard Ranking System (HRS) score. The HRS score is the primary criterion EPA uses to decide whether a site should be placed on the NPL. ESIs are generally conducted at sites where additional environmental sampling or monitoring well installation is necessary to fulfill the HRS documentation requirements. ESIs also are conducted to address site issues that were not adequately resolved in previous investigations.

Specifically, the objectives of the ESI are as follows:

- Obtain and review relevant file material
- Collect samples to attribute hazardous substances to site operations
- Collect samples to establish representative background levels
- Evaluate target populations for the ground water migration, surface water migration, soil exposure, and air migration pathways
- Collect any other missing HRS data
- Document current site conditions
- Develop a site layout map

The remainder of this ESI for the AIP is organized as follows:

- Section 2.0 discusses the site background, including the site description and environmental setting, the operational history, and the findings of previous investigations.

- Section 3.0 describes the ESI field activities conducted from May 11 to 20, 2009.

- Section 4.0 discusses deviations from the final sampling and analysis plan (SAP) dated May 9, 2009.
- Section 5.0 describes source sampling locations and analytical results for samples collected from the source areas.
- Section 6.0 discusses the ground water migration, surface water migration, soil exposure, and air migration pathways as well as the targets associated with each pathway.
- Section 7.0 provides a summary of and the conclusions for the ESI report.
- Section 8.0 provides a list of references used to support the ESI report.
- Figures are provided in Appendix A, tables appear in Appendix B, the field logbook notes are contained in Appendix C, and the photographic log is in Appendix D. The EPA Contract Laboratory Program (CLP) analytical data sheets are provided in Appendix E and the non-CLP data validation report and analytical data sheets are provided in Appendix F.

2.0 SITE BACKGROUND

This section discusses the site background, including the site description and environmental setting, the operational history, and the findings of previous investigations.

2.1 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

The AIP is located at 600 Guy Paine Road in Macon, Bibb County, Georgia. Land use in the area is primarily industrial. Most of the buildings and infrastructure at the AIP site were originally part of the Macon Naval Ordnance Plant (MNOP). The total area of the MNOP was 433.25 acres (Reference [Refs.] 1 p. 2; 2, p. 1). Specifically, the geographical coordinates for the AIP are latitude 32.777462 north and longitude 83.642963 west (as measured from the center of Building 105-Assembly) (see Figure 1 in Appendix A). The AIP is bounded to the north by Guy Paine Road, to the east by Mead Road and the abandoned Central of Georgia railroad tracks, to the southeast by the City of Macon Water Authority (MWA) Rocky Creek Water Reclamation Facility, to the south by the former Macon Naval Ordnance Landfill (FMNOL) and Rocky Creek, and to the west by Armstrong World Industries (Armstrong) (see Figure 2 in Appendix A).

2.2 OPERATIONAL HISTORY

The MNOP was constructed and operated by the Reynolds Corporation before World War II (Ref. 3, p. 1-1). The Navy, under the U.S. Department of Defense, assumed operations in 1941 and continued to manufacture ordnance until 1965. Ordnance manufactured at the MNOP included flares, small primers, detonators, and other triggering mechanisms. The total area of the MNOP was approximately 433 acres, which extended from Guy Paine Road (north) to Rocky Creek (south) (Refs. 2, pp. 1, 2; 4 p. 2; 5, p. 2-9). Structures at the MNOP included numerous buildings, several miles of paved roads, fueling facilities, aboveground storage tanks (AST) and underground storage tanks (UST), solvent storage buildings, explosives storage magazines, a bunker area, a metals plating facility, and a sewage, or wastewater, treatment plant (WWTP) (Refs. 1, pp. 2, 3; 5, p. 2-10).

After it was declared surplus by the Navy, the property was sold in December 1965 to the Maxson Electronics Company (Maxson) of New York. Maxson continued to produce ordnance under contract with the Navy until it sold the property to Allied Chemical Corporation (Allied) in 1973. Allied manufactured automobile seat belts at the site and made beneficial use of all or nearly all of the buildings, USTs and ASTs, and utilities. Allied sold the property in 1980 to the Macon-Bibb County Industrial Authority (MBCIA), which renamed the property the Allied Industrial Park. MBCIA currently leases or sells buildings as office and warehouse space to various industrial and commercial businesses on the AIP property (Ref. 1, pp. 2, 3). Industries that currently lease or own parcels at the AIP include A.C. White Transfer and Storage Company, Blair Moving and Storage Company, Damaste Warehousing LLC, and Politex US Inc.(Freudenberg Texbond), among others. A.C. White Transfer and Storage Company and Blair Moving and Storage Company are both transportation and moving companies; Damaste Warehousing LLC is part of Norfolk Southern's railroad distribution network; and Politex US Inc. is a textile manufacturing firm whose products include roofing membranes, clothing and furniture padding, as well as building materials such as reinforcements, waterproofing materials, reflecting products, and thermo-acoustic insulators (Refs. 6; 7, pp. 2, 9, 20, 83) (see Figure 3 in Appendix A).

2.3 PREVIOUS INVESTIGATIONS

These subsections describe the previous investigations conducted at the AIP. The following discussion addresses only those hazardous constituents with the greatest waste characteristics values for the ground water and surface water migration pathways.

2.3.1 1989, 1990, and 1991 Investigations

In 1989, an environmental assessment was conducted by Beaver Engineering at the AIP. Four eight-point composite soil samples were collected from the property. Analytical results revealed the presence of various metals, methylene chloride, bis-(2-ethylhexyl)-phthalate, and chloroform (Ref. 1, p. 3). In 1990, Environmental Science and Engineering, Inc. (ESE) advanced two shallow boreholes in a flat drainage area that was used for oil recovery during MNOP operations. One composite soil sample and one duplicate soil sample were collected. Analytical results for soil samples revealed the presence of arsenic, cadmium, chromium, lead, pentaerythritol tetranitrate (PETN), and petroleum hydrocarbons (Refs. 1, p. 3; 5, pp. 2-1, 3-18, 4-12, Figures 3-1 and 3-2, Appendix C, p. C-18). PETN is an explosive most commonly used in detonating fuses, boosters, priming compositions, blasting caps, and detonators (Ref. 8, p. 8-19).

In 1991, Westinghouse Environmental and Geotechnical Services, Inc. (WEGS), conducted a preliminary environmental investigation at the AIP. During the investigation, WEGS collected four ground water samples near storm water drainage outfalls on the AIP property. Analytical results revealed the presence of chromium, lead, and trichloroethene (TCE) (Ref. 1, p. 3, Figure 1-2, Table 1-1).

2.3.2 1996 RUST Site Investigation

In 1996, RUST Environment and Infrastructure Inc. (RUST), under contract with the Savannah District of the U.S. Army Corps of Engineers (USACE), conducted a site investigation at the AIP property (Ref. 1, pp. vi, 1). During the AIP site investigation, soil, ground water, surface water, and sediment samples were collected from potential source areas. These areas included storm water drainage outfalls, a sewage treatment plant (also referred to as the WWTP), metal plating facilities, electric transformer buildings, areas of explosives handling and storage, and the plant's USTs and ASTs (Ref. 1, pp. 1, 10, 11, 12, 13, 14, 20, 27, Figures 4-1 through 4-4).

Analytical results for soil samples collected from the AIP indicated the presence of cadmium, chromium, lead, cis-1,2-dichloroethene (DCE), trans-1,2-DCE, tetrachloroethene (PCE), and TCE. The highest levels of TCE were found at sample locations near the former MNOP WWTP and the metal plating facility (Ref. 1, Figure 4-1, Table 4-2, pp. 1 through 22). Analytical results for ground water samples revealed the presence of cadmium, chromium, lead, cis-1,2-DCE, trans-1,2-DCE, TCE, and vinyl chloride (Ref. 1, Figure 4-3, Table 5-2, pp. 1 through 11). Surface water and sediment samples were collected from a flowing stream at the northeastern corner of the AIP property and from the drainage swale located at the northwestern corner of the AIP property, which directs storm water during rainfall, to define possible contamination entering the site from upgradient, off-site sources (Ref. 1, p. 27). Analytical results for surface water and sediment samples indicated the presence of beryllium, cadmium, chromium, lead, mercury, toluene, paracymene, and 4-methylphenol, among other constituents (Ref. 1, pp. 27, 28, Figure 6-1, Tables 6-2, 6-3). Based on the analytical results for surface water and sediment, RUST concluded that surface water and sediment contained in the drainage feature entering the site from the northeast and northwest corners may be contributing contaminants to the AIP (Ref. 1, p. 28, Figure 6-1, Tables 6-2, 6-3).

2.3.3 1998 to 2000 SAIC HSRA Compliance Status Investigation

From 1998 to 2000, Science Applications International Corporation (SAIC), on behalf of USACE, Savannah District, conducted a Hazardous Site Response Act (HSRA) compliance status investigation at the AIP. Surface and subsurface soil, ground water, surface water, and sediment samples were collected during the investigation (Ref. 3, p. 1-1, 1-10). Based on the analytical results from the 1996 RUST investigation conducted at the AIP, SAIC analyzed samples only for those constituents that appeared significant; therefore, surface soil samples were analyzed only for volatile organic compounds (VOC), with a select few surface soil locations analyzed for semivolatile organic compounds (SVOC). No soil samples were analyzed for metals (Ref. 3, p. 2-6).

Analytical results of surface soil samples contained TCE and benzo(a)pyrene, among others. Analytical results for ground water samples contained chromium, TCE, PCE, 1,2- DCE, and vinyl chloride. TCE, DCE, and vinyl chloride are common breakdown products of PCE (Ref. 9, p. 24). Sediment samples collected from the drainage feature located in the central portion of the AIP, which exits the AIP to the south and continues to Rocky Creek, contained arsenic, chromium, and lead. TCE was not detected in any surface water or sediment samples collected along the central drainage feature (Ref. 3, Figures 2-3, 2-5, 2-6, Tables O-3, O-8, O-9, O-10, and O-11).

2.3.4 2004 SAIC Post-Test Ground Water Sampling

Beginning in 2003, SAIC, on behalf of the USACE, Savannah District, developed a pilot-scale alternatives assessment and implementation plan to evaluate the use of Hydrogen Release Compound (HRC) as a remedial alternative for VOC contamination in ground water underlying the western boundary of the AIP. This evaluation consisted of a baseline ground water sampling event before HRC was injected, injection of HRC into the ground water, and a series of three post-injection ground water sampling events to ascertain the impact of HRC, if any, on VOC contamination in the underlying ground water (10, pp. 1, 2). The injection site was located immediately downgradient from the AIP WWTP drainage area, which is believed to be the source of VOC contamination (10, pp. 2, 5). Based on the results of the pilot study, SAIC concluded that a non-aqueous phase liquid (NAPL) is the likely source of TCE in the western AIP plume. The NAPL may be releasing VOCs to the ground water and masking the effects of any enhanced TCE degradation that would result from the HRC within the immediate vicinity of the injection site. Furthermore, the configuration of the TCE plume suggests that preferential pathways are affecting the transport of VOC contamination at the AIP (10, p. 5).

3.0 EXPANDED SITE INSPECTION ACTIVITIES

This section outlines field observations and sampling procedures at the AIP. Individual subsections address the sampling investigation and the rationale for specific ESI activities. The ESI sampling was conducted in accordance with the EPA-approved final SAP dated May 9, 2009 (Ref. 11).

3.1 SAMPLE COLLECTION METHODOLOGY AND PROCEDURES

During the ESI conducted from May 11 to 20, 2009, Tetra Tech collected surface soil, subsurface soil, ground water, surface water, and sediment samples. The specific number, type, and location of samples are listed below.

- 43 surface and 45 subsurface soil samples were collected from the AIP
- Six ground water samples were collected from permanent monitoring wells installed by USACE at the AIP
- Four surface water and 17 sediment samples were collected from drainage ditches that receive runoff from the AIP
- Six surface water and six sediment samples were collected from Rocky Creek

In addition, Tetra Tech collected one collocated background surface and subsurface soil sample to attribute contaminants detected in on-site samples. The background ground water sample was collected from a permanent monitoring well in the vicinity of the background soil sampling location. Tetra Tech also collected two background sediment samples from drainage ditches in an upgradient area of the AIP to attribute contaminants detected in samples of site runoff. In addition, Tetra Tech collected five collocated background surface water and sediment samples (including one duplicate) from Rocky Creek to attribute contaminants detected in downstream samples.

The ESI sampling locations are depicted on Figure 4 in Appendix A and are summarized in Tables 1 through 4 in Appendix B. Tetra Tech followed sample collection procedures outlined in the final SAP and in accordance with the EPA Region 4 Science and Ecosystem Support Division (SESD) Field Branch Quality System and Technical Procedures dated February 2008 (Refs. 11; 12). Field logbooks for the ESI sampling event are contained in Appendix C.

3.2 ANALYTICAL SUPPORT AND METHODOLOGY

All samples were submitted to EPA CLP laboratories for analysis of all parameters on the EPA Target Analyte List (TAL), including metals and cyanide, and were analyzed in accordance with the EPA CLP Statement of Work (SOW) for Inorganic Analysis, Multi-Media, Multi-Concentration (ILM05.4) (Ref. 13). Samples were also submitted for analysis of all parameters on the EPA Target Compound List (TCL), which includes VOCs, SVOCs, pesticides, and PCBs, and were analyzed in accordance with the EPA CLP SOW for Organics Analysis, Multi-Media, Multi-Concentration (SOM01.2) (Ref. 14). Surface water samples collected from Rocky Creek and the drainage ditches were analyzed for total and dissolved TAL metals. In addition to TAL and TCL parameters, a number of samples were also submitted to a non-CLP Tetra Tech-procured laboratory for analysis of energetic compounds and were analyzed in accordance with EPA Methods 8330A, 8331, and 314 (Refs. 15; 16; 17).

The CLP and non-CLP analytical data packages were validated by the EPA Region 4 SESD, Office of Quality Assurance. Data validation was conducted in accordance with the EPA CLP SOW for Organics Analysis, Multi-Media, Multi-Concentration (SOM01.2), April 2007; the EPA CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration (ILM05.4), December 2006; Nitoaromatics, Nitramines, and Nitrate Esters Analysis, Method 8330A, including perchlorate analysis (Method 314); Tetrazene Analysis, Method 8331; the EPA National Functional Guidelines for Superfund Organic Methods Data Review, EPA540/R-07/003, June 2008; the EPA National Functional Guidelines for Inorganic Data Review, EPA540-R-04/004, October 2004; and the EPA Region 4 SESD Data Validation SOP for CLP Routine Analytical Services, Revision 2.1, July 1999 (Refs. 13 through 20).

3.3 ANALYTICAL DATA QUALITY AND DATA QUALIFIERS

All analytical data were subject to a quality assurance review, as described in the EPA SESD laboratory data evaluation guidelines. The text and analytical data tables presented in this report list some concentrations of the parameters as qualified with a "J," indicating that the identification of the analyte is acceptable; however, the reported value is an estimate. Some parameters in the data tables may be qualified with a "J^1" indicating that the concentration reported is less than the lowest standard on the calibration curve and is, therefore, less than the analyte-specific minimum reporting limit (MRL). As a result, any parameter qualified with a "J^1" cannot be considered elevated even if the concentration is three times the background. Constituent concentrations in samples that are greater than or equal to three times the background concentration or that are greater than or equal to the sample-specific and analyte-specific MRL in the background sample are considered elevated. "J" qualified parameters may also include a "+" or "-" indicating either a high or a low bias. Explosive parameters qualified with a "JN" indicate that the result is presumptive (tentatively identified), but a confirmation was not performed because the result was greater than the method detection limit, but less than the reporting limit. Some sample results are reported with a "U" qualifier, meaning that the analyte was not detected at or above the minimum or method reporting limit. The reported value is the sample-specific, laboratory-derived minimum or method reporting limit for the constituent. A "UJ" qualifier means that the analyte was not detected at or above the minimum or method reporting limit and the reported value is an estimate. Sample results reported with an "R" qualifier indicate that the data are unusable (rejected). The analytical data sheets are presented in Appendices E and F.

4.0 DEVIATIONS FROM THE SAMPLING AND ANALYSIS PLAN

During the field sampling event, some sampling locations deviated from the locations proposed in the final SAP in response to site conditions. Deviations in the field were documented in the logbook notes contained in Appendix C and summarized below.

- Ground water sample AIP-143-MW was not collected because the well was dry.
- An additional ground water sample, AIP-149-MW, was collected from permanent monitoring well MW-80.
- A surface water sample was not collected at drainage ditch station DD509 because the drainage ditch was dry. Therefore, a surface water sample was added at drainage ditch station DD508.

- A surface water sample was not collected at drainage ditch station DD519 because the drainage ditch was dry.

- Samples were not collected from Rocky Creek Stations RC410 and RC411 because these locations were inaccessible.

5.0 SOURCE SAMPLING

This section discusses the source areas evaluated at the AIP and the sampling locations and analytical results for samples collected from the source areas. Analytical results were compared with background concentrations for all media sampled. The discussion below addresses only the hazardous constituents associated with site operations and the hazardous constituents that may pose a threat to human health or the environment. Only the highest concentrations of each contaminant of concern are discussed.

Source areas at the AIP include an unknown quantity of contaminated soil near the WWTP, storm drain outfalls, metal plating facility, the oil recovery area, the electric transformer houses, and the explosives handling and storage areas. The AIP was part of the MNOP where flares, small primers, detonators, and other triggering mechanisms were manufactured until about 1965 (Ref. 4, p. 2). Wastes generated from these activities include caustic wastewater, waste solvents, heavy metals, waste oil, and residues from energetics (nitroaromatics) (Ref. 21, p. 2).

5.1 SOURCE SAMPLING LOCATIONS AND ANALYTICAL RESULTS

During the ESI, Tetra Tech collected 43 surface soil (0 to 6 inches bgs) and 45 subsurface soil (12 to 24 inches below ground surface [bgs]) samples from source areas. Source sampling locations are depicted on Figure 4 in Appendix A and are summarized in Table 1 in Appendix B. Source samples were collected in accordance with the EPA Region 4 SESD Field Branch Quality System and Technical Procedures (Ref. 12, SESDPROC-300-R1). Analytical results for source samples are summarized in Tables 5 through 8 in Appendix B. The complete sets of analytical data sheets are provided in Appendices E and F.

5.1.1 Surface Soil

Analytical results for surface soil samples collected from source areas contained SVOCs, pesticides, and PCBs at elevated concentrations. Specifically, dibenzo(a,h,)anthracene was detected at a concentration of

310 micrograms per kilogram (µg/kg) (AIP-129-SF), 4,4'-DDE was detected at a concentration of 190 µg/kg (AIP-135-SF), 4,4'-DDT was detected at a concentration of 180 µg/kg (AIP-133-SF), alpha-chlordane was detected at a concentration of 5.9 µg/kg (AIP-137-SF), dieldrin was detected at a concentration of 11 µg/kg (AIP-131-SF), gamma-chlordane was detected at a concentration of 4.1 µg/kg (AIP-137-SF), endrin was detected at a concentration of 80 µg/kg (AIP-111-SF), methoxychlor was detected at a concentration of 46 µg/kg (AIP-111-SF), and PCB-1260 was detected at a concentration of 11,000 µg/kg (AIP-111-SF) (see Table 5 in Appendix B). Several metals were also detected at elevated concentrations in surface soil samples, including arsenic at a concentration of 9.6 J- milligrams per kilogram (mg/kg) (AIP-132-SF), cadmium at a concentration of 15 mg/kg (AIP-136-SF), lead at a concentration of 1,000 mg/kg (AIP-136-SF), and mercury at a concentration of 1.3 mg/kg (AIP-134-SF) (see Table 6 in Appendix B). See Tables 5 and 6 in Appendix B for a full list of contaminants detected at elevated concentrations in surface soil samples collected from AIP source areas.

5.1.2 Subsurface Soil

Elevated concentrations of SVOCs, pesticides, and PCBs were detected in subsurface soil samples collected from source areas. Specifically, benzo(a)anthracene was detected at a concentration of 210 µg/kg in sample AIP-124-SB, DDE was detected at a concentration of 15 µg/kg in sample AIP-124-SB, DDT was detected at a concentration of 74 J µg/kg in sample AIP-121-SB, alpha-chlordane was detected at a concentration of 5.1 µg/kg in sample AIP-137-SB, and PCB-1260 was detected at a concentration of 66 µg/kg in sample AIP-111-SB (see Table 7 in Appendix B). Metals were also detected at elevated concentrations, including cadmium at a concentration of 2.8 mg/kg (AIP-136-SB), lead at a concentration of 50 mg/kg (AIP-136-SB), and mercury at a concentration of 0.88 mg/kg (AIP-124-SB) (see Table 8 in Appendix B). See Tables 7 and 8 in Appendix B for a full list of contaminants detected at elevated concentrations in subsurface soil samples collected from AIP source areas.

5.2 SOURCE CONCLUSIONS

Tetra Tech collected 43 surface and 45 subsurface soil samples from source areas. Analytical results for the surface and subsurface soil samples collected from AIP source areas contained elevated concentrations of benzo(a)anthracene, DDE, DDT, alpha-chlordane, dieldrin, endrin, gamma-chlordane, methoxychlor, PCB-1260, arsenic, cadmium, lead, and mercury. Soil samples collected from source areas were also analyzed for explosive compounds, but none were detected at elevated concentrations.

Based on wastes reportedly generated by the MNOP, contaminants of concern, including pesticides and metals, have been documented in source samples.

6.0 PATHWAYS

This section discusses the ground water migration, surface water migration, soil exposure, and air migration pathways. Additionally, this section discusses the targets associated with each pathway and draws pathway-specific conclusions. Sampling locations and analytical results for samples collected from the specific pathways also are discussed. The discussions below address only the hazardous constituents associated with site operations and that may pose a threat to human health or the environment. Only the highest concentrations of each contaminant of concern are discussed.

6.1 GROUND WATER MIGRATION PATHWAY

Seven ground water samples were collected during the ESI. Ground water sampling locations are depicted on Figure 4 in Appendix A and are summarized in Table 2 in Appendix B. Ground water samples were collected in accordance with the EPA Region 4 SESD Field Branch Quality System and Technical Procedures (Ref. 12, SESDPROC-301-R1). Field parameters for ground water samples are summarized in Table 9 of Appendix B, and analytical results for ground water samples are summarized in Table 10 of Appendix B. The complete sets of analytical data sheets are provided in Appendices E and F.

6.1.1 Geologic and Hydrogeologic Setting

The AIP is located in the Fall Line Hills District of the Coastal Plain Physiographic Province of Georgia (Refs. 22; 24, p. 4). The elevation of the area ranges from about 345 feet above mean sea level (amsl) on the top of the ridge on the northeast portion of the property to about 275 feet amsl in the stream valley south of the property (Ref. 23). The topography of this area is referred to as the Sand Hills, which consist of gently rolling to swampy flatlands (Ref. 24, p. 4).

Geologically, the area is underlain in descending stratigraphic order by recent alluvial deposits, Pleistocene alluvial deposits, and the Tuscaloosa Formation (Ref. 24, p. 36). The recent alluvial deposits that underlie the AIP consist of four major soil types which include the Cowarts Sandy Loam, 2 to 5 percent slopes: the Cowarts Sandy Loam, 5 to 8 percent slopes: the Norfolk Sandy Loam, 0 to 2 percent slopes: and the Vaucluse-Urban Land Complex, 2 to 8 percent slopes. Generally, these soils are well drained, gently sloped, and acidic and consist of sandy loams, sandy clay loams, and loamy sands. The total thickness of the soils on site is approximately 75 inches (Ref. 25, pp. 12, 13, 17, 19, 21, 22). The Pleistocene alluvial deposits, which underlie the recent alluvial deposits, consist of unconsolidated sediments of interbedded clayey silts and silty clays that grade with depth into silty sands and gravel (Ref. 24, pp. 9, 10). The depth of these deposits is usually less than 40 feet (Ref. 24, p. 36).

The Tuscaloosa Formation, which lies unconformably beneath the Pleistocene alluvial deposits, consists of light-colored fine to coarse sand in some areas and is mingled with white kaolin, and in other areas is separated by lenticular and pure kaolin masses (Ref. 24, pp. 23, 36). The Tuscaloosa Formation is not well bedded, and the beds do not indicate regular or cyclic deposition; hence, the basal part of the formation may be lithologically similar to the top (Ref. 24, p. 23). The base of the Tuscaloosa Formation dips slightly southeast at about 30 feet per mile (Ref. 24, p. 36). The Tuscaloosa Formation thickens southward and may be as deep as 600 feet (Ref. 24, p. 23).

Ground water in the area is available in a surficial aquifer system, consisting of the recent alluvium, Pleistocene alluvium, and the Tuscaloosa Formation. Soils in this aquifer system range from moderate to low permeability (Refs. 24, pp. 9, 12; 25, pp. 12, 13, 17, 19, 21, 22). These three geologic units act as a recharge for the surficial aquifer located in the Tuscaloosa Formation. The Tuscaloosa Formation furnishes water to almost all wells drilled on the Coastal Plain of Bibb County (Ref. 24, p. 37). The hydraulic conductivity of the silty sands found in the Tuscaloosa is on the order of 10^{-3} centimeters per second (Refs. 1, p. 4; 24, p. 36; 26, p. 29). The regional flow direction for this aquifer is to the south-southeast toward Rocky Creek (Ref. 1, p. 6).

6.1.2 Ground Water Sampling Locations and Analytical Results

Seven ground water samples, including one background sample and one duplicate, were collected from permanent monitoring wells installed in the surficial aquifer. The on-site monitoring wells that were sampled ranged in depth from 28.41 feet to 43.33 feet bgs (see Table 9 in Appendix B).

Ground water samples contained VOCs, including TCE, cis-1,2-DCE, PCE, trans-1,2-DCE, and vinyl chloride at elevated concentrations. Specifically, TCE was detected at a concentration of 20,000 micrograms per liter (µg/L) (AIP-144-MW), cis-1,2-DCE was detected at a concentration of 280 J µg/L (AIP-149-MW), PCE was detected at a concentration of 11 µg/L (AIP-144-MW), trans-1,2-DCE was detected at a concentration of 5.1 µg/L (AIP-149-MW), and vinyl chloride was detected at a concentration of 7.0 µg/L (AIP-144-MW). The explosive compound perchlorate was also detected at an elevated concentration (4.3 µg/L) in one ground water sample (AIP-147-MW) (see Table 10 in Appendix B). See Table 10 in Appendix B for a full list of contaminants detected at elevated concentrations in ground water samples.

6.1.3 Ground Water Targets

Municipal water within the 4-mile radius is obtained from the MWA. The MWA maintain two surface water intakes on the Ocmulgee River (Ref. 27). Some areas within the 4-mile radius are supplied drinking water by private wells. In 2007, one drinking water well, which serves residents at the Pine Acres mobile home park (MHP), was identified within 2 miles south of the AIP property. At that time, the Pine Acres MHP well served about 80 residents. Municipal water was available to about 160 residents in the Pine Acres MHP. The depth of the Pine Acres well is about 200 feet deep, and the well water undergoes chlorination treatment. At the time of the ESI report preparation, Tetra Tech was unable to verify whether the Pine Acres MHP well is still active (Refs. 23; 28).

6.1.4 Ground Water Conclusions

The ground water migration pathway is of concern at the AIP site because of the large TCE plume in the underlying ground water. Source samples collected during this investigation did not indicate the presence of TCE in the soil. However, soil samples collected from source areas as well as ground water samples collected during the 1996 RUST and 1998 to 2000 SAIC investigations contained TCE (Refs. 1, Figure 4-1, Table 4-2, pp. 1 through 22; 3, Figure 2-3, Table O-3). Table 11 in Appendix B summarizes the analytical results for ground water samples collected from 1996 to 2009. Municipal water in the area is obtained from surface water intakes; however, the regional flow direction for the surficial aquifer is to the south-southeast toward Rocky Creek (Refs. 4, p. 6; 23).

6.2 SURFACE WATER MIGRATION PATHWAY

During the ESI, Tetra Tech collected 15 surface water and 30 sediment samples from Rocky Creek and drainage ditches. Specifically, four surface water and 17 sediment samples were collected from drainage ditches that receive runoff from the AIP and six collocated surface water and sediment samples were collected from Rocky Creek. In addition, Tetra Tech collected two background sediment samples from drainage ditches in upgradient areas of the AIP and five collocated background surface water and sediment samples (including one duplicate) from Rocky Creek to attribute contaminants detected in on-site samples. Surface water samples were collected from the surface of the water by partially submerging the sampling container into the water. Surface water samples were filtered in the field using a peristaltic pump and a 0.45 micron filter. Sediment samples were collected from depositional areas at depths ranging from 0 and 6 inches bgs.

Surface water and sediment sampling locations are depicted on Figure 4 in Appendix A and are summarized in Tables 3 and 4 in Appendix B. Surface water and sediment sampling was conducted in accordance with EPA Region 4 SESD Field Branch's Quality System and Technical Procedures (Ref. 12, SESDPROC-200-R1, SESDPROC-201-R1). Analytical results for surface water and sediment samples are summarized in Tables 12 through 20 in Appendix B. The complete sets of analytical data sheets are provided in Appendices E and F.

6.2.1 Hydrologic Setting

Surface water runoff within the AIP generally follows the land topography which slopes gently southward across the property. A small tributary enters the property at the northeastern corner and runs parallel to Mead Road before it exits the site south of Allied Industrial Boulevard. Several drainageways exist in the former bunker area where storm water drain outfalls empty onto the northeastern side of the property. A topographic low occurs in the northwestern section of the AIP where surface water runoff during storm events drains into a small creek running along the western property boundary. This creek eventually crosses over onto the property south of the former Central of Georgia railroad spur in the southwestern portion of the property. Once in the southern portion of the MNOP property, runoff flows south-southeast into a drainage easement and wetlands along Rocky Creek (Ref. 1, p. 9). Rocky Creek flows east-southeast for 1.5 miles before it converges with Tobesofkee Creek. Tobesofkee Creek flows south-southeast for about 4 miles before it converges with the Ocmulgee River; flow continues in the Ocmulgee River for more than 9.5 miles, completing the 15-mile surface water target distance limit (TDL) (Ref. 30). The flow rate for Rocky Creek is estimated to be less than 10 cubic feet per second (cfs) (Ref. 32). Rocky Creek has several branches. Specific stream channels are difficult to discern due to extensive wetlands in the area. Also, ground water in the area flows to the south-southeast toward Rocky Creek (Ref. 1, p. 6). According to the U.S. Geological Survey, the flow rate for Tobesofkee Creek is about 91.2 cfs and the flow rate for the Ocmulgee River is about 1,082 cfs (Ref. 31). The Rocky Creek Water Reclamation Facility, located east of the FMNOL, provides water treatment for the southern and western portions of the City of Macon. Treated wastewater from this facility is discharged into the Ocmulgee River (Ref. 36, p. 1).

6.2.2 Drainage Ditch Surface Water and Sediment Sampling Locations and Analytical Results

Tetra Tech collected four surface water and 17 sediment samples from drainage ditches that receive runoff from the AIP during the ESI. In addition, Tetra Tech collected two background sediment samples (DD-502-SD and DD-503-SD) from drainage ditches in upgradient areas of the AIP to attribute contaminants detected in samples of site runoff (see Figure 4 in Appendix A). A surface water background sample was not collected for the drainage ditches because the drainage ditches were dry in upgradient areas of the AIP. Surface water samples contained pesticides, PCBs, and metals, including gamma-chlordane, PCB-1248, and lead. The explosive compound perchlorate was also detected in surface water samples (see Table 12 in Appendix B).

Sediment samples collected from drainage ditches that receive runoff from the AIP contained elevated concentrations of SVOCs, pesticides, and PCBs. Specifically, benzo(a)anthracene and benzo(a)pyrene were detected at elevated concentrations (910 µg/kg and 1,500 µg/kg) in sample DD-509-SD. Pesticides detected at elevated concentrations include DDD at 34 µg/kg (DD-508-SD), DDE at 230 µg/kg (DD-508-SD), DDT at 210 J (DD-508-SD), alpha-chlordane at 27 µg/kg (DD-508-SD), dieldrin at 120 J- µg/kg (DD-518-SD), endrin at 17 µg/kg (DD-509-SD), gamma-BHC (Lindane) at 8.5 µg/kg (DD-514-SD), gamma-chlordane at 86 µg/kg (DD-513-DD), and methoxychlor at 24 µg/kg (DD-508-SD). PCB-1248 was detected at a concentration of 14,000 J- µg/kg in sample DD-508-SD, PCB-1254 was detected at a concentration of 2,000 µg/kg in sample DD-513-SD, and PCB-1260 was detected at a concentration of 750 µg/kg in sample DD-508-SD (see Table 13 in Appendix B).

In addition to organic constituents, inorganic constituents were also detected at elevated concentrations in the drainage ditch sediment samples. Specifically, cadmium was detected at a concentration of 12 mg/kg (DD-514-SD) and mercury was detected at a concentration of 0.63 J- mg/kg (DD-514-SD) (see Table 14 in Appendix B). See Table 14 in Appendix B for a full list of contaminants detected at elevated concentrations in sediment samples collected from drainage ditches that receive runoff from the AIP.

6.2.3 Rocky Creek Surface Water and Sediment Sampling Locations and Analytical Results

During the ESI, Tetra Tech collected six collocated surface water and sediment samples from portions of Rocky Creek that receive drainage from AIP as well as downstream from AIP. In addition, Tetra Tech collected five (including one duplicate) collocated background surface water and sediment samples upstream from the AIP's drainage ditches to attribute contaminants detected in downstream samples (see Figure 4 in Appendix A). The highest background concentration for each constituent detected in surface water and sediment samples was used for comparison to downstream samples. See Table 15 in Appendix B for background surface water analytical results and Tables 17 and 19 in Appendix B for background sediment analytical results.

Analytical results for surface water samples collected from Rocky Creek did not contain any constituents at elevated concentrations (see Table 16 in Appendix B). Analytical results for sediment samples collected from Rocky Creek downstream from AIP drainage ditches contained elevated concentrations of pesticides, PCBs, and metals. Sediment sample RC-408-SD contained the highest concentrations of DDE (77 µg/kg), DDT (72 µg/kg), alpha-chlordane (9.9 µg/kg), gamma-chlordane (94 µg/kg), and PCB-1248 (7,800 µg/kg). Sediment sample RC-406-SD contained PCB-1254 at a concentration of 140 µg/kg (see Table 18 in Appendix B). The metals cadmium and mercury were detected at elevated concentrations in Rocky Creek sediment samples. Specifically, sample RC-408-SD contained the highest concentrations of cadmium (15 mg/kg) and mercury (1.9 mg/kg) (see Table 20 in Appendix B). See Tables 18 and 20 in Appendix B for a full list of contaminants detected at elevated concentrations in sediment samples collected from Rocky Creek downstream of the AIP.

6.2.4 Surface Water Targets

There are no drinking water intakes along the 15-mile downstream TDL. The MWA maintains two surface water intakes along the Ocmulgee River upstream of the AIP property. MWA's primary intake is located on a newly constructed reservoir, Javors Lucas Lake, created from the Ocmulgee River. MWA's secondary intake is located about 2 miles upstream of the I-16 Bridge (Ref. 27). Rocky Creek, Tobesofkee Creek, and the Ocmulgee River are all fished recreationally, where they are accessible to the public; fish are also harvested for consumption (Ref. 32). Rocky Creek, Tobesofkee Creek, and the Ocmulgee River are designated as fisheries by the State of Georgia (Refs. 37, p. 2; 38, Appendix A, pp. A-78, A-80; 39, p. 4-14). The USACE has posted signs advising fishermen that the fish in Rocky Creek contain PCBs and the State of Georgia has issued fish consumption guidelines for the Ocmulgee River as a result of PCB and mercury contamination (Ref. 40, p. 39). In 2007, GAEPD personnel observed people fishing in Rocky Creek (Ref. 29, p. 9). Also, during the ESI sampling event conducted from May 11 to 20, 2009, Tetra Tech observed fishing paraphernalia, including a fishing line and weight, along Rocky Creek (see the Photograph No. 14 in Appendix D).

HRS eligible, palustrine forested, palustrine scrub-shrub, and palustrine emergent wetlands are located south of the AIP, along Rocky Creek, Tobesofkee Creek, and the Ocmulgee River (Ref. 33). The wetland frontages for the water bodies along the 15-mile surface water migration pathway are as follows: Rocky Creek, about 3 miles; Tobesofkee Creek, about 8 miles; and the Ocmulgee River, about 15 miles (Ref. 33). There are no state or federally designated threatened or endangered fish species that inhabit water bodies in Bibb County; however, the bald eagle *(Haliaeetus leucocephalus)*, the wood stork *(Mycteria Americana)*, and the gopher tortoise *(Gopherus polyphemus)* are listed as endangered or threatened species in Bibb County. The specific habitat locations of the above mentioned species are not known (Ref. 34).

6.2.5 Surface Water Conclusion

The surface water migration pathway is of concern at the site. Source samples collected from the AIP contained elevated concentrations of pesticides, PCBs, and metals in soil. Analysis of sediment samples collected from the drainage ditches and Rocky Creek also contained elevated concentrations of pesticides, PCBs, and metals. However, PCBs were only detected in the drainage ditches downgradient of the AIP, south of the Central of Georgia railroad spur, and within the area of influence of the FMNOL and Armstrong remote landfill floodplain. The highest concentrations of hazardous substances detected in Rocky Creek samples were collected downstream from the AIP, before the Rocky Creek Water Reclamation Facility. Rocky Creek is fished downstream of the AIP, and the fish are consumed.

6.3 SOIL EXPOSURE AND AIR MIGRATION PATHWAYS

All soil samples collected during this investigation are discussed in Section 5.0 Source Sampling of this report. No residences are located on the AIP property; therefore, no soil samples were collected from residential properties. The MBCIA currently leases or sells buildings as office and warehouse space to various industrial and commercial businesses on the AIP property (Ref. 1, pp. 2, 3). Industries that currently lease or own properties at the AIP include A.C. White Transfer and Storage Company, Blair

Moving and Storage Company, Damaste Warehousing LLC, and Politex US Inc. (Freudenberg Texbond), among others (Refs. 6; 7, pp. 2, 11, 27, 105) (see Figure 3 in Appendix A).

The AIP properties are zoned for heavy industrial use (Ref. 7, pp. 2 through 90). The southern portion of the AIP was overgrown with vegetation during the sampling event; therefore, it was necessary to cut paths to access the sampling locations. Based on the U.S. Bureau of the Census 2000 population data, the residential population within a 4-mile radius is distributed as follows: 0 to 0.25 mile, 0 persons; 0.25 to 0.50 mile, 172 persons; 0.50 to 1.0 mile, 1,453 persons; 1.0 to 2.0 miles, 6,673 persons; 2.0 to 3.0 miles, 9,917 persons; and 3.0 to 4.0 miles, 22,518 persons (Ref. 35). The U.S. Fish and Wildlife Service list the bald eagle *(Haliaeetus leucocephalus)*, the red-cockaded woodpecker *(Picoides borealis)*, the wood stork *(Mycteria Americana)*, and the gopher tortoise *(Gopherus polyphemus)* as endangered or threatened species in Bibb County; however, specific habitat locations are not known (Ref. 34).

7.0 SUMMARY AND CONCLUSIONS

The manufacture of ordnance at MNOP began before World War II and continued until 1973 when the property was sold to Allied, which manufactured seat belts until 1981. In 1981, Allied sold the property to MBCIA. MBCIA owns what is currently the AIP and leases or sells properties to various industrial or commercial businesses. Items manufactured at the MNOP included flares, small primers, detonators, and other triggering mechanisms. Structures at the MNOP included numerous buildings, several miles of paved roads, fueling facilities, ASTs and USTs, solvent storage buildings, explosives storage magazines, a bunker area, a metals plating facility, and a WWTP.

Surface and subsurface soil samples collected from source areas contained pesticides, PCBs, and metals including DDD, DDE, DDT, alpha-chlordane, dieldrin, endrin, gamma-chlordane, methoxychlor, PCB-1260, arsenic, cadmium, lead, and mercury. The highest concentrations of hazardous substances were detected in source samples collected from the oil recovery, transformer houses, WWTP, and explosive handling and storage areas.

Analytical results for ground water samples collected on site indicated the presence of VOCs at elevated concentrations, including cis-1,2-DCE, trans-1,2-DCE, TCE, PCE, and vinyl chloride. VOCs were not detected in source samples during this investigation; however, VOCs were detected in source areas as well as in ground water samples collected during previous investigations conducted by the USACE. The highest concentrations of VOCs in ground water were detected in samples collected from the WWTP area. Municipal water in the area is obtained from surface water intakes. The regional flow ground water direction in the surficial aquifer is to the south-southeast toward Rocky Creek.

Sediment samples collected from drainage ditches that receive runoff from the AIP contained elevated concentrations of pesticides and metals including DDD, DDE, DDT, alpha-chlordane, dieldrin, endrin, gamma-BHC (Lindane), gamma-chlordane, methoxychlor, cadmium, and mercury. PCBs were also detected at elevated concentrations in AIP drainage ditches; however, they were only detected south of the Central of Georgia railroad spur and within the area of influence of the FMNOL and Armstrong remote landfill floodplain. The highest concentrations of hazardous substances were detected in AIP drainage ditch samples collected below the Central of Georgia railroad spur.

Analytical results for sediment samples collected from Rocky Creek indicated the presence of elevated concentrations of DDE, DDT, alpha-chlordane, cadmium, and mercury. The highest concentrations of hazardous substances were detected in Rocky Creek samples collected downstream from the AIP, before the Rocky Creek Water Reclamation Facility. No drinking water intakes are located along the 15-mile surface water migration pathway TDL. Rocky Creek, Tobesofkee Creek, and the Ocmulgee River are all fished recreationally, where accessible to the public; fish are also harvested for consumption. HRS eligible, palustrine forested, palustrine scrub-shrub, and palustrine emergent wetlands are located along Rocky Creek, Tobesofkee Creek, and the Ocmulgee River.

Based on the analytical results of soil, sediment, and ground water samples collected on site, and sediment samples collected from drainage ditches and Rocky Creek downstream of areas of contaminated soil at the AIP, Tetra Tech recommends further action at the AIP at the discretion of EPA.

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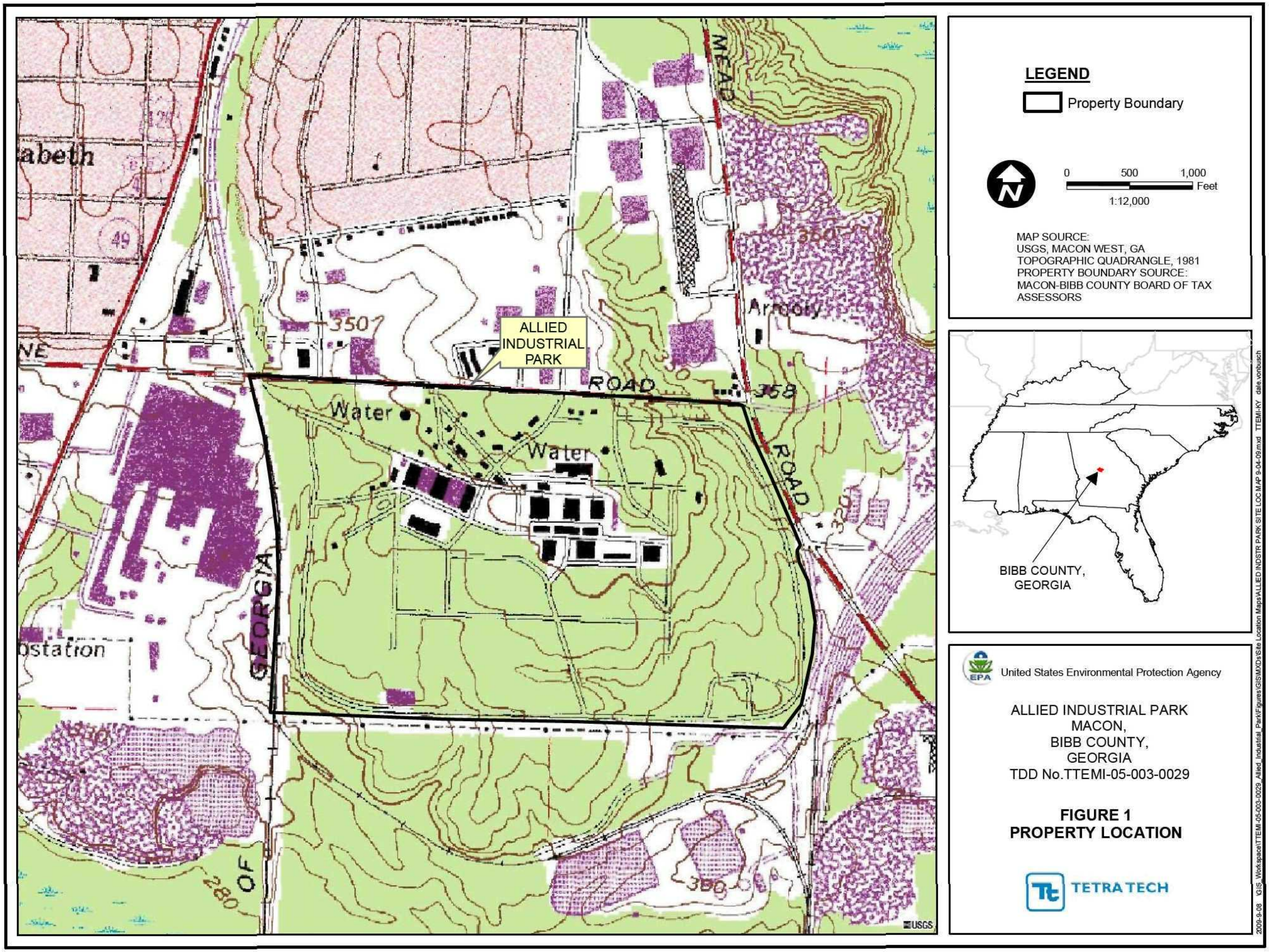
APPENDIX A

FIGURES

(Four Pages)



MAP SOURCE:
USGS, MACON WEST, GA
TOPOGRAPHIC QUADRANGLE, 1981
PROPERTY BOUNDARY SOURCE:
MACON-BIBB COUNTY BOARD OF TAX
ASSESSORS

United States Environmental Protection Agency

ALLIED INDUSTRIAL PARK
MACON,
BIBB COUNTY,
GEORGIA
TDD No.TTEMI-05-003-0029

FIGURE 1
PROPERTY LOCATION

TETRA TECH

2009-9-08 \GIS_Workspace\TTEMI-05-003-0029_Allied_Industrial_Park\Figures\GIS\MXDs\Site Location Maps\ALLIED INDSTR PARK SITE LOC MAP 9-04-09.mxd TTEMI-KY dale.vonbusch

LEGEND

- Allied Industrial Park Property Boundary
- Adjacent Property
- Creek
- Drainage Ditch
- Drainage Easement
- Armstrong World Industries Remote Landfill
- FMNOL

Notes:
FMNOL - Former Macon Naval Ordnance Landfill
Source:
Aerial Photograph: DigitalGlobe/Globe Explorer, 2004
Property Boundaries: Macon-Bibb County, Board of Tax Assessors

0 400 800 Feet
1:9,600

N

United States
Environmental Protection Agency

ALLIED INDUSTRIAL PARK
MACON,
BIBB COUNTY,
GEORGIA
TDD No.TTEMI-05-003-0029

FIGURE 2
SURROUNDING PROPERTIES

TETRA TECH

2009-9-08 \GIS_Workspace\TTEMI-05-003-0029_Allied_Industrial_Park\Figures\GIS\MXDs\Surrounding Property Maps\ALLIED INDSTR PARK SUROND PROP 11x17 9-08-09.mxd dale.vonbusch

LEGEND

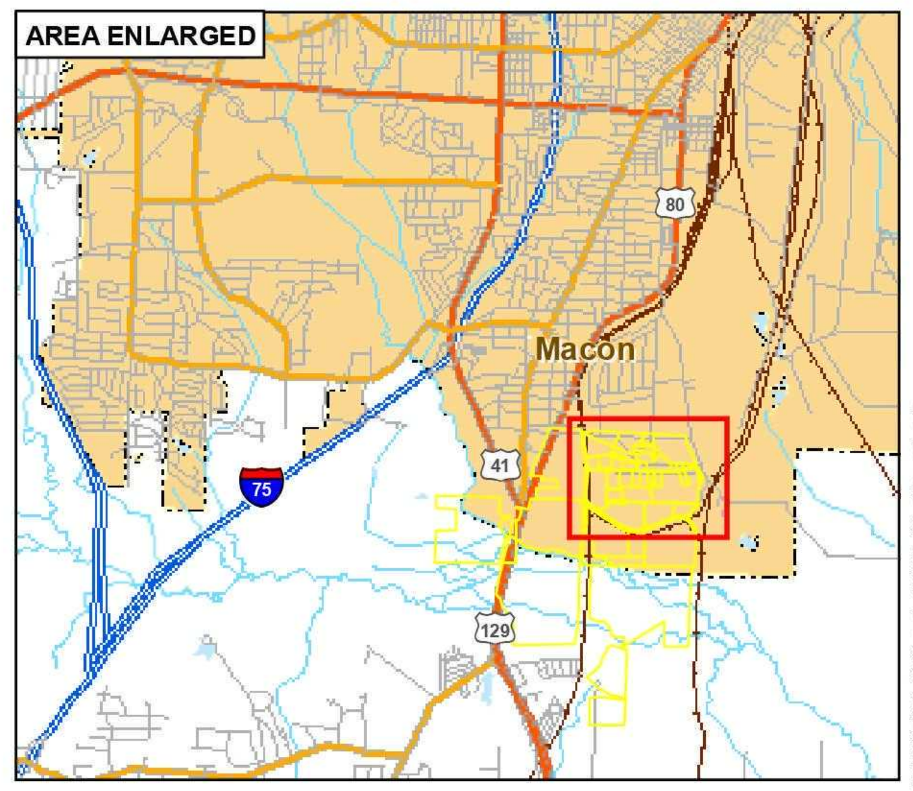
▭	Parcel Boundaries with Parcel ID and Ownership

Map Source:
Aerial Photograph: DigitalGlobe/Globe Explorer, 2004,
Resolution 0.6m, Spatial accuracy 1:50,000,
NAD 83, UTM Zone 17N.
Parcels: Macon/Bibb County Board of Tax Assessors, 2009.

0 100 200 400 Feet

1:2,400

N



United States
Environmental Protection Agency

ALLIED INDUSTRIAL PARK
MACON,
BIBB COUNTY,
GEORGIA
TDD NO. TTEMI-05-003-0029

FIGURE 3
PARCEL OWNERSHIP

TETRA TECH

2009-9-17 \GIS_Workspace\TTEMI-05-003-0029_Allied_Industrial_Park\Figures\Combined 3 Site Figures\MXDs\MACON SITES COMBINED PARCEL MAP 24x36 9-16-09.mxd TTEMI-KY dale.vonbusch

LEGEND

Sample Stations

- ◐ Surface & Subsurface Soil Sample
- 🟩 Sediment Sample
- △ Surface Water & Sediment Sample
- ✚ Ground Water Sample

Background Sample Stations

- ◐ Surface & Subsurface Soil Sample
- 🟨 Sediment Sample
- △ Surface Water & Sediment Sample
- ✚ Ground Water Sample

Features

- ◆ PPE
- D WWTP Discharge
-)(Culverts
- —+— Railroad Tracks
- — Creek
- -··- Drainage
- ▨ Drainage Easement

Allied Industrial Park Storage Tanks

- ● Tank Location

Allied Industrial Park Structures

- ▨ Currently In Use
- ▩ Currently Not Used

Allied Industrial Park Area Usage

- 🟦 Drainage Area of Offsite Sources
- 🟪 Electric Transformer Houses
- 🟥 Explosives Handling & Storage Areas
- 🟩 Plant Operations Areas

Allied Industrial Park Miscellaneous Features

- 🟩 Allied Industrial Park Waste Water Treatment Plant

Armstrong World Industries Structures

- ▨ Currently In Use

Property Boundaries

- ☐ Allied Industrial Park
- ☐ Armstrong World Industries
- ☐ Armstrong World Industries Remote Landfill
- ☐ Former Macon Naval Ordnance Landfill
- ☐ Georgia Power
- ☐ Yancy Brothers

Explosives Area

- ▨ FMNOL Explosives Demolition Boundary

Landfills

- ○ Armstrong World Industries Landfill (on-site)
- ○ Armstrong World Industries Remote Landfill
- ○ Former Macon Naval Ordnance Landfill

Notes:
AIP - Allied Industrial Park
AWI - Armstrong World Industries
Bldg. - Building
DD - Drainage ditch
FML - Former Macon Naval Ordnance Landfill
FMNOL - Former Macon Naval Ordnance Landfilll
MW - Monitoring well
PCB - Polychlorinated biphenyl
PPE - Probable Point of Entry
RC - Rocky Creek
WWTP - Waste water treatment plant

Lab Result Notes:
B(a)A - Benzo(a)anthracene
B(a)P - Benzo(a)pyrene
B(k)F- Benzo(k)fluoranthene
DiB(a,h)A - Dibenzo(a,h)anthracene
a-Chlordane - alpha-Chlordane
g-Chlordane - gamma-Chlordane
g-BHC - gamma-BHC (Lindane)
Methoxy - Methoxychlor
PCP - Pentachlorphenol
t-1,2-DCE - trans-1,2-DCE
Vinyl chlor - Vinyl chloride
µg/kg - Micrograms per kilogram
µg/L - Micrograms per liter
mg/kg - Milligrams per kilogram
J - The identification of the analyte is acceptable;
the reported value is an estimate.
J- - The identification of the analyte is acceptable;
the reported value is an estimate with a possible low bias.
J+ - The identification of the analyte is acceptable;
the reported value is an estimate with a possible high bias.
U - The analyte was not detected at or above the reporting limit.
UJ - The analyte was not detected at or above the reporting limit
the reported value is an estimate.

Map Source:
Aerial Photograph: DigitalGlobe/Globe Explorer, 2004.
Property Boundaries: Macon-Bibb County Board of Tax Assessors

0 150 300 Feet

N

United States
Environmental Protection Agency

FORMER MACON NAVAL ORDNANCE LANDFILL
(TTEMI-05-003-0022)
ALLIED INDUSTRIAL PARK
(TTEMI-05-003-0029)
ARMSTRONG WORLD INDUSTRIES
(TTEMI-05-003-0030)
MACON,
BIBB COUNTY,
GEORGIA

FIGURE 4
SAMPLING LOCATIONS AND SELECTED ELEVATED ANALYTICAL RESULTS

TETRA TECH

2009-9-08 \GIS_Workspace\TTEMI-05-003-0029_Allied_Industrial_Park\Figures\Combined 3 Site Figures\MXDs\Combined Site Sample Results\MACON SITES COMBINED SAMPL RESULTS MAP 36x48 9-08-09.m

APPENDIX B

TABLES

(113 Pages)

TABLE

TABLE 1
EXPANDED SITE INSPECTION
SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	Depth (inches bgs)	Sample Type	Location	Rationale
AIP100	AIP-100-SF	0 to 6	Grab	Background location, northeastern corner of the AIP	Background soil sample for comparison to on-site sample results
	AIP-100-SB	12 to 24			
AIP101	AIP-101-SF	0 to 6	Grab	Area near Bldg. 105	Determine the presence or absence of hazardous substances
	AIP-101-SB	12 to 24			
AIP102	AIP-102-SF	0 to 6	Grab	Area near Bldg. 105	Determine the presence or absence of hazardous substances
	AIP-102-SB	12 to 24			
AIP103	AIP-103-SF	0 to 6	Grab	Area near Bldg. 105E	Determine the presence or absence of hazardous substances
	AIP-103-SB	12 to 24			
AIP104	AIP-104-SF	0 to 6	Grab	Area near Bldg. 105E	Determine the presence or absence of hazardous substances
	AIP-104-SB	12 to 24			
	AIP-104-SB-DUP				
AIP105	AIP-105-SF	0 to 6	Grab	Area near Bldg. 105	Determine the presence or absence of hazardous substances
	AIP-105-SB	12 to 24			
AIP106	AIP-106-SF	0 to 6	Grab	Area near Bldg. 107	Determine the presence or absence of hazardous substances
	AIP-106-SB	12 to 24			
AIP107	AIP-107-SF	0 to 6	Grab	Area near Bldg. 107	Determine the presence or absence of hazardous substances
	AIP-107-SB	12 to 24			
AIP108	AIP-108-SF	0 to 6	Grab	Area near Bldg. 106A	Determine the presence or absence of hazardous substances
	AIP-108-SB	12 to 24			
AIP109	AIP-109-SF	0 to 6	Grab	Area near Bldg. 108	Determine the presence or absence of hazardous substances
	AIP-109-SB	12 to 24			

TABLE 1
EXPANDED SITE INSPECTION
SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	Depth (inches bgs)	Sample Type	Location	Rationale
AIP110	AIP-110-SF	0 to 6	Grab	Area near Bldg. 106A	Determine the presence or absence of hazardous substances
	AIP-110-SB	12 to 24			
AIP111	AIP-111-SF	0 to 6	Grab	Area near Bldg. 109	Determine the presence or absence of hazardous substances
	AIP-111-SB	12 to 24			
AIP112	AIP-112-SF	0 to 6	Grab	Area near Bldg. 109	Determine the presence or absence of hazardous substances
	AIP-112-SB	12 to 24			
AIP113	AIP-113-SF	0 to 6	Grab	Rail spur receiving area	Determine the presence or absence of hazardous substances
	AIP-113-SB	12 to 24			
AIP114	AIP-114-SF	0 to 6	Grab	Rail spur receiving area	Determine the presence or absence of hazardous substances
	AIP-114-SB	12 to 24			
AIP115	AIP-115-SF	0 to 6	Grab	Rail spur receiving area	Determine the presence or absence of hazardous substances
	AIP-115-SB	12 to 24			
AIP116	AIP-116-SF	0 to 6	Grab	Area near Bldg. 198	Determine the presence or absence of hazardous substances
	AIP-116-SB	12 to 24			
AIP117	AIP-117-SF	0 to 6	Grab	Area near Bldg. 198	Determine the presence or absence of hazardous substances
	AIP-117-SB	12 to 24			
AIP118	AIP-118-SF	0 to 6	Grab	Area near Bldg. 198	Determine the presence or absence of hazardous substances
	AIP-118-SB	12 to 24			
AIP119	AIP-119-SF	0 to 6	Grab	Area near Bldg. 198	Determine the presence or absence of hazardous substances
	AIP-119-SB	12 to 24			

TABLE 1
EXPANDED SITE INSPECTION
SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	Depth (inches bgs)	Sample Type	Location	Rationale
AIP120	AIP-120-SF	0 to 6	Grab	Former location of the mixing/blending houses	Determine the presence or absence of hazardous substances
	AIP-120-SB	12 to 24			
AIP121	AIP-121-SF	0 to 6	Grab	Former location of the mixing/blending houses	Determine the presence or absence of hazardous substances
	AIP-121-SB	12 to 24			
AIP122	AIP-122-SF	0 to 6	Grab	Former location of the mixing/blending houses	Determine the presence or absence of hazardous substances
	AIP-122-SB	12 to 24			
AIP123	AIP-123-SF	0 to 6	Grab	Former location of the mixing/blending houses	Determine the presence or absence of hazardous substances
	AIP-123-SB	12 to 24			
AIP124	AIP-124-SF	0 to 6	Grab	Former location of the mixing/blending houses	Determine the presence or absence of hazardous substances
	AIP-124-SB	12 to 24			
AIP125	AIP-125-SF	0 to 6	Grab	Former location of the mixing/blending houses	Determine the presence or absence of hazardous substances
	AIP-125-SB	12 to 24			
AIP126	AIP-126-SF	0 to 6	Grab	Area near Bldg. 5	Determine the presence or absence of hazardous substances
	AIP-126-SB	12 to 24			
AIP127	AIP-127-SF	0 to 6	Grab	Area near Bldg. 5	Determine the presence or absence of hazardous substances
	AIP-127-SB	12 to 24			
AIP128	AIP-128-SF	0 to 6	Grab	Area near Bldg. 5	Determine the presence or absence of hazardous substances
	AIP-128-SB	12 to 24			
AIP129	AIP-129-SF	0 to 6	Grab	Area near Bldg. 5	Determine the presence or absence of hazardous substances
	AIP-129-SB	12 to 24			

TABLE 1
EXPANDED SITE INSPECTION
SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	Depth (inches bgs)	Sample Type	Location	Rationale
AIP130	AIP-130-SF	0 to 6	Grab	Area near the transformer house (Bldg. 4)	Determine the presence or absence of hazardous substances
	AIP-130-SB	12 to 24			
AIP131	AIP-131-SF	0 to 6	Grab	Area near the transformer house (Bldg. 104)	Determine the presence or absence of hazardous substances
	AIP-131-SB	12 to 24			
AIP132	AIP-132-SF	0 to 6	Grab	Oil recovery area	Determine the presence or absence of hazardous substances
	AIP-132-SF-DUP				
	AIP-132-SB	12 to 24			
AIP133	AIP-133-SF	0 to 6	Grab	Oil recovery area	Determine the presence or absence of hazardous substances
	AIP-133-SB	12 to 24			
AIP134	AIP-134-SF	0 to 6	Grab	AIP WWTP Area	Determine the presence or absence of hazardous substances
	AIP-134-SB	12 to 24			
	AIP-134-SB-DUP				
AIP135	AIP-135-SF	0 to 6	Grab	AIP WWTP Area	Determine the presence or absence of hazardous substances
	AIP-135-SB	12 to 24			
AIP136	AIP-136-SF	0 to 6	Grab	NW Drainage Area	Determine the presence or absence of hazardous substances
	AIP-136-SB	12 to 24			
AIP137	AIP-137-SF	0 to 6	Grab	NE Drainage Area	Determine the presence or absence of hazardous substances
	AIP-137-SB	12 to 24			
AIP138	AIP-138-SF	0 to 6	Grab	South of Blair Moving & Storage Company	Determine the presence or absence of hazardous substances
	AIP-138-SB	12 to 24			
AIP139	AIP-139-SF	0 to 6	Grab	NE of Blair Moving & Storage Company	Determine the presence or absence of hazardous substances
	AIP-139-SB	12 to 24			

TABLE 1
EXPANDED SITE INSPECTION
SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	Depth (inches bgs)	Sample Type	Location	Rationale
AIP140	AIP-140-SF	0 to 6	Grab	SE of Blair Moving & Storage Company	Determine the presence or absence of hazardous substances
	AIP-140-SB	12 to 24			
	AIP-140-SB-DUP				
AIP141	AIP-141-SF	0 to 6	Grab	East of James Resch Trust property (Gulfside Supply, Inc.)	Determine the presence or absence of hazardous substances
	AIP-141-SB	12 to 24			
AIP142	AIP-142-SF	0 to 6	Grab	East of the David Thornton property	Determine the presence or absence of hazardous substances
	AIP-142-SB	12 to 24			

Notes:

AIP	Allied Industrial Park
bgs	Below ground surface
Bldg.	Building
DUP	Duplicate
ID	Identification
NE	Northeast
NW	Northwest
SB	Subsurface soil
SE	Southeast
SF	Surface soil
WWTP	Waste water treatment plant

TABLE 2
EXPANDED SITE INSPECTION
GROUND WATER SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	USACE Well ID	Depth of Well (feet bgs)	Sample Type	Location	Rationale
AIP144	AIP-144-MW	MW-45	28.41	Grab	South of AIP WWTP	To assess whether on-site contamination is affecting underlying ground water
AIP145	AIP-145-MW	MW-57	42.35	Grab	North of Drainage Ditch 3	To assess whether on-site contamination is affecting underlying ground water
	AIP-145-MW-DUP					
AIP146	AIP-146-MW	MW-66	37.30	Grab	West of Drainage Ditch 3, north of railroad spur	To assess whether on-site contamination is affecting underlying ground water
AIP147	AIP-147-MW	MW-70	38.42	Grab	North of Drainage Ditch 4 and railroad spur	To assess whether on-site contamination is affecting underlying ground water
AIP148	AIP-148-MW	MW-30	43.33	Grab	Background monitoring well location, northeast corner of AIP	Background ground water sample for comparison to on-site sample results
AIP149	AIP-149-MW	MW-80	40	Grab	South of Drainage Ditch 3, north of railroad spur	To assess whether on-site contamination is affecting underlying ground water

Notes:

AIP	Allied Industrial Park	MW	Monitoring well
bgs	Below ground surface	USACE	U.S. Army Corps of Engineers
Bldg.	Building	WWTP	Waste water treatment plant
DUP	Duplicate		
ID	Identification		

TABLE 3
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	Depth (inches bgs)	Sample Type	Location	Rationale
Drainage Ditch 2					
DD502	DD-502-SD	0 to 3	Grab	Background location, AIP western boundary drainage	Background sample for comparison to downgradient sample results.
DD503	DD-503-SD	0 to 3	Grab	Background location, AIP western boundary drainage	Background sample for comparison to downgradient sample results.
DD504	DD-504-SD	0 to 3	Grab	AIP western boundary drainage, west of AIP WWTP	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
DD505	DD-505-SD	0 to 3	Grab	AIP western boundary drainage, east of Armstrong WWTP	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
DD506	DD-506-SD	0 to 3	Grab	Drainage easement that receives drainage from AIP and Armstrong	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
DD507	DD-507-SW	NA	Grab	Drainage easement that receives drainage from AIP and Armstrong	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
	DD-507-SD	0 to 3			
DD508	DD-508-SW	NA	Grab	Drainage easement that receives drainage from AIP, Armstrong, FMNOL	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
	DD-508-SD	0 to 3			

TABLE 3
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	Depth (inches bgs)	Sample Type	Location	Rationale
DD509	DD-509-SD	0 to 3	Grab	Drainage easement that receives drainage from AIP, Armstrong, FMNOL	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
DD510	DD-510-SD	0 to 3	Grab	Drainage easement that receives drainage from AIP, Armstrong, FMNOL	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
Drainage Ditch 3					
DD511	DD-511-SD	0 to 3	Grab	Receives drainage from AIP, south of Politex US, Inc.	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
DD512	DD-512-SD	0 to 3	Grab	Receives drainage from AIP, north of railroad spur	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
DD513	DD-513-SW	NA	Grab	Receives drainage from AIP, south of railroad spur	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
	DD-513-SD	0 to 3			
DD514	DD-514-SW	NA	Grab	Receives drainage from AIP, Armstrong, FMNOL, north of Rocky Creek	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
	DD-514-SD	0 to 3			
Drainage Ditch 4					
DD515	DD-515-SD	0 to 3	Grab	Receives drainage from AIP, west of Michael R. Smith property	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek

TABLE 3
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	Depth (inches bgs)	Sample Type	Location	Rationale
DD516	DD-516-SD	0 to 3	Grab	Receives drainage from AIP, west of rail spur receiving area	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
	DD-516-SD-DUP				
DD517	DD-517-SD	0 to 3	Grab	Receives drainage from AIP, south of rail spur receiving area	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
DD518	DD-518-SD	0 to 3	Grab	Receives drainage from AIP, north of Rocky Creek Water Reclamation Facility	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek
DD519	DD-519-SD	0 to 3	Grab	Receives drainage from AIP, north of PPE 3	To assess whether on-site contaminants have entered drainage ditches to Rocky Creek

Notes:

AIP	Allied Indusrial Park
Armstrong	Armstrong World Industries
bgs	Below ground surface
DD	Drianage ditch
DUP	Duplicate
FMNOL	Former Macon Naval Ordnance Landfill
ID	Identification
NA	Not applicable
PPE	Probable point of entry
SD	Sediment
SW	Surface water

TABLE 4
EXPANDED SITE INSPECTION
ROCKY CREEK
SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	Depth (inches bgs)	Sample Type	Location	Rationale
RC400	RC-400-SW	NA	Grab	Background location, upstream, east of Broadway, south branch	To assess whether on-site contamination has migrated to Rocky Creek
	RC-400-SD	0 to 3			
RC401	RC-401-SW	NA	Grab	Background location, upstream, east of Broadway, north branch	To assess whether on-site contamination has migrated to Rocky Creek
	RC-401-SD	0 to 3			
RC402	RC-402-SW	NA	Grab	Background location, upstream, between Broadway and railroad tracks	To assess whether on-site contamination has migrated to Rocky Creek
	RC-402-SD	0 to 3			
RC403	RC-403-SW	NA	Grab	Background location, west of railroad tracks and Armstrong remote landfill	To assess whether on-site contamination has migrated to Rocky Creek
	RC-403-SW-DUP				
	RC-403-SD	0 to 3			
	RC-403-SD-DUP				
RC404	RC-404-SW	NA	Grab	East of railroad tracks, south of Armstrong remote landfill	To assess whether on-site contamination has migrated to Rocky Creek
	RC-404-SD	0 to 3			
RC405	RC-405-SW	NA	Grab	Downstream from PPE 1	To assess whether on-site contamination has migrated to Rocky Creek
	RC-405-SD	0 to 3			
RC406	RC-406-SW	NA	Grab	At PPE 2	To assess whether on-site contamination has migrated to Rocky Creek
	RC-406-SD	0 to 3			

TABLE 4
EXPANDED SITE INSPECTION
ROCKY CREEK
SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	Depth (inches bgs)	Sample Type	Location	Rationale
RC407	RC-407-SW	NA	Grab	Between PPE 2 and PPE 3	To assess whether on-site contamination has migrated to Rocky Creek
	RC-407-SD	0 to 3			
RC408	RC-408-SW	NA	Grab	At PPE 3	To assess whether on-site contamination has migrated to Rocky Creek
	RC-408-SD	0 to 3			
RC409	RC-409-SW	NA	Grab	Downstream from PPE 3	To assess whether on-site contamination has migrated to Rocky Creek
	RC-409-SD	0 to 3			

Notes:

bgs	Below ground surface
DUP	Duplicate
ID	Identification
NA	Not applicable
PPE	Probable point of entry
RC	Rocky Creek
SD	Sediment
SW	Surface water

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Area Near Building 105		Area Near Building 105E		Area Near Building 105
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-101-SF**	**AIP-102-SF**	**AIP-103-SF**	**AIP-104-SF**	**AIP-105-SF**
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	81 J	7.7 U	8.8 U	9.0 U	7.6 U	9.1 U
cis-1,2-Dichloroethene	10,000,000	4.5 U	3.9 U	4.4 U	4.5 U	3.8 U	4.6 U
Methyl Acetate	1,000,000,000	4.5 U	3.9 U	4.4 U	4.5 U	3.8 U	4.6 U
Methyl Ethyl Ketone	190,000,000	9.1 U	7.7 U	8.8 U	9.0 U	7.6 U	9.1 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	49 J[1]	190 U	190 U	200 U	200 U	180 U
Acenaphthylene	NE	200 U	190 U	190 U	200 U	200 U	180 U
Acetophenone	100,000,000	200 U	190 U	190 U	200 U	200 U	180 U
Anthracene	170,000,000	56 J[1]	190 UJ	190 UJ	200 UJ	200 UJ	180 UJ
Benzaldehyde	100,000,000	200 U	190 U	190 U	200 U	200 U	180 U
Benzo(a)anthracene	2,100	270	190 U	190 U	200 U	200 U	64 J[1]
Benzo(a)pyrene	210	290	190 U	190 U	200 U	200 U	120 J[1]
Benzo(b)fluoranthene	2,100	360	190 U	190 U	200 U	200 U	200
Benzo(g,h,i)perylene	NE	140 J[1]	190 U	190 U	200 U	200 U	180 U
Benzo(k)fluoranthene	21,000	320 J	190 U	190 U	200 U	200 U	170 J[1]
Bis(2-ethylhexyl) phthalate	120,000	200 UJ	190 U	190 U	200 UJ	200 UJ	180 UJ
Carbazole	NE	90 J[1]	190 U	190 U	200 UJ	200 UJ	180 UJ
Chrysene	210,000	330	190 U	190 U	200 U	200 U	110 J[1]
Dibenzo(a,h)anthracene	210	50 J[1]	190 U	190 U	200 U	200 U	38 J[1]
Di-n-octylphthalate	NE	200 U	190 U	190 U	200 U	200 U	180 U
Fluoranthene	22,000,000	630	190 U	190 U	200 U	200 U	87 J[1]
Indeno (1,2,3-cd) pyrene	2,100	180 J[1]	190 U	190 U	200 U	200 U	85 J[1]
Naphthalene	20,000	200 U	190 U	190 U	200 U	200 U	180 U
Phenanthrene	NE	360	190 U	190 U	200 U	200 U	180 U
Pyrene	17,000,000	500	190 U	190 U	200 U	200 U	180 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

Analyte	EPA Apri 2009 Regional Screening Level	Background	Area Near Building 105		Area Near Building 105E		Area Near Building 105
	Industrial Soil	AIP-100-SF	AIP-101-SF	AIP-102-SF	AIP-103-SF	AIP-104-SF	AIP-105-SF
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	3.8 U	3.7 U	3.7 U	3.8 U	3.8 U	3.5 U
4,4'-DDE (p,p'-DDE)	5,100	5.7	**24**	**41**	**58**	**49**	**24**
4,4'-DDT (p,p'-DDT)	7,000	9.5	2.7 J[1]	8.4	3.5 J[1]	5.6	6.0
alpha-Chlordane	6,500[a]	2.0 U	1.9 U	1.9 U	2.0 U	2.0 U	1.8 U
Dieldrin	110	2.4 J[1]	3.7 U	3.7 U	3.8 U	3.8 U	1.1 J[1]
Endosulfan I (alpha)	3,700,000[b]	2.0 U	1.9 U	1.9 U	2.0 U	2.0 U	1.8 U
Endosulfan II (beta)	3,700,000[b]	3.8 U	3.7 U	1.3 J[1]	3.8 U	3.8 U	3.5 U
Endrin	180,000	3.8 U	3.7 U	3.7 U	3.8 U	3.8 U	3.5 U
Endrin aldehyde	NE	3.8 U	3.7 U	3.7 U	3.8 U	3.8 U	3.5 U
Endrin ketone	NE	3.8 U	3.7 U	3.7 U	3.8 U	3.8 U	0.89 J[1]
gamma-Chlordane	6,500[a]	2.0 U	0.50 J[1]	1.9 U	0.58 J[1]	2.0 U	0.64 J[1]
Heptachlor epoxide	190	0.51 J[1]	1.9 U	1.9 U	0.81 J[1]	2.0 U	1.8 U
Methoxychlor	3,100,000	20 U	19 U	19 U	20 U	20 U	18 U
Toxaphene	1,600	200 U	190 U	190 U	200 U	200 U	180 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1248 (Aroclor 1248)	740	38 UJ	37 UJ	37 UJ	38 UJ	38 UJ	35 UJ
PCB-1254 (Aroclor 1254)	740	21 J[1]	37 U	37 U	38 U	38 U	35 U
PCB-1260 (Aroclor 1260)	740	68	37 U	37 U	38 U	38 U	35 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	**Background**	**Area Near Building 107**		**Area Near Building 106**	**Area Near Building 108**	**Area Near Building 106A**
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-106-SF**	**AIP-107-SF**	**AIP-108-SF**	**AIP-109-SF**	**AIP-110-SF**
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	81 J	26	43	15 U	46	49
cis-1,2-Dichloroethene	10,000,000	4.5 U	7.5 U	7.4 U	7.7 U	7.4 U	7.2 U
Methyl Acetate	1,000,000,000	4.5 U	7.5 U	7.4 UJ	7.7 U	5.0 J[1]	7.2 U
Methyl Ethyl Ketone	190,000,000	9.1 U	15 U	15 U	15 U	15 U	14 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	49 J[1]	190 U	200 U	180 U	190 U	180 U
Acenaphthylene	NE	200 U	190 U	200 U	180 U	190 U	180 U
Acetophenone	100,000,000	200 U	190 U	200 U	180 U	190 U	180 U
Anthracene	170,000,000	56 J[1]	190 U	200 U	180 U	24 J[1]	180 U
Benzaldehyde	100,000,000	200 U	190 U	200 U	180 U	190 U	180 U
Benzo(a)anthracene	2,100	270	29 J[1]	71 J[1]	180 U	110 J[1]	180 U
Benzo(a)pyrene	210	290	35 J[1]	69 J[1]	180 U	92 J[1]	180 U
Benzo(b)fluoranthene	2,100	360	35 J[1]	92 J[1]	180 U	100 J[1]	180 U
Benzo(g,h,i)perylene	NE	140 J[1]	36 J[1]	58 J[1]	180 U	67 J[1]	180 U
Benzo(k)fluoranthene	21,000	320 J	25 J[1]	36 J[1]	180 U	68 J[1]	180 U
Bis(2-ethylhexyl) phthalate	120,000	200 UJ	190 UJ	200 UJ	180 UJ	190 UJ	180 UJ
Carbazole	NE	90 J[1]	190 U	200 U	180 U	25 J[1]	180 U
Chrysene	210,000	330	33 J[1]	77 J[1]	180 U	110 J[1]	180 U
Dibenzo(a,h)anthracene	210	50 J[1]	190 U	200 U	180 U	30 J[1]	180 U
Di-n-octylphthalate	NE	200 U	190 UJ	200 J[1]	180 UJ	190 UJ	180 UJ
Fluoranthene	22,000,000	630	55 J[1]	150 J[1]	21 J[1]	200	180 U
Indeno (1,2,3-cd) pyrene	2,100	180 J[1]	30 J[1]	67 J[1]	180 U	69 J[1]	180 U
Naphthalene	20,000	200 U	190 U	200 U	180 U	190 U	180 U
Phenanthrene	NE	360	20 J[1]	90 J[1]	180 U	110 J[1]	180 U
Pyrene	17,000,000	500	48 J[1]	130 J[1]	19 J[1]	160 J[1]	180 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Area Near Building 107		Area Near Building 106	Area Near Building 108	Area Near Building 106A
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-106-SF**	**AIP-107-SF**	**AIP-108-SF**	**AIP-109-SF**	**AIP-110-SF**
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	3.8 U	3.8 U	3.7 U	3.6 U	3.7 U	3.6 U
4,4'-DDE (p,p'-DDE)	5,100	5.7	**19**	2.2 J[1]	**35**	9.0	13
4,4'-DDT (p,p'-DDT)	7,000	9.5	3.8 U	3.7 U	6.3 J	1.5 J[1]	11 J
alpha-Chlordane	6,500[a]	2.0 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
Dieldrin	110	2.4 J[1]	3.8 U	3.7 U	3.6 U	3.7 U	3.6 U
Endosulfan I (alpha)	3,700,000[b]	2.0 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
Endosulfan II (beta)	3,700,000[b]	3.8 U	3.8 U	3.7 U	3.6 U	3.7 U	3.6 U
Endrin	180,000	3.8 U	3.8 U	3.7 U	3.6 U	3.7 U	3.6 U
Endrin aldehyde	NE	3.8 U	3.8 U	3.7 U	3.6 U	3.7 U	3.6 U
Endrin ketone	NE	3.8 U	3.8 U	3.7 U	3.6 U	3.7 U	3.6 U
gamma-Chlordane	6,500[a]	2.0 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
Heptachlor epoxide	190	0.51 J[1]	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
Methoxychlor	3,100,000	20 U	19 U	19 U	19 U	19 U	19 U
Toxaphene	1,600	200 U	190 U	190 U	190 U	190 U	190 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1248 (Aroclor 1248)	740	38 UJ	38 U	37 U	36 U	37 U	36 U
PCB-1254 (Aroclor 1254)	740	21 J[1]	38 U	37 U	36 U	37 U	36 U
PCB-1260 (Aroclor 1260)	740	68	38 U	4.7 J[1]	36 U	37 U	36 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

Analyte	EPA Apri 2009 Regional Screening Level	Background	Area Near Building 109		Rail Spur Receiving Area		
	Industrial Soil	AIP-100-SF	AIP-111-SF	AIP-112-SF	AIP-113-SF	AIP-114-SF	AIP-115-SF
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	81 J	78 J	9.5 UJ	8.9 UJ	7.2 U	11 UJ
cis-1,2-Dichloroethene	10,000,000	4.5 U	4.0 U	4.8 U	4.4 U	3.6 U	5.3 U
Methyl Acetate	1,000,000,000	4.5 U	1.5 J[1]	4.8 U	4.4 U	3.6 U	2.2 J[1]
Methyl Ethyl Ketone	190,000,000	9.1 U	8.0 U	9.5 U	8.9 U	7.2 U	11 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	49 J[1]	190 U	200 U	190 U	180 U	180 U
Acenaphthylene	NE	200 U	190 U	200 U	190 U	180 U	180 U
Acetophenone	100,000,000	200 U	190 U	200 U	190 U	47 J[1]	180 U
Anthracene	170,000,000	56 J[1]	190 UJ	200 UJ	190 UJ	180 UJ	180 UJ
Benzaldehyde	100,000,000	200 U	190 U	200 U	190 U	180 U	180 U
Benzo(a)anthracene	2,100	270	190 U	200 U	190 U	180 U	76 J[1]
Benzo(a)pyrene	210	290	190 U	200 U	190 U	180 U	84 J[1]
Benzo(b)fluoranthene	2,100	360	53 J[1]	200 U	190 U	180 U	80 J[1]
Benzo(g,h,i)perylene	NE	140 J[1]	190 UJ	200 U	190 U	180 U	180 U
Benzo(k)fluoranthene	21,000	320 J	190 U	200 U	190 U	180 U	98 J[1]
Bis(2-ethylhexyl) phthalate	120,000	200 UJ	190 UJ	200 UJ	190 UJ	180 UJ	180 UJ
Carbazole	NE	90 J[1]	190 UJ	200 UJ	190 UJ	180 UJ	180 UJ
Chrysene	210,000	330	28 J[1]	200 U	190 U	180 U	98 J[1]
Dibenzo(a,h)anthracene	210	50 J[1]	190 UJ	200 U	190 U	180 U	180 U
Di-n-octylphthalate	NE	200 U	190 U	200 U	190 U	180 U	180 U
Fluoranthene	22,000,000	630	190 U	200 U	190 U	180 U	190
Indeno (1,2,3-cd) pyrene	2,100	180 J[1]	190 UJ	200 U	190 U	180 U	62 J[1]
Naphthalene	20,000	200 U	190 U	200 U	190 U	180 U	180 U
Phenanthrene	NE	360	190 U	200 U	190 U	180 U	65 J[1]
Pyrene	17,000,000	500	190 U	200 U	190 U	180 U	180 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Area Near Building 109		Rail Spur Receiving Area		
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-111-SF**	**AIP-112-SF**	**AIP-113-SF**	**AIP-114-SF**	**AIP-115-SF**
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	3.8 U	11 U	3.9 U	3.7 U	3.6 U	3.6 U
4,4'-DDE (p,p'-DDE)	5,100	5.7	**150**	1.4 J[1]	3.7 U	1.7 J[1]	1.2 J[1]
4,4'-DDT (p,p'-DDT)	7,000	9.5	210 U	3.9 U	3.7 U	6.1	1.5 J[1]
alpha-Chlordane	6,500[a]	2.0 U	3.7 U	2.0 U	1.9 U	1.8 U	1.8 U
Dieldrin	110	2.4 J[1]	41 U	3.9 U	3.7 U	3.6 U	1.2 J[1]
Endosulfan I (alpha)	3,700,000[b]	2.0 U	3.7 U	2.0 U	1.9 U	1.8 U	1.8 U
Endosulfan II (beta)	3,700,000[b]	3.8 U	7.3 U	3.9 U	3.7 U	3.6 U	3.6 U
Endrin	180,000	3.8 U	**80**	3.9 U	3.7 U	3.6 U	3.6 U
Endrin aldehyde	NE	3.8 U	28 U	3.9 U	3.7 U	3.6 U	3.6 U
Endrin ketone	NE	3.8 U	9.0 U	3.9 U	3.7 U	3.6 U	3.6 U
gamma-Chlordane	6,500[a]	2.0 U	3.7 U	2.0 U	1.9 U	0.49 J[1]	1.8 U
Heptachlor epoxide	190	0.51 J[1]	9.0 U	2.0 U	1.9 U	1.8 U	1.8 U
Methoxychlor	3,100,000	20 U	**46**	20 U	19 U	18 U	18 U
Toxaphene	1,600	200 U	370 U	200 U	190 U	180 U	180 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1248 (Aroclor 1248)	740	38 UJ	180 UJ	39 UJ	37 UJ	36 UJ	36 UJ
PCB-1254 (Aroclor 1254)	740	21 J[1]	180 U	39 U	37 U	36 U	36 U
PCB-1260 (Aroclor 1260)	740	68	**11,000**	39 U	37 U	36 U	36 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Area Near Building 198				Former Location of the Mixing/Blending Houses
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-116-SF**	**AIP-117-SF**	**AIP-118-SF**	**AIP-119-SF**	**AIP-120-SF**
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	81 J	R	R	R	R	R
cis-1,2-Dichloroethene	10,000,000	4.5 U	7.4 U	7.0 U	7.0 U	7.3 U	7.2 U
Methyl Acetate	1,000,000,000	4.5 U	7.4 U	7.0 U	7.0 U	7.3 UJ	7.2 U
Methyl Ethyl Ketone	190,000,000	9.1 U	15 U	14 U	14 U	15 UJ	14 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	49 J[1]	180 U	190 U	180 U	180 U	180 U
Acenaphthylene	NE	200 U	180 U	190 U	180 U	180 U	180 U
Acetophenone	100,000,000	200 U	180 U	190 U	180 U	180 U	180 U
Anthracene	170,000,000	56 J[1]	180 U	190 U	180 U	180 U	180 U
Benzaldehyde	100,000,000	200 U	180 U	190 U	180 U	180 U	180 U
Benzo(a)anthracene	2,100	270	180 U	190 U	180 U	180 U	180 U
Benzo(a)pyrene	210	290	180 U	190 U	180 U	180 U	180 U
Benzo(b)fluoranthene	2,100	360	180 U	190 U	180 U	180 U	180 U
Benzo(g,h,i)perylene	NE	140 J[1]	180 U	190 U	180 U	180 U	180 U
Benzo(k)fluoranthene	21,000	320 J	180 U	190 U	180 U	180 U	180 U
Bis(2-ethylhexyl) phthalate	120,000	200 UJ	180 UJ	190 UJ	180 UJ	180 UJ	180 UJ
Carbazole	NE	90 J[1]	180 U	190 U	180 U	180 U	180 U
Chrysene	210,000	330	180 U	190 U	180 U	180 U	180 U
Dibenzo(a,h)anthracene	210	50 J[1]	180 U	190 U	180 U	180 U	180 U
Di-n-octylphthalate	NE	200 U	180 UJ	190 UJ	180 UJ	180 UJ	180 UJ
Fluoranthene	22,000,000	630	180 U	190 U	180 U	180 U	24 J[1]
Indeno (1,2,3-cd) pyrene	2,100	180 J[1]	180 U	190 U	180 U	180 U	180 U
Naphthalene	20,000	200 U	180 U	190 U	180 U	180 U	180 U
Phenanthrene	NE	360	180 U	190 U	180 U	180 U	180 U
Pyrene	17,000,000	500	180 U	190 U	180 U	180 U	21 J[1]

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

Analyte	EPA Apri 2009 Regional Screening Level	Background	Area Near Building 198				Former Location of the Mixing/Blending Houses
	Industrial Soil	AIP-100-SF	AIP-116-SF	AIP-117-SF	AIP-118-SF	AIP-119-SF	AIP-120-SF
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	3.8 U	3.5 U	3.6 U	3.3 U	3.5 U	3.5 U
4,4'-DDE (p,p'-DDE)	5,100	5.7	3.5 U	3.6 U	3.3 U	3.5 U	3.5 U
4,4'-DDT (p,p'-DDT)	7,000	9.5	3.5 U	3.6 U	3.3 U	3.5 U	3.5 U
alpha-Chlordane	6,500[a]	2.0 U	1.8 U	1.8 U	1.7 U	1.8 U	1.8 U
Dieldrin	110	2.4 J[1]	3.5 U	3.6 U	3.3 U	3.5 U	3.5 U
Endosulfan I (alpha)	3,700,000[b]	2.0 U	1.8 U	1.8 U	1.7 U	1.8 U	1.8 U
Endosulfan II (beta)	3,700,000[b]	3.8 U	3.5 U	3.6 U	3.3 U	3.5 U	3.5 U
Endrin	180,000	3.8 U	3.5 U	3.6 U	3.3 U	3.5 U	3.5 U
Endrin aldehyde	NE	3.8 U	3.5 U	3.6 U	3.3 U	3.5 U	3.5 U
Endrin ketone	NE	3.8 U	3.5 U	3.6 U	3.3 U	3.5 U	3.5 U
gamma-Chlordane	6,500[a]	2.0 U	1.8 U	1.8 U	1.7 U	1.8 U	1.8 U
Heptachlor epoxide	190	0.51 J[1]	1.8 U	1.8 U	1.7 U	1.8 U	1.8 U
Methoxychlor	3,100,000	20 U	18 U	18 U	17 U	18 U	18 U
Toxaphene	1,600	200 U	180 U	180 U	170 U	180 U	180 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1248 (Aroclor 1248)	740	38 UJ	35 U	36 U	33 U	35 U	35 U
PCB-1254 (Aroclor 1254)	740	21 J[1]	35 U	36 U	33 U	35 U	35 U
PCB-1260 (Aroclor 1260)	740	68	35 U	36 U	33 U	35 U	35 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Former Location of the Mixing/Blending Houses				
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-121-SF**	**AIP-122-SF**	**AIP-123-SF**	**AIP-124-SF**	**AIP-125-SF**
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	81 J	R	16 U	R	R	R
cis-1,2-Dichloroethene	10,000,000	4.5 U	7.2 U	8.2 U	7.7 U	8.1 U	7.3 U
Methyl Acetate	1,000,000,000	4.5 U	7.2 UJ	8.2 U	7.7 UJ	8.1 UJ	7.3 U
Methyl Ethyl Ketone	190,000,000	9.1 U	14 UJ	16 U	15 UJ	16 UJ	15 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	49 J[1]	180 U	180 U	190 U	180 U	180 U
Acenaphthylene	NE	200 U	180 U	180 U	190 U	180 U	180 U
Acetophenone	100,000,000	200 U	180 U	180 U	190 U	180 U	180 U
Anthracene	170,000,000	56 J[1]	180 U	180 U	190 U	180 U	180 U
Benzaldehyde	100,000,000	200 U	180 U	180 U	190 U	180 U	180 U
Benzo(a)anthracene	2,100	270	180 U	180 U	190 U	180 U	180 U
Benzo(a)pyrene	210	290	180 U	180 U	190 U	180 U	180 U
Benzo(b)fluoranthene	2,100	360	180 U	180 U	190 U	180 U	180 U
Benzo(g,h,i)perylene	NE	140 J[1]	180 U	180 U	190 U	180 U	180 U
Benzo(k)fluoranthene	21,000	320 J	180 U	180 U	190 U	180 U	180 U
Bis(2-ethylhexyl) phthalate	120,000	200 UJ	180 UJ	180 UJ	190 UJ	180 UJ	180 UJ
Carbazole	NE	90 J[1]	180 U	180 U	190 U	180 U	180 U
Chrysene	210,000	330	180 U	180 U	190 U	180 U	180 U
Dibenzo(a,h)anthracene	210	50 J[1]	180 U	180 U	190 U	180 U	180 U
Di-n-octylphthalate	NE	200 U	180 UJ	180 UJ	190 UJ	180 UJ	180 UJ
Fluoranthene	22,000,000	630	180 U	180 U	190 U	180 U	180 U
Indeno (1,2,3-cd) pyrene	2,100	180 J[1]	180 U	180 U	190 U	180 U	180 U
Naphthalene	20,000	200 U	180 U	180 U	190 U	180 U	180 U
Phenanthrene	NE	360	180 U	180 U	190 U	180 U	180 U
Pyrene	17,000,000	500	180 U	180 U	190 U	180 U	180 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

Analyte	EPA Apri 2009 Regional Screening Level	Background	Former Location of the Mixing/Blending Houses				
	Industrial Soil	AIP-100-SF	AIP-121-SF	AIP-122-SF	AIP-123-SF	AIP-124-SF	AIP-125-SF
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	3.8 U	3.6 U	3.5 U	3.7 U	3.6 U	3.5 U
4,4'-DDE (p,p'-DDE)	5,100	5.7	3.6 U	3.5 U	3.7 U	3.6 U	3.5 U
4,4'-DDT (p,p'-DDT)	7,000	9.5	3.6 U	3.5 U	3.7 U	3.6 U	3.5 U
alpha-Chlordane	6,500[a]	2.0 U	1.8 U	1.8 U	1.9 U	1.8 U	1.8 U
Dieldrin	110	2.4 J[1]	3.6 U	3.5 U	3.7 U	3.6 U	3.5 U
Endosulfan I (alpha)	3,700,000[b]	2.0 U	1.8 U	1.8 U	1.9 U	1.8 U	1.8 U
Endosulfan II (beta)	3,700,000[b]	3.8 U	3.6 U	3.5 U	3.7 U	3.6 U	3.5 U
Endrin	180,000	3.8 U	3.6 U	3.5 U	3.7 U	3.6 U	3.5 U
Endrin aldehyde	NE	3.8 U	3.6 U	3.5 U	3.7 U	3.6 U	3.5 U
Endrin ketone	NE	3.8 U	3.6 U	3.5 U	3.7 U	3.6 U	3.5 U
gamma-Chlordane	6,500[a]	2.0 U	1.8 U	1.8 U	1.9 U	1.8 U	1.8 U
Heptachlor epoxide	190	0.51 J[1]	1.8 U	1.8 U	1.9 U	1.8 U	1.8 U
Methoxychlor	3,100,000	20 U	18 U	18 U	19 U	18 U	18 U
Toxaphene	1,600	200 U	180 U	180 U	190 U	180 U	180 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1248 (Aroclor 1248)	740	38 UJ	36 U	35 U	37 U	36 U	35 U
PCB-1254 (Aroclor 1254)	740	21 J[1]	36 U	35 U	37 U	36 U	35 U
PCB-1260 (Aroclor 1260)	740	68	36 U	35 U	37 U	36 U	35 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Area Near Building 5				Area Near the Transformer House (Building 4)
Analyte	Industrial Soil	AIP-100-SF	AIP-126-SF	AIP-127-SF	AIP-128-SF	AIP-129-SF	AIP-130-SF
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	81 J	9.4 U	8.6 U	7.3 U	7.9 U	10 U
cis-1,2-Dichloroethene	10,000,000	4.5 U	4.7 U	4.3 U	3.7 U	4.0 U	5.1 U
Methyl Acetate	1,000,000,000	4.5 U	1.5 J[1]	4.3 U	3.7 U	4.0 U	5.1 U
Methyl Ethyl Ketone	190,000,000	9.1 U	9.4 U	8.6 U	7.3 U	7.9 U	10 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	49 J[1]	190 U	200 U	180 U	180 U	240 U
Acenaphthylene	NE	200 U	190 U	200 U	180 U	**290**	240 U
Acetophenone	100,000,000	200 U	190 U	200 U	180 U	120 J[1]	240 U
Anthracene	170,000,000	56 J[1]	190 UJ	200 UJ	180 UJ	**280 J-**	240 UJ
Benzaldehyde	100,000,000	200 U	190 U	200 U	180 U	180 U	240 U
Benzo(a)anthracene	2,100	270	190 U	200 U	36 J[1]	510	240 U
Benzo(a)pyrene	210	290	190 U	200 U	37 J[1]	810	240 U
Benzo(b)fluoranthene	2,100	360	190 U	200 U	59 J[1]	**1,700**	240 U
Benzo(g,h,i)perylene	NE	140 J[1]	190 U	200 U	180 U	390	240 U
Benzo(k)fluoranthene	21,000	320 J	190 U	200 U	180 U	**1,000**	240 U
Bis(2-ethylhexyl) phthalate	120,000	200 UJ	190 UJ	200 UJ	180 UJ	180 UJ	240 UJ
Carbazole	NE	90 J[1]	190 UJ	200 UJ	180 UJ	55 J[1]	240 UJ
Chrysene	210,000	330	190 U	200 U	52 J[1]	770	240 U
Dibenzo(a,h)anthracene	210	50 J[1]	190 U	200 U	180 U	**310**	240 U
Di-n-octylphthalate	NE	200 U	190 U	200 U	180 U	180 U	240 U
Fluoranthene	22,000,000	630	190 U	200 U	86 J[1]	480	46 J[1]
Indeno (1,2,3-cd) pyrene	2,100	180 J[1]	190 U	200 U	180 U	**660**	240 U
Naphthalene	20,000	200 U	190 U	200 U	180 U	180 U	240 U
Phenanthrene	NE	360	190 U	200 U	180 U	41 J[1]	240 U
Pyrene	17,000,000	500	190 U	200 U	180 U	930	240 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Area Near Building 5				Area Near the Transformer House (Building 4)
Analyte	Industrial Soil	AIP-100-SF	AIP-126-SF	AIP-127-SF	AIP-128-SF	AIP-129-SF	AIP-130-SF
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	3.8 U	3.6 U	3.8 U	3.6 U	3.5 U	4.6 U
4,4'-DDE (p,p'-DDE)	5,100	5.7	**47**	**97**	**43**	**140**	**32**
4,4'-DDT (p,p'-DDT)	7,000	9.5	9.7	27	21	**66**	7.7
alpha-Chlordane	6,500[a]	2.0 U	0.52 J[1]	2.0 U	1.8 U	1.8	2.4 U
Dieldrin	110	2.4 J[1]	1.1 J[1]	2.2 J[1]	3.6 U	3.3 J[1]	4.6 U
Endosulfan I (alpha)	3,700,000[b]	2.0 U	1.9 U	2.0 U	1.8 U	1.8 U	2.4 U
Endosulfan II (beta)	3,700,000[b]	3.8 U	3.6 U	3.8 U	3.6 U	3.4 U	4.6 U
Endrin	180,000	3.8 U	0.86 J[1]	0.89 J[1]	3.6 U	3.4 U	4.6 U
Endrin aldehyde	NE	3.8 U	3.6 U	3.8 U	4.2 U	**3.6**	4.6 U
Endrin ketone	NE	3.8 U	3.6 U	3.8 U	3.6 U	**5.4**	4.6 U
gamma-Chlordane	6,500[a]	2.0 U	1.9 U	2.0 U	1.8 U	1.8 U	0.65 J[1]
Heptachlor epoxide	190	0.51 J[1]	0.61 J[1]	0.84 J[1]	0.79 J[1]	1.8 U	2.4 U
Methoxychlor	3,100,000	20 U	19 U	20 U	18 U	11 J[1]	24 U
Toxaphene	1,600	200 U	190 U	200 U	180 U	180 U	240 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1248 (Aroclor 1248)	740	38 UJ	36 UJ	38 UJ	36 UJ	34 UJ	46 UJ
PCB-1254 (Aroclor 1254)	740	21 J[1]	36 U	38 U	36 U	34 U	46 U
PCB-1260 (Aroclor 1260)	740	68	36 U	38 U	65	34 U	46 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Area Near the Transformer House (Building 104)	Oil Recovery Area			Waste Water Treatment Plant Area
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-131-SF**	**AIP-132-SF**	**AIP-132-SF-DUP**	**AIP-133-SF**	**AIP-134-SF**
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	81 J	7.9 U	130	92	R	8.5 UJ
cis-1,2-Dichloroethene	10,000,000	4.5 U	3.9 U	0.54 J[1]	1.5 J[1]	3.9 U	4.3 U
Methyl Acetate	1,000,000,000	4.5 U	3.9 U	3.9 U	4.7 U	3.9 UJ	2.4 J[1]
Methyl Ethyl Ketone	190,000,000	9.1 U	7.9 U	**41**	**20**	7.8 U	8.5 UJ
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	49 J[1]	180 U	190 U	4,400 U	190 U	200 U
Acenaphthylene	NE	200 U	180 U	190 U	4,400 U	190 U	200 U
Acetophenone	100,000,000	200 U	180 U	75 J[1]	4,400 U	190 U	48 J[1]
Anthracene	170,000,000	56 J[1]	180 UJ	190 UJ	4,400 UJ	190 UJ	200 UJ
Benzaldehyde	100,000,000	200 U	180 U	190 U	4,400 U	190 U	63 J[1]
Benzo(a)anthracene	2,100	270	98 J[1]	190 UJ	4,400 U	190 U	200 U
Benzo(a)pyrene	210	290	99 J[1]	190 UJ	4,400 U	190 U	200 U
Benzo(b)fluoranthene	2,100	360	120 J[1]	190 UJ	4,400 U	190 U	57 J[1]
Benzo(g,h,i)perylene	NE	140 J[1]	180 U	190 UJ	4,400 U	190 U	200 U
Benzo(k)fluoranthene	21,000	320 J	100 J[1]	190 UJ	4,400 U	190 U	200 U
Bis(2-ethylhexyl) phthalate	120,000	200 UJ	180 UJ	190 UJ	4,400 U	190 U	200 UJ
Carbazole	NE	90 J[1]	49 J[1]	190 UJ	4,400 UJ	190 U	200 UJ
Chrysene	210,000	330	130 J[1]	190 UJ	4,400 U	190 U	44 J[1]
Dibenzo(a,h)anthracene	210	50 J[1]	180 U	190 UJ	4,400 U	190 U	200 U
Di-n-octylphthalate	NE	200 U	180 U	190 UJ	4,400 U	190 U	200 U
Fluoranthene	22,000,000	630	340	190 U	4,400 U	190 U	55 J[1]
Indeno (1,2,3-cd) pyrene	2,100	180 J[1]	68 J[1]	190 UJ	4,400 U	190 U	200 U
Naphthalene	20,000	200 U	41 J[1]	190 U	4,400 U	190 U	200 U
Phenanthrene	NE	360	250	190 U	4,400 U	190 U	200 U
Pyrene	17,000,000	500	250	190 UJ	4,400 U	190 U	200 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Area Near the Transformer House (Building 104)	Oil Recovery Area			Waste Water Treatment Plant Area
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-131-SF**	**AIP-132-SF**	**AIP-132-SF-DUP**	**AIP-133-SF**	**AIP-134-SF**
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	3.8 U	3.5 U	6.7 U	25 J[1]	3.7 U	1.2 J[1]
4,4'-DDE (p,p'-DDE)	5,100	5.7	**100**	8.0	**93**	11 U	3.8 J[1]
4,4'-DDT (p,p'-DDT)	7,000	9.5	**45**	3.8 U	43 U	**180**	8.1
alpha-Chlordane	6,500[a]	2.0 U	1.8 U	27 U	22 U	1.9 U	3.4
Dieldrin	110	2.4 J[1]	**11**	3.7 U	40 J[1]	19 U	1.0 J[1]
Endosulfan I (alpha)	3,700,000[b]	2.0 U	1.8 U	**14**	22 U	1.9 U	2.0 U
Endosulfan II (beta)	3,700,000[b]	3.8 U	3.5 U	3.7 U	43 U	3.7 U	3.8 U
Endrin	180,000	3.8 U	**4.2**	3.7 U	43 U	**25**	3.8 U
Endrin aldehyde	NE	3.8 U	3.5 U	3.7 U	43 U	15 U	3.8 U
Endrin ketone	NE	3.8 U	3.5 U	3.7 U	43 U	7.4 U	3.8 U
gamma-Chlordane	6,500[a]	2.0 U	3.1 U	9.6 U	22 U	2.7 U	**3.3**
Heptachlor epoxide	190	0.51 J[1]	2.9 U	1.9 U	22 U	7.9 U	0.68 J[1]
Methoxychlor	3,100,000	20 U	18 U	19 U	220 U	**35**	20 U
Toxaphene	1,600	200 U	180 U	190 U	2,200 U	190 U	200 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1248 (Aroclor 1248)	740	38 UJ	**110 J-**	37 UJ	430 UJ	37 UJ	38 UJ
PCB-1254 (Aroclor 1254)	740	21 J[1]	**240**	37 U	430 U	37 U	38 U
PCB-1260 (Aroclor 1260)	740	68	82	37 U	210 J[1]	**4,500**	38 U

TETRA TECH

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Waste Water Treatment Plant Area	Northwest Drainage Area	Northeast Drainage Area	South of Blair Moving & Storage Company	Northeast of Blair Moving & Storage Company
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-135-SF**	**AIP-136-SF**	**AIP-137-SF**	**AIP-138-SF**	**AIP-139-SF**
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	81 J	7.7 U	180 J	9.3 U	R	R
cis-1,2-Dichloroethene	10,000,000	4.5 U	3.9 U	4.0 U	4.7 U	4.1 U	4.5 U
Methyl Acetate	1,000,000,000	4.5 U	3.9 U	4.0 U	4.7 U	4.1 UJ	4.5 UJ
Methyl Ethyl Ketone	190,000,000	9.1 U	7.7 U	**20**	9.3 U	8.2 U	9.0 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	49 J[1]	180 U	200 U	210 U	190 U	200 U
Acenaphthylene	NE	200 U	180 U	200 U	210 U	190 U	200 U
Acetophenone	100,000,000	200 U	180 U	200 U	210 U	190 U	200 U
Anthracene	170,000,000	56 J[1]	180 UJ	200 UJ	210 UJ	190 UJ	200 UJ
Benzaldehyde	100,000,000	200 U	180 U	200 U	210 U	190 U	200 U
Benzo(a)anthracene	2,100	270	180 U	200 UJ	46 J[1]	190 UJ	200 U
Benzo(a)pyrene	210	290	180 U	200 U	63 J[1]	190 U	200 U
Benzo(b)fluoranthene	2,100	360	180 U	52 J[1]	85 J[1]	190 U	200 U
Benzo(g,h,i)perylene	NE	140 J[1]	180 U	200 U	210 U	190 U	200 U
Benzo(k)fluoranthene	21,000	320 J	180 U	200 U	210 U	190 U	200 U
Bis(2-ethylhexyl) phthalate	120,000	200 UJ	180 U	**1,200**	210 U	190 U	200 U
Carbazole	NE	90 J[1]	180 UJ	200 UJ	210 UJ	190 U	200 U
Chrysene	210,000	330	180 U	43 J[1]	68 J[1]	190 UJ	200 U
Dibenzo(a,h)anthracene	210	50 J[1]	180 U	200 U	210 U	190 U	200 U
Di-n-octylphthalate	NE	200 U	180 U	200 U	210 U	190 U	200 U
Fluoranthene	22,000,000	630	180 U	61 J[1]	110 J[1]	190 UJ	43 J[1]
Indeno (1,2,3-cd) pyrene	2,100	180 J[1]	180 U	200 U	59 J[1]	190 U	200 U
Naphthalene	20,000	200 U	180 U	200 U	210 U	190 U	200 U
Phenanthrene	NE	360	180 U	200 U	210 U	190 U	200 U
Pyrene	17,000,000	500	180 U	200 UJ	210 UJ	190 UJ	200 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

Analyte	EPA Apri 2009 Regional Screening Level Industrial Soil	Background AIP-100-SF	Waste Water Treatment Plant Area AIP-135-SF	Northwest Drainage Area AIP-136-SF	Northeast Drainage Area AIP-137-SF	South of Blair Moving & Storage Company AIP-138-SF	Northeast of Blair Moving & Storage Company AIP-139-SF
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	3.8 U	3.5 U	2.7 J[1]	4.1 U	3.6 U	3.8 U
4,4'-DDE (p,p'-DDE)	5,100	5.7	**190**	**38**	**37**	1.3 J[1]	2.2 J[1]
4,4'-DDT (p,p'-DDT)	7,000	9.5	19	**100**	16	3.6 U	3.8 U
alpha-Chlordane	6,500[a]	2.0 U	1.8 U	2.3 U	**5.9**	1.9 U	2.0 U
Dieldrin	110	2.4 J[1]	3.5 U	1.3 J[1]	4.1 U	3.6 U	1.9 J[1]
Endosulfan I (alpha)	3,700,000[b]	2.0 U	1.8 U	2.0 U	2.1 U	1.9 U	2.0 U
Endosulfan II (beta)	3,700,000[b]	3.8 U	0.73 J[1]	3.9 U	4.1 U	3.6 U	3.8 U
Endrin	180,000	3.8 U	3.5 U	3.9 U	4.1 U	3.6 U	3.8 U
Endrin aldehyde	NE	3.8 U	3.5 U	3.9 U	4.1 U	3.6 U	3.8 U
Endrin ketone	NE	3.8 U	3.5 U	3.9 U	4.1 U	3.6 U	3.8 U
gamma-Chlordane	6,500[a]	2.0 U	1.8 U	**3.2**	**4.1**	1.9 U	2.0 U
Heptachlor epoxide	190	0.51 J[1]	1.1 J[1]	1.6 J[1]	1.4 J[1]	1.9 U	2.0 U
Methoxychlor	3,100,000	20 U	18 U	20 U	21 U	19 U	20 U
Toxaphene	1,600	200 U	180 U	200 U	210 U	190 U	150 J[1]
Polychlorinated Biphenyls (µg/kg)							
PCB-1248 (Aroclor 1248)	740	38 UJ	35 UJ	39 UJ	41 UJ	36 UJ	38 UJ
PCB-1254 (Aroclor 1254)	740	21 J[1]	35 U	39 U	41 U	36 U	38 U
PCB-1260 (Aroclor 1260)	740	68	35 U	39 U	41 U	36 U	38 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Southeast of Blair Moving & Storage Company	East of James Resch Trust Property (Gulfside Supply, Inc.)	East of the David Thornton Property
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-140-SF**	**AIP-141-SF**	**AIP-142-SF**
Volatile Organic Compounds (µg/kg)					
Acetone	610,000,000	81 J	R	15 U	8.2 U
cis-1,2-Dichloroethene	10,000,000	4.5 U	7.9 U	7.4 U	4.1 U
Methyl Acetate	1,000,000,000	4.5 U	7.9 U	7.4 U	4.1 U
Methyl Ethyl Ketone	190,000,000	9.1 U	16 U	15 U	8.2 U
Semivolatile Organic Compounds (µg/kg)					
Acenaphthene	33,000,000	49 J[1]	180 U	190 U	190 U
Acenaphthylene	NE	200 U	180 U	190 U	190 U
Acetophenone	100,000,000	200 U	180 U	190 U	190 U
Anthracene	170,000,000	56 J[1]	180 U	190 U	190 UJ
Benzaldehyde	100,000,000	200 U	180 U	190 U	190 U
Benzo(a)anthracene	2,100	270	180 U	190 U	190 U
Benzo(a)pyrene	210	290	180 U	190 U	190 U
Benzo(b)fluoranthene	2,100	360	180 U	190 U	190 U
Benzo(g,h,i)perylene	NE	140 J[1]	180 U	190 U	190 U
Benzo(k)fluoranthene	21,000	320 J	180 U	190 U	190 U
Bis(2-ethylhexyl) phthalate	120,000	200 UJ	180 UJ	190 UJ	190 U
Carbazole	NE	90 J[1]	180 U	190 U	190 U
Chrysene	210,000	330	180 U	190 U	190 U
Dibenzo(a,h)anthracene	210	50 J[1]	180 U	190 U	190 U
Di-n-octylphthalate	NE	200 U	180 UJ	190 UJ	190 U
Fluoranthene	22,000,000	630	180 U	190 U	190 U
Indeno (1,2,3-cd) pyrene	2,100	180 J[1]	180 U	190 U	190 U
Naphthalene	20,000	200 U	180 U	190 U	190 U
Phenanthrene	NE	360	180 U	190 U	190 U
Pyrene	17,000,000	500	180 U	190 U	190 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA Apri 2009 Regional Screening Level	Background	Southeast of Blair Moving & Storage Company	East of James Resch Trust Property (Gulfside Supply, Inc.)	East of the David Thornton Property
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-140-SF**	**AIP-141-SF**	**AIP-142-SF**
Pesticides (µg/kg)					
4,4'-DDD (p,p'-DDD)	7,200	3.8 U	3.6 U	3.7 U	3.6 U
4,4'-DDE (p,p'-DDE)	5,100	5.7	3.6 U	3.7 U	1.5 J[1]
4,4'-DDT (p,p'-DDT)	7,000	9.5	3.6 U	3.7 U	3.6 U
alpha-Chlordane	6,500[a]	2.0 U	1.8 U	1.9 U	1.9 U
Dieldrin	110	2.4 J[1]	3.6 U	3.7 U	3.6 U
Endosulfan I (alpha)	3,700,000[b]	2.0 U	1.8 U	1.9 U	1.9 U
Endosulfan II (beta)	3,700,000[b]	3.8 U	3.6 U	3.7 U	3.6 U
Endrin	180,000	3.8 U	3.6 U	3.7 U	3.6 U
Endrin aldehyde	NE	3.8 U	3.6 U	3.7 U	3.6 U
Endrin ketone	NE	3.8 U	3.6 U	3.7 U	3.6 U
gamma-Chlordane	6,500[a]	2.0 U	1.8 U	1.9 U	1.9 U
Heptachlor epoxide	190	0.51 J[1]	1.8 U	1.9 U	1.9 U
Methoxychlor	3,100,000	20 U	18 U	19 U	19 U
Toxaphene	1,600	200 U	180 U	190 U	190 U
Polychlorinated Biphenyls (µg/kg)					
PCB-1248 (Aroclor 1248)	740	38 UJ	36 U	37 U	36 UJ
PCB-1254 (Aroclor 1254)	740	21 J[1]	36 U	37 U	36 U
PCB-1260 (Aroclor 1260)	740	68	36 U	37 U	36 U

TABLE 5
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

Notes:

[a]	EPA April 2009 Regional Screening Level for chlordane.
[b]	EPA April 2009 Regional Screening Level for endosulfan.
AIP	Allied Industrial Park
DUP	Field duplicate
EPA	U.S. Environmental Protection Agency
J	The identification of the analyte is acceptable; the reported value is an estimate.
J-	The identification of the analyte is acceptable; the reported value is an estimate with a possible low bias.
J^1	Concentration reported is less than the lowest standard on the calibration curve.
µg/kg	Micrograms per kilogram
NE	Not established
PCB	Polychlorinate biphenyl
R	The sample results are unusable based on the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
SF	Surface soil sample
U	The analyte was not detected at or above the minimum reporting limit.
UJ	The analyte was not detected at or above the minimum reporting limit; the reported value is an estimate.
BOLD	Bolded values are elevated, meaning that the values are three times the concentration of detected constituents in the background sample or greater than or equal to the non-detect concentration in the background sample.
BOLD	Shaded and bolded values are elevated and are above the EPA April 2009 Regional Screening Level.
▨	Shaded values are above the EPAApril 2009 Regional Screening Level.

TABLE 6
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near Building 105		Area Near Building 105E		Area Near Building 105
Analyte	Industrial Soil	AIP-100-SF	AIP-101-SF	AIP-102-SF	AIP-103-SF	AIP-104-SF	AIP-105-SF
Metals (mg/kg)							
Aluminum	990,000	6,600	6,600	5,100	6,400	6,200	3,400
Antimony	410[c]	0.82 J[1]	R	R	R	R	R
Arsenic	1.6[d]	2.2 J-	2.3	1.8	2.8	2.8	1.2
Barium	190,000	53	24	37	23 J[1]	24	26
Beryllium	2,000[e]	0.21 UJ	0.13 UJ	0.16 UJ	0.16 UJ	0.16 UJ	0.10 UJ
Cadmium	810[f]	0.58 U	0.55 U	0.36 J[1]	0.57 U	0.56 U	0.029 J[1]
Calcium	NE	1,400	490 J[1]	550	440 J[1]	400 J[1]	400 J[1]
Chromium	1,400[g]	170	14	10	24	19	7.4
Cobalt	300	1.4 UJ	0.70 UJ	0.59 UJ	0.30 UJ	0.61 UJ	0.70 UJ
Copper	41,000	34	9.0	9.7	5.2	3.7	5.0
Iron	720,000	12,000	14,000	7,800	21,000	16,000	4,600
Lead	800[h]	57	18	20	14	12	20
Magnesium	NE	640	130 J[1]	140 J[1]	75 J[1]	100 J[1]	140 J[1]
Manganese	23,000[i]	150	80	130	100	170	120
Mercury	24[j]	0.096 UJ	0.023 UJ	0.03 UJ	0.06 UJ	0.11 U	0.11 U
Nickel	20,000[k]	3.6 J[1]	8.1 J+	2.0 J[1]	1.1 J[1]	1.4 J[1]	2.0 J[1]
Potassium	NE	330 J[1]	140 J[1]	62 J[1]	69 J[1]	87 J[1]	78 J[1]
Selenium	5,100	R	3.9 UJ	3.8 UJ	4.0 UJ	3.9 UJ	3.8 UJ
Silver	5,100	1.2 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
Sodium	NE	24 J[1]	8.9 J[1]	5.3 J[1]	12 J[1]	9.4 J[1]	4.2 J[1]
Thallium	66[l]	0.31 UJ	0.21 UJ	2.7 U	2.9 U	2.8 U	0.13 UJ
Vanadium	7,200[m]	34 J-	32 J-	23 J-	57 J-	41 J-	16 J-
Zinc	310,000[n]	240	17	16	16	8.0	23

TABLE 6
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near Building 107		Area Near Building 106	Area Near Building 108	Area Near Building 106A
Analyte	Industrial Soil	AIP-100-SF	AIP-106-SF	AIP-107-SF	AIP-108-SF	AIP-109-SF	AIP-110-SF
Metals (mg/kg)							
Aluminum	990,000	6,600	6,300	4,200	6,600	3,700	4,600
Antimony	410[c]	0.82 J[1]	R	R	R	R	6.6 UJ
Arsenic	1.6[d]	2.2 J-	2.1	2.0	2.3	1.6	1.1 J-
Barium	190,000	53	26	20 J[1]	31	26	140
Beryllium	2,000[e]	0.21 UJ	0.15 UJ	0.11 UJ	0.16 UJ	0.13 UJ	0.13 J[1]
Cadmium	810[f]	0.58 U	0.56 U	0.58 U	0.58 U	0.56 U	0.55 U
Calcium	NE	1,400	650	660	750	360 J[1]	460 J[1]
Chromium	1,400[g]	170	13	15	12	7.2	8.1
Cobalt	300	1.4 UJ	0.38 UJ	0.49 UJ	0.73 UJ	0.72 UJ	0.69 UJ
Copper	41,000	34	4.2	4.8	11	2.4	5.9
Iron	720,000	12,000	11,000	12,000	9,800	5,800	6,200
Lead	800[h]	57	13	21	20	9.8	9.3
Magnesium	NE	640	130 J[1]	140 J[1]	170 J[1]	48 J[1]	76 J[1]
Manganese	23,000[i]	150	94	120	110	140	63
Mercury	24[j]	0.096 UJ	0.022 UJ	0.12 U	0.022 UJ	0.12 U	0.085 UJ
Nickel	20,000[k]	3.6 J[1]	1.6 J[1]	1.0 J[1]	1.8 J[1]	0.96 J[1]	1.1 J[1]
Potassium	NE	330 J[1]	120 J[1]	64 J[1]	110 J[1]	57 J[1]	54 J[1]
Selenium	5,100	R	3.9 UJ	4.1 UJ	4.0 UJ	3.9 UJ	3.9 UJ
Silver	5,100	1.2 U	1.1 U	1.2 U	1.2 U	1.1 U	1.1 U
Sodium	NE	24 J[1]	8.1 J[1]	5.2 J[1]	11 J[1]	5.0 J[1]	10 J[1]
Thallium	66[l]	0.31 UJ	2.8 U	2.9 U	2.9 U	2.8 U	0.19 UJ
Vanadium	7,200[m]	34 J-	32 J-	34 J-	25 J-	16 J-	17 J-
Zinc	310,000[n]	240	18	18	43	6.7	7.2

TABLE 6
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

Analyte	EPA April 2009 Regional Screening Level	Background	Area Near Building 109		Rail Spur Receiving Area		
	Industrial Soil	AIP-100-SF	AIP-111-SF	AIP-112-SF	AIP-113-SF	AIP-114-SF	AIP-115-SF
Metals (mg/kg)							
Aluminum	990,000	6,600	4,200	6,500	6,200	4,600	2,800
Antimony	410[c]	0.82 J[1]	R	R	R	R	R
Arsenic	1.6[d]	2.2 J-	1.5 J-	1.5 J-	1.6 J-	2.2 J-	2.1 J-
Barium	190,000	53	39	18 J[1]	18 J[1]	34	23
Beryllium	2,000[e]	0.21 UJ	0.17 UJ	0.14 UJ	0.13 UJ	0.17 UJ	0.13 UJ
Cadmium	810[f]	0.58 U	**4.2**	0.58 U	0.56 U	0.54 U	0.54 U
Calcium	NE	1,400	760	500 J[1]	**7,400**	1,500	1,500
Chromium	1,400[g]	170	11	15	12	6.7	7.6
Cobalt	300	1.4 UJ	1.2 UJ	0.35 UJ	0.44 UJ	1.4 UJ	0.79 UJ
Copper	41,000	34	14	4.0	3.9	3.3	2.0 J[1]
Iron	720,000	12,000	7,100	15,000	13,000	5,200	3,900
Lead	800[h]	57	42	23	7.8	14	13
Magnesium	NE	640	120 J[1]	86 J[1]	120 J[1]	110 J[1]	93 J[1]
Manganese	23,000[i]	150	220	55	74	160	140
Mercury	24[j]	0.096 UJ	**0.12**	0.063 UJ	0.042 UJ	0.074 UJ	0.023 UJ
Nickel	20,000[k]	3.6 J[1]	1.3 J[1]	0.80 J[1]	1.0 J[1]	1.1 J[1]	0.66 J[1]
Potassium	NE	330 J[1]	71 J[1]	84 J[1]	160 J[1]	170 J[1]	140 J[1]
Selenium	5,100	R	R	R	R	R	R
Silver	5,100	1.2 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
Sodium	NE	24 J[1]	10 J[1]	16 J[1]	7.1 J[1]	6.6 J[1]	4.0 J[1]
Thallium	66[l]	0.31 UJ	0.17 UJ	0.16 UJ	0.27 UJ	0.14 UJ	2.7 UJ
Vanadium	7,200[m]	34 J-	18 J-	44 J-	31 J-	13 J-	9.7 J-
Zinc	310,000[n]	240	23	6.3 UJ	8.1	10	14

TABLE 6
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

Analyte	EPA April 2009 Regional Screening Level	Background	Area Near Building 198				Former Location of the Mixing/Blending Houses
	Industrial Soil	AIP-100-SF	AIP-116-SF	AIP-117-SF	AIP-118-SF	AIP-119-SF	AIP-120-SF
Metals (mg/kg)							
Aluminum	990,000	6,600	4,900	5,800	7,400	6,000	2,500
Antimony	410[c]	0.82 J[1]	R	R	R	R	R
Arsenic	1.6[d]	2.2 J-	1.6 J-	1.5 J-	1.5 J-	2.0 J-	0.89 J[1]
Barium	190,000	53	26	30	45	57	21 J[1]
Beryllium	2,000[e]	0.21 UJ	0.14 UJ	0.16 UJ	0.14 UJ	0.18 UJ	0.10 UJ
Cadmium	810[f]	0.58 U	0.55 U	0.55 U	0.52 U	0.54 U	0.079 UJ
Calcium	NE	1,400	660	300 J[1]	1,400	1,100	490 J[1]
Chromium	1,400[g]	170	8.2	5.9	12	6.5	3.7
Cobalt	300	1.4 UJ	1.1 UJ	0.58 UJ	2.7 UJ	2.3 UJ	0.79 UJ
Copper	41,000	34	2.9	2.5 J[1]	7.2	4.7	2.2 J[1]
Iron	720,000	12,000	6,600	6,300	12,000	7,400	2,800
Lead	800[h]	57	8.5	5.5	3.5	6.9	6.6
Magnesium	NE	640	91 J[1]	100 J[1]	**4,800**	1,000	130 J[1]
Manganese	23,000[i]	150	140	24	360	130	140
Mercury	24[j]	0.096 UJ	0.078 UJ	0.10 UJ	0.027 UJ	0.086 UJ	0.08 UJ
Nickel	20,000[k]	3.6 J[1]	1.2 J[1]	1.4 J[1]	4.4 J+	2.2 J[1]	0.80 J[1]
Potassium	NE	330 J[1]	55 J[1]	54 J[1]	**5,800**	580	110 J[1]
Selenium	5,100	R	R	R	R	R	R
Silver	5,100	1.2 U	1.1 U	1.1 U	1.0 U	1.1 U	1.1 U
Sodium	NE	24 J[1]	6.0 J[1]	4.4 J[1]	63 J[1]	22 J[1]	4.2 J[1]
Thallium	66[l]	0.31 UJ	0.43 UJ	0.44 UJ	1.0 UJ	0.43 UJ	2.7 U
Vanadium	7,200[m]	34 J-	17 J-	14 J-	18 J-	16 J-	7.7 J-
Zinc	310,000[n]	240	6.6 U	6.9	44	20	7.4

TABLE 6
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	**Background**	**Former Location of the Mixing/Blending Houses**				
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-121-SF**	**AIP-122-SF**	**AIP-123-SF**	**AIP-124-SF**	**AIP-125-SF**
Metals (mg/kg)							
Aluminum	990,000	6,600	3,200	2,600	4,600	3,400	3,000
Antimony	410[c]	0.82 J[1]	R	R	R	R	6.7 UJ
Arsenic	1.6[d]	2.2 J-	0.79 J[1]	1.4 J-	1.1 J[1]	1.1 J-	1.6
Barium	190,000	53	23	16 J[1]	17 J[1]	13 J[1]	23
Beryllium	2,000[e]	0.21 UJ	0.092 UJ	0.098 UJ	0.080 UJ	0.027 UJ	0.11 UJ
Cadmium	810[f]	0.58 U	0.54 U	0.54 U	0.054 UJ	0.54 U	0.56 UJ
Calcium	NE	1,400	210 J[1]	130 J[1]	460 J[1]	470 J[1]	310 J[1]
Chromium	1,400[g]	170	6.4	3.5	7.0	6.6	3.8
Cobalt	300	1.4 UJ	0.69 UJ	0.77 UJ	0.42 UJ	0.27 UJ	0.73 UJ
Copper	41,000	34	1.6 J[1]	2.0 J[1]	2.6 J[1]	2.4 J[1]	1.7 J[1]
Iron	720,000	12,000	5,500	2,500	5,400	5,300	2,600
Lead	800[h]	57	4.0	5.3	6.6	4.5	7.5
Magnesium	NE	640	70 J[1]	57 J[1]	170 J[1]	100 J[1]	76 J[1]
Manganese	23,000[i]	150	38	87	57	47	110
Mercury	24[j]	0.096 UJ	0.056 UJ	0.056 UJ	**0.13**	0.083 UJ	0.11 UJ
Nickel	20,000[k]	3.6 J[1]	0.72 J[1]	0.74 J[1]	0.92 J[1]	0.52 J[1]	0.90 J[1]
Potassium	NE	330 J[1]	110 J[1]	37 J[1]	140 J[1]	96 J[1]	32 J[1]
Selenium	5,100	R	R	R	R	R	3.9 U
Silver	5,100	1.2 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U
Sodium	NE	24 J[1]	2.9 J[1]	3.1 J[1]	4.8 J[1]	3.7 J[1]	5.0 J[1]
Thallium	66[l]	0.31 UJ	0.36 UJ	0.15 UJ	0.29 UJ	0.23 UJ	0.26 UJ
Vanadium	7,200[m]	34 J-	15 J-	7.2 J-	17 J-	21 J-	7.1 J-
Zinc	310,000[n]	240	3.2 UJ	2.8 UJ	7.6	5.6 UJ	3.9 UJ

TABLE 6
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near Building 5				Area Near the Transformer House (Building 4)
Analyte	Industrial Soil	AIP-100-SF	AIP-126-SF	AIP-127-SF	AIP-128-SF	AIP-129-SF	AIP-130-SF
Metals (mg/kg)							
Aluminum	990,000	6,600	3,400	3,600	5,300	4,600	4,700
Antimony	410[c]	0.82 J[1]	6.6 UJ	6.8 UJ	6.4 UJ	6.8 UJ	6.6 UJ
Arsenic	1.6[d]	2.2 J-	1.6 J-	1.4 J-	1.8 J-	1.8 J-	1.9 J-
Barium	190,000	53	27	44	43	30	18 J
Beryllium	2,000[e]	0.21 UJ	0.16 J[1]	0.20 J[1]	0.27 J[1]	0.16 J[1]	0.10 J[1]
Cadmium	810[f]	0.58 U	0.44 UJ	**3.2**	0.54 U	**1.2**	0.50 UJ
Calcium	NE	1,400	400 J[1]	1,100	720	660	480 J[1]
Chromium	1,400[g]	170	6.1	8.5	7.7	9.1	16
Cobalt	300	1.4 UJ	1.4 UJ	1.7 UJ	1.8 UJ	1.2 UJ	0.56 UJ
Copper	41,000	34	8.0	7.1	4.5	31	7.6
Iron	720,000	12,000	3,400	3,900	6,100	6,200	11,000
Lead	800[h]	57	19	25	19	32	11
Magnesium	NE	640	110 J[1]	220 J[1]	96 J[1]	160 J[1]	65 J[1]
Manganese	23,000[i]	150	240	280	340	120	89
Mercury	24[j]	0.096 UJ	0.11 U	0.11 U	0.11 U	0.029 UJ	0.021 UJ
Nickel	20,000[k]	3.6 J[1]	1.4 J[1]	1.5 J[1]	1.4 J[1]	3.4 J[1]	3.1 J[1]
Potassium	NE	330 J[1]	170 J[1]	140 J[1]	68 J[1]	77 J[1]	50 J[1]
Selenium	5,100	R	3.8 UJ	4.0 UJ	3.8 UJ	4.0 UJ	3.9 UJ
Silver	5,100	1.2 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
Sodium	NE	24 J[1]	4.7 J[1]	7.6 J[1]	12 J[1]	9.4 J[1]	5.5 J[1]
Thallium	66[l]	0.31 UJ	2.7 U	2.8 U	2.7 U	0.18 UJ	0.26 UJ
Vanadium	7,200[m]	34 J-	10 J-	11 J-	15 J-	17 J-	47 J-
Zinc	310,000[n]	240	18	40	9.4	47	14

TABLE 6
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	**Background**	**Area Near the Transformer House (Building 104)**	**Oil Recovery Area**			**Waste Water Treatment Plant Area**
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-131-SF**	**AIP-132-SF**	**AIP-132-SF-DUP**	**AIP-133-SF**	**AIP-134-SF**
Metals (mg/kg)							
Aluminum	990,000	6,600	4,300	2,600	3,800	9,200	5,900
Antimony	410[c]	0.82 J[1]	6.3 UJ	0.88 J[1]	8.7 J[1]	6.7 UJ	R
Arsenic	1.6[d]	2.2 J-	2.0 J-	**9.6 J-**	**7.4**	2.0 J-	2.2 J-
Barium	190,000	53	31	17 J[1]	34	31	89
Beryllium	2,000[e]	0.21 UJ	0.23 J[1]	0.064 J[1]	0.15 UJ	0.16 J[1]	**0.60**
Cadmium	810[f]	0.58 U	0.41 UJ	0.56 U	0.64 U	0.55 U	**3.8**
Calcium	NE	1,400	400 J[1]	1,400	**14,000**	1,000	**11,000**
Chromium	1,400[g]	170	30	57	420	16	19
Cobalt	300	1.4 UJ	1.4 UJ	5.4 UJ	**6.7**	1.4 UJ	1.1 UJ
Copper	41,000	34	5.9	**180**	**250**	11	11
Iron	720,000	12,000	5,000	**120,000**	**170,000**	11,000	6,100
Lead	800[h]	57	28	40	90	14	25
Magnesium	NE	640	80 J[1]	29 J[1]	480 J[1]	1,200 J[1]	**2,000**
Manganese	23,000[i]	150	200	**1,800**	**1,800**	99	410
Mercury	24[j]	0.096 UJ	0.11 U	0.083 UJ	0.13 U	0.028 UJ	**1.3**
Nickel	20,000[k]	3.6 J[1]	2.2 J[1]	**120 J+**	**440 J+**	3.3 J[1]	1.9 J[1]
Potassium	NE	330 J[1]	77 J[1]	68 J[1]	240 J[1]	**1,300**	560 J[1]
Selenium	5,100	R	3.7 UJ	3.9 UJ	4.4 UJ	3.9 UJ	R
Silver	5,100	1.2 U	1.1 U	1.1 U	0.22 J[1]	1.1 U	6.9
Sodium	NE	24 J[1]	5.6 J[1]	22 J[1]	82 J[1]	18 J[1]	49 J[1]
Thallium	66[l]	0.31 UJ	0.16 UJ	2.8 U	3.2 U	0.48 UJ	2.8 U
Vanadium	7,200[m]	34 J-	17 J-	12 J-	20 J-	25 J-	15 J-
Zinc	310,000[n]	240	14	83	160	24	100

TABLE 6
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

Analyte	EPA April 2009 Regional Screening Level	Background	Waste Water Treatment Plant Area	Northwest Drainage Area	Northeast Drainage Area	South of Blair Moving & Storage Company	Northeast of Blair Moving & Storage Company
	Industrial Soil	**AIP-100-SF**	**AIP-135-SF**	**AIP-136-SF**	**AIP-137-SF**	**AIP-138-SF**	**AIP-139-SF**
Metals (mg/kg)							
Aluminum	990,000	6,600	4,200	6,000	11,000	5,200	7,300
Antimony	410[c]	0.82 J[1]	R	0.88 J[1]	0.50 J[1]	6.6 UJ	R
Arsenic	1.6[d]	2.2 J-	1.8 J-	3.1 J-	2.3	1.7 J-	2.8
Barium	190,000	53	26	75	95	26	26
Beryllium	2,000[e]	0.21 UJ	0.17 UJ	0.21 UJ	0.25 J[1]	0.11 J[1]	0.15 UJ
Cadmium	810[f]	0.58 U	**0.65**	**15**	0.62 UJ	0.55 U	0.58 U
Calcium	NE	1,400	270 J[1]	1,200	2,200	950	1,200
Chromium	1,400[g]	170	6.2	14	51	12	18
Cobalt	300	1.4 UJ	0.91 UJ	2.1 UJ	1.7 J[1]	0.56 UJ	0.41 UJ
Copper	41,000	34	6.1	28	21	3.6	5.2
Iron	720,000	12,000	4,400	9,200	19,000	10,000	16,000
Lead	800[h]	57	29	**1,000**	60	9.0	9.0
Magnesium	NE	640	67 J[1]	500 J[1]	520 J[1]	160 J[1]	200 J[1]
Manganese	23,000[i]	150	120	360	350	100	96
Mercury	24[j]	0.096 UJ	**0.59**	**0.38**	**0.14**	0.12 U	0.082 UJ
Nickel	20,000[k]	3.6 J[1]	1.0 J[1]	3.1 J[1]	3.2 J[1]	1.3 J[1]	1.3 J[1]
Potassium	NE	330 J[1]	59 J[1]	360 J[1]	420 J[1]	210 J[1]	140 J[1]
Selenium	5,100	R	R	R	4.3 UJ	3.8 UJ	0.65 J[1]
Silver	5,100	1.2 U	0.20 J[1]	0.28 J[1]	1.2 U	1.1 U	1.2 U
Sodium	NE	24 J[1]	4.6 J[1]	14 J[1]	56 J[1]	6.9 J[1]	5.9 J[1]
Thallium	66[l]	0.31 UJ	0.14 UJ	0.44 UJ	0.37 J[1]	0.30 UJ	0.20 UJ
Vanadium	7,200[m]	34 J-	13 J-	24 J-	56 J-	28 J-	43 J-
Zinc	310,000[n]	240	19	510	110	14	15

TABLE 6
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	**Background**	**Southeast of Blair Moving & Storage Company**	**East of James Resch Trust Property (Gulfside Supply, Inc.)**	**East of the David Thornton Property**
Analyte	**Industrial Soil**	**AIP-100-SF**	**AIP-140-SF**	**AIP-141-SF**	**AIP-142-SF**
Metals (mg/kg)					
Aluminum	990,000	6,600	4,300	5,100	3,700
Antimony	410[c]	0.82 J[1]	6.6 UJ	6.8 UJ	6.5 UJ
Arsenic	1.6[d]	2.2 J-	1.4	1.8	1.0 J[1]
Barium	190,000	53	23	18 J	24
Beryllium	2,000[e]	0.21 UJ	0.11 UJ	0.10 UJ	0.089 J[1]
Cadmium	810[f]	0.58 U	0.028 UJ	0.56 UJ	0.55 UJ
Calcium	NE	1,400	1,700	440 J[1]	590
Chromium	1,400[g]	170	11	15	6.6
Cobalt	300	1.4 UJ	0.61 UJ	0.76 UJ	1.0 J[1]
Copper	41,000	34	3.3 J+	3.5 J+	3.7
Iron	720,000	12,000	9,000	12,000	4,000
Lead	800[h]	57	9.9	9.3	7.4
Magnesium	NE	640	150 J[1]	92 J[1]	540 J[1]
Manganese	23,000[i]	150	110	120	130
Mercury	24[j]	0.096 UJ	0.056 UJ	0.031 UJ	0.11 U
Nickel	20,000[k]	3.6 J[1]	0.98 J[1]	0.93 J[1]	1.4 J[1]
Potassium	NE	330 J[1]	110 J[1]	35 J[1]	690
Selenium	5,100	R	3.9 U	4.0 U	3.8 UJ
Silver	5,100	1.2 U	1.1 U	1.1 U	1.1 U
Sodium	NE	24 J[1]	5.4 J[1]	8.7 J[1]	8.4 J[1]
Thallium	66[l]	0.31 UJ	0.39 UJ	0.51 UJ	2.7 U
Vanadium	7,200[m]	34 J-	25 J-	34 J-	10 J-
Zinc	310,000[n]	240	5.4 UJ	31 J	10

TABLE 6
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES

Notes:

[c]	EPA April 2009 Regional Screening Level for metallic antimony.
[d]	EPA April 2009 Regional Screening Level for inorganic arsenic.
[e]	EPA April 2009 Regional Screening Level for beryllium and compounds.
[f]	EPA April 2009 Regional Screening Level for dietary cadmium.
[g]	EPA April 2009 Regional Screening Level for total chromium.
[h]	EPA April 2009 Regional Screening Level for lead and compounds.
[i]	EPA April 2009 Regional Screening Level for manganese (water).
[j]	EPA April 2009 Regional Screening Level for elemental mercury.
[k]	EPA April 2009 Regional Screening Level for soluble salts of nickel.
[l]	EPA April 2009 Regional Screening Level for soluble salts of thallium.
[m]	EPA April 2009 Regional Screening Level for metallic vanadium.
[n]	EPA April 2009 Regional Screening Level for metallic zinc.
AIP	Allied Industrial Park
DUP	Field duplicate
EPA	U.S. Environmental Protection Agency
J	The identification of the analyte is acceptable; the reported value is an estimate.
J+	The identification of the analyte is acceptable; the reported value is an estimate with a possible high bias.
J-	The identification of the analyte is acceptable; the reported value is an estimate with a possible low bias.
J^1	Concentration reported is less than the lowest standard on the calibration curve.

mg/kg	Milligrams per kilogram
NE	Not established
R	The sample results are unusable based on the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
SF	Surface soil sample
U	The analyte was not detected at or above the minimum reporting limit.
UJ	The analyte was not detected at or above the minimum reporting limit; the reported value is an estimate.
BOLD	Bolded values are elevated, meaning that the values are three times the concentration of detected constituents in the background sample or greater than or equal to the non-detect concentration in the background sample.
BOLD	Shaded and bolded values are elevated and are above the EPA April 2009 Regional Screening Level.
▨	Shaded values are above the EPA April 2009 Regional Screening Level.

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near Building 105		Area Near Building 105E		
Analyte	Industrial Soil	AIP-100-SB	AIP-101-SB	AIP-102-SB	AIP-103-SB	AIP-104-SB	AIP-104-SB-DUP
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	25 J	8.0 U	8.0 U	9.3 U	7.9 U	8.6 U
Trichloroethene (Trichloroethylene)	14,000	5.0 UJ	4.0 U	4.0 U	4.6 U	3.9 U	4.3 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	210 U	200 U	190 U	200 U	200 U	200 U
Acetophenone	100,000,000	210 U	46 J[1]	190 U	200 U	200 U	200 U
Anthracene	170,000,000	210 UJ	200 UJ	190 UJ	200 UJ	200 UJ	200 UJ
Benzo(a)anthracene	2,100	210 U	200 U	190 U	200 UJ	200 U	200 UJ
Benzo(a)pyrene	210	210 U	200 U	190 U	200 U	200 U	200 UJ
Benzo(b)fluoranthene	2,100	210 U	200 U	190 U	200 U	200 U	200 UJ
Benzo(g,h,i)perylene	NE	210 U	200 U	190 U	200 U	200 U	200 UJ
Benzo(k)fluoranthene	21,000	210 U	200 U	190 U	200 U	200 U	200 UJ
Bis(2-ethylhexyl) phthalate	120,000	210 U	200 U	190 U	200 U	**610 J**	200 UJ
Carbazole	NE	210 UJ	200 U	190 U	200 U	200 UJ	200 UJ
Chrysene	210,000	210 U	200 U	190 U	200 UJ	200 U	200 UJ
Dibenzo(a,h)anthracene	210	210 U	200 U	190 U	200 U	200 U	200 UJ
Di-n-octylphthalate	NE	210 U	200 U	190 U	200 U	200 U	200 J-
Fluoranthene	22,000,000	210 U	200 U	190 U	200 UJ	200 U	200 UJ
Fluorene	22,000,000	210 UJ	200 UJ	190 UJ	200 UJ	200 UJ	200 UJ
Indeno (1,2,3-cd) pyrene	2,100	210 U	200 U	190 U	200 U	200 U	200 UJ
Phenanthrene	NE	210 U	200 U	190 U	200 U	200 U	200 U
Pyrene	17,000,000	210 U	200 U	190 U	200 UJ	200 U	200 UJ
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	4.0 U	3.8 U	3.7 U	4.0 U	3.8 U	3.8 U
4,4'-DDE (p,p'-DDE)	5,100	4.0 U	3.8 U	3.7 U	4.0 U	3.8 U	3.8 U
4,4'-DDT (p,p'-DDT)	7,000	4.0 U	3.8 U	3.7 U	4.0 U	3.8 U	3.8 U
alpha-Chlordane	6,500[a]	2.1 U	2.0 U	1.9 U	2.0 U	2.0 U	2.0 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near Building 105		Area Near Building 105E		
Analyte	Industrial Soil	AIP-100-SB	AIP-101-SB	AIP-102-SB	AIP-103-SB	AIP-104-SB	AIP-104-SB-DUP
Pesticides (µg/kg)							
beta-BHC	960	2.1 U	2.0 U	1.9 U	0.79 J[1]	2.0 U	2.0 U
Endrin	180,000	4.0 U	3.8 U	3.7 U	4.0 U	3.8 U	3.8 U
Endrin aldehyde	NE	4.0 U	3.8 U	3.7 U	4.0 U	3.8 U	3.8 U
Endrin ketone	NE	4.0 U	3.8 U	3.7 U	4.0 U	3.8 U	3.8 U
gamma-Chlordane	6,500[a]	2.1 U	2.0 U	1.9 U	0.60 J[1]	2.0 U	2.0 U
Methoxychlor	3,100,000	21 U	20 U	19 U	20 U	20 U	20 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1016 (Aroclor 1016)	21,000	17 J[1]	38 U	37 U	40 U	38 U	38 U
PCB-1260 (Aroclor 1260)	740	20 J[1]	38 U	37 U	40 U	38 U	38 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

Analyte	EPA April 2009 Regional Screening Level	Background	Area Near Building 105	Area Near Building 107		Area Near Building 106	Area Near Building 108
	Industrial Soil	AIP-100-SB	AIP-105-SB	AIP-106-SB	AIP-107-SB	AIP-108-SB	AIP-109-SB
Volatile Organic Compounds (μg/kg)							
Acetone	610,000,000	25 J	8.0 U	15	16 U	16 U	16 U
Trichloroethene (Trichloroethylene)	14,000	5.0 UJ	4.0 U	7.5 U	8.0 U	8.1 U	8.2 U
Semivolatile Organic Compounds (μg/kg)							
Acenaphthene	33,000,000	210 U	200 U	190 U	200 U	190 U	200 U
Acetophenone	100,000,000	210 U	200 U	190 U	200 U	190 U	200 U
Anthracene	170,000,000	210 UJ	200 UJ	190 U	200 U	190 U	200 U
Benzo(a)anthracene	2,100	210 U	200 U	190 U	200 U	190 U	200 U
Benzo(a)pyrene	210	210 U	200 U	190 U	200 U	190 U	200 U
Benzo(b)fluoranthene	2,100	210 U	200 U	190 U	200 U	190 U	200 U
Benzo(g,h,i)perylene	NE	210 U	200 U	190 U	200 U	190 U	200 U
Benzo(k)fluoranthene	21,000	210 U	200 U	190 U	200 U	190 U	200 U
Bis(2-ethylhexyl) phthalate	120,000	210 U	200 UJ	190 UJ	200 UJ	190 UJ	200 UJ
Carbazole	NE	210 UJ	200 UJ	190 U	200 U	190 U	200 U
Chrysene	210,000	210 U	200 U	190 U	200 U	190 U	200 U
Dibenzo(a,h)anthracene	210	210 U	200 U	190 U	200 U	190 U	200 U
Di-n-octylphthalate	NE	210 U	200 U	190 UJ	200 UJ	190 UJ	200 UJ
Fluoranthene	22,000,000	210 U	200 U	190 U	200 U	190 U	200 U
Fluorene	22,000,000	210 UJ	200 UJ	190 U	200 U	190 U	200 U
Indeno (1,2,3-cd) pyrene	2,100	210 U	200 U	190 U	200 U	190 U	200 U
Phenanthrene	NE	210 U	200 U	190 U	200 U	190 U	200 U
Pyrene	17,000,000	210 U	200 U	190 U	200 U	190 U	200 U
Pesticides (μg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	4.0 U	3.8 U	3.7 U	3.8 U	3.7 U	3.8 U
4,4'-DDE (p,p'-DDE)	5,100	4.0 U	3.8 U	3.7 U	3.8 U	3.7 U	3.8 U
4,4'-DDT (p,p'-DDT)	7,000	4.0 U	3.8 U	3.7 U	3.8 U	3.7 U	3.8 U
alpha-Chlordane	6,500[a]	2.1 U	2.0 U	1.9 U	2.0 U	1.9 U	2.0 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near Building 105	Area Near Building 107		Area Near Building 106	Area Near Building 108
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-105-SB**	**AIP-106-SB**	**AIP-107-SB**	**AIP-108-SB**	**AIP-109-SB**
Pesticides (µg/kg)							
beta-BHC	960	2.1 U	2.0 U	1.9 U	2.0 U	1.9 U	2.0 U
Endrin	180,000	4.0 U	3.8 U	3.7 U	3.8 U	3.7 U	3.8 U
Endrin aldehyde	NE	4.0 U	3.8 U	3.7 U	3.8 U	3.7 U	3.8 U
Endrin ketone	NE	4.0 U	3.8 U	3.7 U	3.8 U	3.7 U	3.8 U
gamma-Chlordane	6,500[a]	2.1 U	2.0 U	1.9 U	2.0 U	1.9 U	2.0 U
Methoxychlor	3,100,000	21 U	8.1 J[1]	19 U	20 U	19 U	20 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1016 (Aroclor 1016)	21,000	17 J[1]	38 U	37 U	38 U	37 U	38 U
PCB-1260 (Aroclor 1260)	740	20 J[1]	38 U	37 U	38 U	37 U	38 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near Building 106A	Area Near Building 109		Rail Spur Receiving Area	
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-110-SB**	**AIP-111-SB**	**AIP-112-SB**	**AIP-113-SB**	**AIP-114-SB**
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	25 J	15 U	7.8 UJ	11 U	9.1 UJ	7.7 UJ
Trichloroethene (Trichloroethylene)	14,000	5.0 UJ	7.4 U	3.9 U	5.4 U	4.6 U	3.8 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	210 U	190 U	180 U	210 U	190 U	190 U
Acetophenone	100,000,000	210 U	190 U	180 U	210 U	190 U	190 U
Anthracene	170,000,000	210 UJ	190 U	180 UJ	210 UJ	190 UJ	190 UJ
Benzo(a)anthracene	2,100	210 U	190 U	180 U	210 U	190 U	190 U
Benzo(a)pyrene	210	210 U	190 U	180 U	210 U	190 U	190 U
Benzo(b)fluoranthene	2,100	210 U	190 U	180 U	210 U	190 U	190 U
Benzo(g,h,i)perylene	NE	210 U	190 U	180 UJ	210 U	190 U	190 U
Benzo(k)fluoranthene	21,000	210 U	190 U	180 U	210 U	190 U	190 U
Bis(2-ethylhexyl) phthalate	120,000	210 U	190 UJ	180 UJ	210 UJ	190 UJ	190 UJ
Carbazole	NE	210 UJ	190 U	180 UJ	210 UJ	190 UJ	190 UJ
Chrysene	210,000	210 U	190 U	180 U	210 U	190 U	190 U
Dibenzo(a,h)anthracene	210	210 U	190 U	180 UJ	210 U	190 U	190 U
Di-n-octylphthalate	NE	210 U	190 UJ	180 U	210 U	190 U	190 U
Fluoranthene	22,000,000	210 U	190 U	180 U	210 U	190 U	190 U
Fluorene	22,000,000	210 UJ	190 U	180 UJ	210 UJ	190 UJ	190 UJ
Indeno (1,2,3-cd) pyrene	2,100	210 U	190 U	180 UJ	210 U	190 U	190 U
Phenanthrene	NE	210 U	190 U	180 U	210 U	190 U	190 U
Pyrene	17,000,000	210 U	190 U	180 U	210 U	190 U	190 U
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	4.0 U	3.8 U	3.6 U	4.1 U	3.6 U	3.8 U
4,4'-DDE (p,p'-DDE)	5,100	4.0 U	3.8 U	3.6 U	4.1 U	3.6 U	3.8 U
4,4'-DDT (p,p'-DDT)	7,000	4.0 U	3.8 U	**10**	4.1 U	3.6 U	3.8 U
alpha-Chlordane	6,500[a]	2.1 U	1.9 U	1.8 U	2.1 U	1.9 U	1.9 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near Building 106A	Area Near Building 109		Rail Spur Receiving Area	
Analyte	Industrial Soil	AIP-100-SB	AIP-110-SB	AIP-111-SB	AIP-112-SB	AIP-113-SB	AIP-114-SB
Pesticides (µg/kg)							
beta-BHC	960	2.1 U	1.9 U	1.8 U	2.1 U	1.9 U	1.9 U
Endrin	180,000	4.0 U	3.8 U	1.4 J[1]	4.1 U	3.6 U	3.8 U
Endrin aldehyde	NE	4.0 U	3.8 U	3.6 U	4.1 U	3.6 U	3.8 U
Endrin ketone	NE	4.0 U	3.8 U	3.6 U	4.1 U	3.6 U	3.8 U
gamma-Chlordane	6,500[a]	2.1 U	1.9 U	1.8 U	2.1 U	1.9 U	1.9 U
Methoxychlor	3,100,000	21 U	19 U	18 U	21 U	19 U	19 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1016 (Aroclor 1016)	21,000	17 J[1]	38 U	36 U	41 U	36 U	38 U
PCB-1260 (Aroclor 1260)	740	20 J[1]	38 U	**66**	41 U	36 U	38 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Rail Spur Receiving Area	Area Near Building 198			
Analyte	Industrial Soil	AIP-100-SB	AIP-115-SB	AIP-116-SB	AIP-117-SB	AIP-118-SB	AIP-119-SB
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	25 J	8.4 UJ	R	R	R	R
Trichloroethene (Trichloroethylene)	14,000	5.0 UJ	4.2 U	7.3 U	8.1 U	7.8 U	7.1 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	210 U	200 U	180 U	190 U	180 U	190 U
Acetophenone	100,000,000	210 U	200 U	180 U	190 U	180 U	190 U
Anthracene	170,000,000	210 UJ	200 UJ	180 U	190 U	180 U	190 U
Benzo(a)anthracene	2,100	210 U	200 U	180 U	190 U	180 U	190 U
Benzo(a)pyrene	210	210 U	200 U	180 U	190 U	180 U	190 U
Benzo(b)fluoranthene	2,100	210 U	200 U	180 U	190 U	180 U	190 U
Benzo(g,h,i)perylene	NE	210 U	200 U	180 U	190 U	180 U	190 U
Benzo(k)fluoranthene	21,000	210 U	200 U	180 U	190 U	180 U	190 U
Bis(2-ethylhexyl) phthalate	120,000	210 U	200 UJ	180 UJ	190 UJ	180 UJ	190 UJ
Carbazole	NE	210 UJ	200 UJ	180 U	190 U	180 U	190 U
Chrysene	210,000	210 U	200 U	180 U	190 U	180 U	190 U
Dibenzo(a,h)anthracene	210	210 U	200 U	180 U	190 U	180 U	190 U
Di-n-octylphthalate	NE	210 U	200 U	180 UJ	190 UJ	180 UJ	190 UJ
Fluoranthene	22,000,000	210 U	200 U	180 U	190 U	180 U	190 U
Fluorene	22,000,000	210 UJ	200 UJ	180 U	190 U	180 U	190 U
Indeno (1,2,3-cd) pyrene	2,100	210 U	200 U	180 U	190 U	180 U	190 U
Phenanthrene	NE	210 U	200 U	180 U	190 U	180 U	190 U
Pyrene	17,000,000	210 U	200 U	180 U	190 U	180 U	190 U
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	4.0 U	3.8 U	3.4 U	3.6 U	3.5 U	3.7 U
4,4'-DDE (p,p'-DDE)	5,100	4.0 U	3.8 U	3.4 U	3.6 U	3.5 U	3.7 U
4,4'-DDT (p,p'-DDT)	7,000	4.0 U	3.8 U	3.4 U	3.6 U	3.5 U	3.7 U
alpha-Chlordane	6,500[a]	2.1 U	2.0 U	1.8 U	1.9 U	1.8 U	1.9 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

Analyte	EPA April 2009 Regional Screening Level Industrial Soil	Background AIP-100-SB	Rail Spur Receiving Area AIP-115-SB	Area Near Building 198 AIP-116-SB	AIP-117-SB	AIP-118-SB	AIP-119-SB
Pesticides (µg/kg)							
beta-BHC	960	2.1 U	2.0 U	1.8 U	1.9 U	1.8 U	1.9 U
Endrin	180,000	4.0 U	3.8 U	3.4 U	3.6 U	3.5 U	3.7 U
Endrin aldehyde	NE	4.0 U	3.8 U	3.4 U	3.6 U	3.5 U	3.7 U
Endrin ketone	NE	4.0 U	3.8 U	3.4 U	3.6 U	3.5 U	3.7 U
gamma-Chlordane	6,500[a]	2.1 U	2.0 U	1.8 U	1.9 U	1.8 U	1.9 U
Methoxychlor	3,100,000	21 U	20 U	18 U	19 U	18 U	19 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1016 (Aroclor 1016)	21,000	17 J[1]	38 U	34 U	36 U	35 U	37 U
PCB-1260 (Aroclor 1260)	740	20 J[1]	38 U	34 U	36 U	35 U	37 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

Analyte	EPA April 2009 Regional Screening Level	Background	Former Location of the Mixing/Blending Houses				
	Industrial Soil	AIP-100-SB	AIP-120-SB	AIP-121-SB	AIP-122-SB	AIP-123-SB	AIP-124-SB
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	25 J	R	15 U	R	R	14 U
Trichloroethene (Trichloroethylene)	14,000	5.0 UJ	8.2 U	7.7 U	7.8 U	9.1 U	6.8 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	210 U	180 U	190 U	200 U	200 U	23 J[1]
Acetophenone	100,000,000	210 U	180 U	190 U	200 U	200 U	180 U
Anthracene	170,000,000	210 UJ	180 U	190 U	200 U	200 U	64 J[1]
Benzo(a)anthracene	2,100	210 U	180 U	190 U	200 U	200 U	**210**
Benzo(a)pyrene	210	210 U	180 U	190 U	200 U	200 U	180 J[1]
Benzo(b)fluoranthene	2,100	210 U	180 U	190 U	200 U	200 U	**250**
Benzo(g,h,i)perylene	NE	210 U	180 U	190 U	200 U	200 U	150 J[1]
Benzo(k)fluoranthene	21,000	210 U	180 U	190 U	200 U	200 U	120 J[1]
Bis(2-ethylhexyl) phthalate	120,000	210 U	180 UJ	190 UJ	200 UJ	200 UJ	180 UJ
Carbazole	NE	210 UJ	180 U	190 U	200 U	200 U	30 J[1]
Chrysene	210,000	210 U	180 U	20 J[1]	200 U	200 U	200
Dibenzo(a,h)anthracene	210	210 U	180 U	190 U	200 U	200 U	62 J[1]
Di-n-octylphthalate	NE	210 U	180 UJ	190 UJ	200 UJ	200 UJ	180 UJ
Fluoranthene	22,000,000	210 U	180 U	51 J[1]	200 U	200 U	**470**
Fluorene	22,000,000	210 UJ	180 U	190 U	200 U	200 U	29 J[1]
Indeno (1,2,3-cd) pyrene	2,100	210 U	180 U	190 U	200 U	200 U	160 J[1]
Phenanthrene	NE	210 U	180 U	34 J[1]	200 U	200 U	**290**
Pyrene	17,000,000	210 U	180 U	35 J[1]	200 U	200 U	**380**
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	4.0 U	3.6 U	3.7 U	3.9 U	3.9 U	3.0 J[1]
4,4'-DDE (p,p'-DDE)	5,100	4.0 U	3.6 U	77 U	3.9 U	3.9 U	**15**
4,4'-DDT (p,p'-DDT)	7,000	4.0 U	3.6 U	**74 J**	3.9 U	3.9 U	12 J
alpha-Chlordane	6,500[a]	2.1 U	1.8 U	1.9 U	2.0 U	2.0 U	**2.3**

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Former Location of the Mixing/Blending Houses				
Analyte	Industrial Soil	AIP-100-SB	AIP-120-SB	AIP-121-SB	AIP-122-SB	AIP-123-SB	AIP-124-SB
Pesticides (µg/kg)							
beta-BHC	960	2.1 U	1.8 U	1.9 U	2.0 U	2.0 U	1.8 U
Endrin	180,000	4.0 U	3.6 U	3.7 U	3.9 U	3.9 U	3.6 U
Endrin aldehyde	NE	4.0 U	3.6 U	3.7 U	3.9 U	3.9 U	3.6 U
Endrin ketone	NE	4.0 U	3.6 U	3.7 U	3.9 U	3.9 U	3.6 U
gamma-Chlordane	6,500[a]	2.1 U	1.8 U	1.9 U	2.0 U	2.0 U	2.0
Methoxychlor	3,100,000	21 U	18 U	19 U	20 U	20 U	18 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1016 (Aroclor 1016)	21,000	17 J[1]	36 U	37 U	39 U	39 U	35 U
PCB-1260 (Aroclor 1260)	740	20 J[1]	36 U	37 U	39 U	39 U	35 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Former Location of the Mixing/Blending Houses	Area Near Building 5			
Analyte	Industrial Soil	AIP-100-SB	AIP-125-SB	AIP-126-SB	AIP-127-SB	AIP-128-SB	AIP-129-SB
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	25 J	15 U	8.0 U	8.0 U	8.1 U	7.4 U
Trichloroethene (Trichloroethylene)	14,000	5.0 UJ	7.7 U	4.0 U	4.0 U	4.0 U	3.7 UJ
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	210 U	190 U	180 U	190 U	200 U	190 U
Acetophenone	100,000,000	210 U	190 U	180 U	190 U	200 U	190 U
Anthracene	170,000,000	210 UJ	190 U	180 UJ	190 UJ	200 UJ	190 UJ
Benzo(a)anthracene	2,100	210 U	190 U	180 U	190 U	200 U	190 U
Benzo(a)pyrene	210	210 U	190 U	180 U	190 U	200 U	190 U
Benzo(b)fluoranthene	2,100	210 U	190 U	180 U	190 U	200 U	190 U
Benzo(g,h,i)perylene	NE	210 U	190 U	180 U	190 U	200 U	190 U
Benzo(k)fluoranthene	21,000	210 U	190 U	180 U	190 U	200 U	190 U
Bis(2-ethylhexyl) phthalate	120,000	210 U	190 UJ	180 UJ	190 UJ	200 UJ	190 U
Carbazole	NE	210 UJ	190 U	180 UJ	190 UJ	200 UJ	190 U
Chrysene	210,000	210 U	190 U	180 U	190 U	200 U	190 U
Dibenzo(a,h)anthracene	210	210 U	190 U	180 U	190 U	200 U	190 U
Di-n-octylphthalate	NE	210 U	190 UJ	180 U	190 U	200 U	190 U
Fluoranthene	22,000,000	210 U	190 U	180 U	190 U	200 U	190 U
Fluorene	22,000,000	210 UJ	190 U	180 UJ	190 UJ	200 UJ	190 UJ
Indeno (1,2,3-cd) pyrene	2,100	210 U	190 U	180 U	190 U	200 U	190 U
Phenanthrene	NE	210 U	190 U	180 U	190 U	200 U	190 U
Pyrene	17,000,000	210 U	190 U	180 U	190 U	200 U	190 U
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	4.0 U	3.7 U	3.5 U	3.7 U	3.8 U	3.8 U
4,4'-DDE (p,p'-DDE)	5,100	4.0 U	3.7 U	3.5 U	3.7 U	3.8 U	3.8 U
4,4'-DDT (p,p'-DDT)	7,000	4.0 U	3.7 U	3.5 U	3.7 U	3.8 U	3.8 U
alpha-Chlordane	6,500[a]	2.1 U	1.9 U	1.8 U	1.9 U	2.0 U	1.9 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Former Location of the Mixing/Blending Houses	Area Near Building 5			
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-125-SB**	**AIP-126-SB**	**AIP-127-SB**	**AIP-128-SB**	**AIP-129-SB**
Pesticides (µg/kg)							
beta-BHC	960	2.1 U	1.9 U	1.8 U	1.9 U	2.0 U	1.9 U
Endrin	180,000	4.0 U	3.7 U	3.5 U	3.7 U	3.8 U	3.8 U
Endrin aldehyde	NE	4.0 U	3.7 U	3.5 U	3.7 U	3.8 U	3.8 U
Endrin ketone	NE	4.0 U	3.7 U	3.5 U	3.7 U	3.8 U	3.8 U
gamma-Chlordane	6,500[a]	2.1 U	1.9 U	1.8 U	1.9 U	2.0 U	1.9 U
Methoxychlor	3,100,000	21 U	19 U	18 U	19 U	20 U	19 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1016 (Aroclor 1016)	21,000	17 J[1]	37 U	35 U	37 U	38 U	38 U
PCB-1260 (Aroclor 1260)	740	20 J[1]	37 U	35 U	37 U	38 U	38 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near theTransformer House (Building 4)	Area Near the Transformer House (Building 104)	Oil Recovery Area		Water Treatment Plant Area
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-130-SB**	**AIP-131-SB**	**AIP-132-SB**	**AIP-133-SB**	**AIP-134-SB**
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	25 J	8.6 U	10 U	7.0 U	7.6 U	12 UJ
Trichloroethene (Trichloroethylene)	14,000	5.0 UJ	1.1 J[1]	5.2 U	3.5 U	3.8 U	5.9 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	210 U	190 U	210 U	190 U	200 U	190 U
Acetophenone	100,000,000	210 U	190 U	210 U	190 U	200 U	190 U
Anthracene	170,000,000	210 UJ	190 UJ	210 UJ	190 UJ	200 UJ	190 UJ
Benzo(a)anthracene	2,100	210 U	68 J[1]	210 U	190 U	40 J[1]	190 U
Benzo(a)pyrene	210	210 U	55 J[1]	210 U	190 U	98 J[1]	190 U
Benzo(b)fluoranthene	2,100	210 U	62 J[1]	210 U	190 U	95 J[1]	190 U
Benzo(g,h,i)perylene	NE	210 U	190 U	210 U	190 U	68 J[1]	190 U
Benzo(k)fluoranthene	21,000	210 U	190 U	210 U	190 U	92 J[1]	190 U
Bis(2-ethylhexyl) phthalate	120,000	210 U	190 UJ	**350 J**	190 UJ	200 UJ	190 UJ
Carbazole	NE	210 UJ	190 UJ	210 UJ	190 UJ	200 UJ	190 UJ
Chrysene	210,000	210 U	72 J[1]	210 U	190 U	54 J[1]	190 U
Dibenzo(a,h)anthracene	210	210 U	190 U	210 U	190 U	40 J[1]	190 U
Di-n-octylphthalate	NE	210 U	190 U	210 U	190 U	200 U	190 U
Fluoranthene	22,000,000	210 U	150 J[1]	210 U	190 U	38 J[1]	190 U
Fluorene	22,000,000	210 UJ	190 UJ	210 UJ	190 UJ	200 UJ	190 UJ
Indeno (1,2,3-cd) pyrene	2,100	210 U	190 U	210 U	190 U	96 J[1]	190 U
Phenanthrene	NE	210 U	73 J[1]	210 U	190 U	200 U	190 U
Pyrene	17,000,000	210 U	190 U	210 U	190 U	200 U	190 U
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	4.0 U	3.8 U	4.1 U	3.8 U	3.8 U	3.8 U
4,4'-DDE (p,p'-DDE)	5,100	4.0 U	1.5 J[1]	4.1 U	3.8 U	**6.5**	3.8 U
4,4'-DDT (p,p'-DDT)	7,000	4.0 U	3.8 U	4.1 U	3.8 U	**8.4**	3.8 U
alpha-Chlordane	6,500[a]	2.1 U	1.9 U	2.1 U	1.9 U	2.0 U	1.9 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	**Background**	**Area Near theTransformer House (Building 4)**	**Area Near the Transformer House (Building 104)**	**Oil Recovery Area**		**Water Treatment Plant Area**
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-130-SB**	**AIP-131-SB**	**AIP-132-SB**	**AIP-133-SB**	**AIP-134-SB**
Pesticides (µg/kg)							
beta-BHC	960	2.1 U	1.9 U	2.1 U	1.9 U	2.0 U	1.9 U
Endrin	180,000	4.0 U	3.8 U	4.1 U	3.8 U	3.8 U	3.8 U
Endrin aldehyde	NE	4.0 U	3.8 U	4.1 U	3.8 U	1.5 J[1]	3.8 U
Endrin ketone	NE	4.0 U	3.8 U	4.1 U	3.8 U	3.8 U	3.8 U
gamma-Chlordane	6,500[a]	2.1 U	1.9 U	2.1 U	1.9 U	2.0 U	1.9 U
Methoxychlor	3,100,000	21 U	19 U	21 U	19 U	20 U	19 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1016 (Aroclor 1016)	21,000	17 J[1]	38 U	41 U	38 U	38 U	38 U
PCB-1260 (Aroclor 1260)	740	20 J[1]	38 U	41 U	38 U	38 U	38 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Water Treatment Plant Area		Northwest Drainage Area	Northeast Drainage Area	South of Blair Moving & Storage Company
Analyte	Industrial Soil	AIP-100-SB	AIP-134-SB-DUP	AIP-135-SB	AIP-136-SB	AIP-137-SB	AIP-138-SB
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	25 J	8.3 U	8.2 UJ	13 J	11 U	8.8 U
Trichloroethene (Trichloroethylene)	14,000	5.0 UJ	4.1 UJ	4.1 U	4.7 U	5.4 U	4.4 U
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	210 U	190 U	190 U	200 U	220 U	190 U
Acetophenone	100,000,000	210 U	190 U	44 J[1]	200 U	220 U	190 U
Anthracene	170,000,000	210 UJ	190 UJ	190 UJ	200 UJ	220 UJ	190 UJ
Benzo(a)anthracene	2,100	210 U	190 UJ	190 U	200 U	220 UJ	190 U
Benzo(a)pyrene	210	210 U	190 U	190 U	200 U	220 U	190 U
Benzo(b)fluoranthene	2,100	210 U	190 U	190 U	200 U	220 U	190 U
Benzo(g,h,i)perylene	NE	210 U	190 U	190 U	200 U	220 U	190 U
Benzo(k)fluoranthene	21,000	210 U	190 U	190 U	200 U	220 U	190 U
Bis(2-ethylhexyl) phthalate	120,000	210 U	190 UJ	190 UJ	200 U	220 U	190 U
Carbazole	NE	210 UJ	190 UJ	190 UJ	200 UJ	220 UJ	190 U
Chrysene	210,000	210 U	190 UJ	190 U	200 U	220 UJ	190 U
Dibenzo(a,h)anthracene	210	210 U	190 U	190 U	200 U	220 U	190 U
Di-n-octylphthalate	NE	210 U	190 U	190 U	200 U	220 U	190 U
Fluoranthene	22,000,000	210 U	190 UJ	190 U	200 U	220 UJ	190 U
Fluorene	22,000,000	210 UJ	190 UJ	190 UJ	200 UJ	220 UJ	190 UJ
Indeno (1,2,3-cd) pyrene	2,100	210 U	190 U	190 U	200 U	220 U	190 U
Phenanthrene	NE	210 U	190 U	190 U	200 U	220 U	190 U
Pyrene	17,000,000	210 U	190 UJ	190 U	200 U	220 UJ	190 U
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	4.0 U	3.7 U	3.6 U	3.8 U	4.3 U	3.7 U
4,4'-DDE (p,p'-DDE)	5,100	4.0 U	3.7 U	1.6 J[1]	3.8 U	4.3 U	1.6 J[1]
4,4'-DDT (p,p'-DDT)	7,000	4.0 U	3.7 U	3.6 U	3.8 U	4.3 U	3.7 U
alpha-Chlordane	6,500[a]	2.1 U	1.9 U	1.9 U	2.0 U	**5.1**	1.9 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Water Treatment Plant Area		Northwest Drainage Area	Northeast Drainage Area	South of Blair Moving & Storage Company
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-134-SB-DUP**	**AIP-135-SB**	**AIP-136-SB**	**AIP-137-SB**	**AIP-138-SB**
Pesticides (µg/kg)							
beta-BHC	960	2.1 U	1.9 U	1.9 U	2.0 U	2.2 U	1.9 U
Endrin	180,000	4.0 U	3.7 U	3.6 U	3.8 U	4.3 U	3.7 U
Endrin aldehyde	NE	4.0 U	3.7 U	3.6 U	3.8 U	4.3 U	3.7 U
Endrin ketone	NE	4.0 U	3.7 U	3.6 U	3.8 U	1.2 J[1]	3.7 U
gamma-Chlordane	6,500[a]	2.1 U	1.9 U	1.9 U	2.0 U	2.2 U	1.9 U
Methoxychlor	3,100,000	21 U	19 U	19 U	20 U	22 U	19 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1016 (Aroclor 1016)	21,000	17 J[1]	37 U	36 U	38 U	43 U	37 U
PCB-1260 (Aroclor 1260)	740	20 J[1]	37 U	36 U	38 U	43 U	37 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

Analyte	EPA April 2009 Regional Screening Level	Background	Northeast of Blair Moving & Storage Company	Southeast of Blair Moving & Storage Company		East of James Resch Trust Property (Gulfside Supply, Inc.)	East of the David Thornton Property
	Industrial Soil	AIP-100-SB	AIP-139-SB	AIP-140-SB	AIP-140-SB-DUP	AIP-141-SB	AIP-142-SB
Volatile Organic Compounds (µg/kg)							
Acetone	610,000,000	25 J	R	R	R	R	7.7 U
Trichloroethene (Trichloroethylene)	14,000	5.0 UJ	3.8 U	7.7 U	8.2 U	7.6 U	3.8 UJ
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	33,000,000	210 U	180 U	200 U	190 U	200 U	190 U
Acetophenone	100,000,000	210 U	180 U	200 U	190 U	200 U	190 U
Anthracene	170,000,000	210 UJ	180 UJ	200 U	190 U	200 U	190 UJ
Benzo(a)anthracene	2,100	210 U	180 U	200 U	190 U	200 U	190 UJ
Benzo(a)pyrene	210	210 U	180 U	200 U	190 U	200 U	190 U
Benzo(b)fluoranthene	2,100	210 U	180 U	200 U	190 U	200 U	190 U
Benzo(g,h,i)perylene	NE	210 U	180 U	200 U	190 U	200 U	190 U
Benzo(k)fluoranthene	21,000	210 U	180 U	200 U	190 U	200 U	190 U
Bis(2-ethylhexyl) phthalate	120,000	210 U	180 U	200 UJ	190 UJ	200 UJ	190 U
Carbazole	NE	210 UJ	180 U	200 U	190 U	200 U	190 UJ
Chrysene	210,000	210 U	180 U	200 U	190 U	200 U	190 UJ
Dibenzo(a,h)anthracene	210	210 U	180 U	200 U	190 U	200 U	190 U
Di-n-octylphthalate	NE	210 U	180 U	200 UJ	190 UJ	200 UJ	190 U
Fluoranthene	22,000,000	210 U	180 U	200 U	190 U	200 U	190 UJ
Fluorene	22,000,000	210 UJ	180 UJ	200 U	190 U	200 U	190 UJ
Indeno (1,2,3-cd) pyrene	2,100	210 U	180 U	200 U	190 U	200 U	190 U
Phenanthrene	NE	210 U	180 U	200 U	190 U	200 U	190 U
Pyrene	17,000,000	210 U	180 U	200 U	190 U	200 U	190 UJ
Pesticides (µg/kg)							
4,4'-DDD (p,p'-DDD)	7,200	4.0 U	3.6 U	3.8 U	3.7 U	3.8 U	3.7 U
4,4'-DDE (p,p'-DDE)	5,100	4.0 U	3.6 U	3.8 U	3.7 U	3.8 U	3.7 U
4,4'-DDT (p,p'-DDT)	7,000	4.0 U	3.6 U	3.8 U	3.7 U	3.8 U	3.7 U
alpha-Chlordane	6,500[a]	2.1 U	1.8 U	2.0 U	1.9 U	1.9 U	1.9 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Northeast of Blair Moving & Storage Company	Southeast of Blair Moving & Storage Company		East of James Resch Trust Property (Gulfside Supply, Inc.)	East of the David Thornton Property
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-139-SB**	**AIP-140-SB**	**AIP-140-SB-DUP**	**AIP-141-SB**	**AIP-142-SB**
Pesticides (µg/kg)							
beta-BHC	960	2.1 U	1.8 U	2.0 U	1.9 U	1.9 U	1.9 U
Endrin	180,000	4.0 U	3.6 U	3.8 U	3.7 U	3.8 U	3.7 U
Endrin aldehyde	NE	4.0 U	3.6 U	3.8 U	3.7 U	3.8 U	3.7 U
Endrin ketone	NE	4.0 U	3.6 U	3.8 U	3.7 U	3.8 U	3.7 U
gamma-Chlordane	6,500[a]	2.1 U	1.8 U	2.0 U	1.9 U	1.9 U	1.9 U
Methoxychlor	3,100,000	21 U	18 U	20 U	19 U	19 U	19 U
Polychlorinated Biphenyls (µg/kg)							
PCB-1016 (Aroclor 1016)	21,000	17 J[1]	36 U	38 U	37 U	38 U	37 U
PCB-1260 (Aroclor 1260)	740	20 J[1]	36 U	38 U	37 U	38 UJ	37 U

TABLE 7
EXPANDED SITE INSPECTION
ORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

Notes:

[a]	EPA April 2009 Regional Screening Level for chlordane.
AIP	Allied Industrial Park
DUP	Field duplicate
EPA	U.S. Environmental Protection Agency
J	The identification of the analyte is acceptable; the reported value is an estimate.
J-	The identification of the analyte is acceptable; the reported value is an estimate with a possible low bias.
J^1	Concentration reported is less than the lowest standard on the calibration curve.
µg/kg	Micrograms per kilogram
NE	Not established
R	The sample results are unusable based on the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
SB	Subsurface soil sample
PCB	Polychlorinated biphenyl
U	The analyte was not detected at or above the minimum reporting limit.
UJ	The analyte was not detected at or above the minimum reporting limit; the reported value is an estimate.
BOLD	Bolded values are elevated, meaning that the values are three times the concentration of detected constituents in the background sample or greater than or equal to the non-detect concentration in the background sample.
▨	Shaded values are above the EPA April 2009 Regional Screening Level.

TABLE 8
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near Building 105		Area Near Building 105E		
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-101-SB**	**AIP-102-SB**	**AIP-103-SB**	**AIP-104-SB**	**AIP-104-SB-DUP**
Metals (mg/kg)							
Aluminum	990,000	8,900	8,700	9,800	9,000	6,200	6,100
Antimony	410[b]	R	R	R	R	R	R
Arsenic	1.6[c]	1.9 J-	1.9	2.5	1.8	2.7	2.4
Barium	190,000	34	11 J[1]	18 J[1]	5.0 UJ	5.7 UJ	5.3 UJ
Beryllium	2,000[d]	0.26 UJ	0.095 J[1]	0.16 UJ	0.096 UJ	0.067 UJ	0.070 UJ
Cadmium	810[e]	0.59 U	0.58 U	0.57 U	0.61 U	0.58 U	0.58 U
Calcium	NE	210 J[1]	230 J[1]	320 J[1]	150 J[1]	50 J[1]	66 J[1]
Chromium	1,400[f]	18	21	19	53	37	37
Cobalt	300	1.1 UJ	0.099 UJ	0.34 UJ	6.1 U	5.8 U	5.8 U
Copper	41,000	5.9	4.1	4.0	8.0	4.2	4.0
Iron	720,000	12,000	18,000	18,000	**60,000**	31,000	34,000
Lead	800[g]	11	5.5	7.6	9.2	6.3	6.4
Magnesium	NE	88 J[1]	100 J[1]	110 J[1]	47 J[1]	28 J[1]	38 J[1]
Manganese	23,000[h]	260	15	34	9.7	41	48
Mercury	24[i]	0.050 UJ	0.12 U	0.031 UJ	**0.13**	0.12 U	0.12 U
Nickel	20,000[j]	1.7 J[1]	1.3 J[1]	1.7 J[1]	4.9 U	0.62 J[1]	0.56 J[1]
Potassium	NE	74 J[1]	70 J[1]	75 J[1]	50 J[1]	49 J[1]	49 J[1]
Selenium	5,100	R	4.1 UJ	4.0 UJ	4.3 UJ	4.1 UJ	4.0 UJ
Silver	5,100	1.2 U	1.2 U	1.1 U	1.2 U	1.2 U	1.2 U
Sodium	NE	13 J[1]	9.1 J[1]	8.2 J[1]	20 J[1]	16 J[1]	16 J[1]
Thallium	66[k]	0.37 UJ	0.30 UJ	0.48 UJ	3.1 U	2.9 U	0.38 UJ
Vanadium	7,200[l]	33 J-	46 J-	44 J-	**140 J-**	77 J-	77 J-
Zinc	310,000[m]	22	4.2 J[1]	4.7 J[1]	2.7 J[1]	3.5 J[1]	3.6 J[1]

TABLE 8
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	**Background**	**Area Near Building 105**	**Area Near Building 107**		**Area Near Building 106**	**Area Near Building 108**
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-105-SB**	**AIP-106-SB**	**AIP-107-SB**	**AIP-108-SB**	**AIP-109-SB**
Metals (mg/kg)							
Aluminum	990,000	8,900	4,500	7,300	12,000	6,100	6,900
Antimony	410[b]	R	R	R	R	R	R
Arsenic	1.6[c]	1.9 J-	0.52 J[1]	2.1	2.7	2.3	2.5
Barium	190,000	34	4.3 UJ	26	37	7.8 J[1]	5.0 UJ
Beryllium	2,000[d]	0.26 UJ	0.065 UJ	0.19 UJ	0.35 UJ	0.071 UJ	0.074 UJ
Cadmium	810[e]	0.59 U	0.58 U	0.56 U	0.58 U	0.57 U	0.59 U
Calcium	NE	210 J[1]	230 J[1]	280 J[1]	300 J[1]	310 J[1]	180 J[1]
Chromium	1,400[f]	18	22	14	24	25	39
Cobalt	300	1.1 UJ	5.8 U	0.75 UJ	0.98 UJ	5.7 U	5.9 U
Copper	41,000	5.9	4.8	3.5	3.8	3.3	4.0
Iron	720,000	12,000	20,000	12,000	15,000	23,000	27,000
Lead	800[g]	11	3.8	6.7	9.4	6.0	5.0
Magnesium	NE	88 J[1]	22 J[1]	92 J[1]	190 J[1]	86 J[1]	53 J[1]
Manganese	23,000[h]	260	8.6	140	48	41	17
Mercury	24[i]	0.050 UJ	0.12 U	0.043 UJ	0.067 UJ	0.12 U	0.12 U
Nickel	20,000[j]	1.7 J[1]	4.6 U	1.5 J[1]	2.9 J[1]	0.67 J[1]	0.38 J[1]
Potassium	NE	74 J[1]	22 J[1]	77 J[1]	140 J[1]	59 J[1]	50 J[1]
Selenium	5,100	R	4.0 UJ	3.9 UJ	4.1 UJ	4.0 UJ	4.2 UJ
Silver	5,100	1.2 U	1.2 U	1.1 U	1.2 U	1.1 U	1.2 U
Sodium	NE	13 J[1]	5.4 J[1]	6.3 J[1]	5.9 J[1]	5.8 J[1]	5.2 J[1]
Thallium	66[k]	0.37 UJ	0.15 UJ	0.33 UJ	0.22 UJ	0.17 UJ	0.19 UJ
Vanadium	7,200[l]	33 J-	67 J-	31 J-	36 J-	63 J-	86 J-
Zinc	310,000[m]	22	1.6 J[1]	3.8 J[1]	6.1 J[1]	3.2 J[1]	2.9 J[1]

TABLE 8
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near Building 106A	Area Near Building 109		Rail Spur Receiving Area	
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-110-SB**	**AIP-111-SB**	**AIP-112-SB**	**AIP-113-SB**	**AIP-114-SB**
Metals (mg/kg)							
Aluminum	990,000	8,900	8,800	4,200	7,700	6,000	7,800
Antimony	410[b]	R	6.8 UJ	R	R	R	R
Arsenic	1.6[c]	1.9 J-	1.3 J-	1.2 J-	1.2 J-	1.6 J-	1.5 J-
Barium	190,000	34	27	50	9.7 J[1]	20 J[1]	19 J[1]
Beryllium	2,000[d]	0.26 UJ	0.21 J[1]	0.20 UJ	0.077 UJ	0.14 UJ	0.16 UJ
Cadmium	810[e]	0.59 U	0.57 U	0.54 U	0.60 U	0.55 U	0.56 U
Calcium	NE	210 J[1]	330 J[1]	260 J[1]	130 J[1]	560	340 J[1]
Chromium	1,400[f]	18	12	5.9	29	9.7	12
Cobalt	300	1.1 UJ	0.89 UJ	1.9 UJ	6.0 U	0.67 UJ	0.35 UJ
Copper	41,000	5.9	2.3 J[1]	0.95 J[1]	4.7	4.1	2.5 J[1]
Iron	720,000	12,000	9,700	4,600	28,000	9,600	11,000
Lead	800[g]	11	5.7	7.1	6.8	32	6.1
Magnesium	NE	88 J[1]	160 J[1]	77 J[1]	110 J[1]	84 J[1]	110 J[1]
Manganese	23,000[h]	260	78	380	12	89	18
Mercury	24[i]	0.050 UJ	0.060 UJ	0.026 UJ	**0.21**	0.069 UJ	0.066 UJ
Nickel	20,000[j]	1.7 J[1]	1.8 J[1]	0.89 J[1]	0.20 J[1]	1.1 J[1]	1.3 J[1]
Potassium	NE	74 J[1]	74 J[1]	41 J[1]	40 J[1]	120 J[1]	110 J[1]
Selenium	5,100	R	4.0 UJ	R	0.83 J[1]	R	R
Silver	5,100	1.2 U	1.1 U	1.1 U	1.2 U	1.1 U	1.1 U
Sodium	NE	13 J[1]	15 J[1]	4.8 J[1]	24 J[1]	4.4 J[1]	3.7 J[1]
Thallium	66[k]	0.37 UJ	0.27 UJ	0.21 UJ	0.62 UJ	0.28 UJ	0.36 UJ
Vanadium	7,200[l]	33 J-	26 J-	11 J-	89 J-	23 J-	26 J-
Zinc	310,000[m]	22	3.9 UJ	2.2 UJ	4.3 UJ	8.8	4.1 UJ

TABLE 8
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

Analyte	EPA April 2009 Regional Screening Level	Background	Rail Spur Receiving Area	Area Near Building 198			
	Industrial Soil	AIP-100-SB	AIP-115-SB	AIP-116-SB	AIP-117-SB	AIP-118-SB	AIP-119-SB
Metals (mg/kg)							
Aluminum	990,000	8,900	7,300	2,500	5,000	3,400	6,900
Antimony	410[b]	R	R	R	R	R	R
Arsenic	1.6[c]	1.9 J-	1.3 J-	0.63 J[1]	1.2 J-	1.3 J-	1.6 J-
Barium	190,000	34	17 J[1]	19 J[1]	16 J[1]	21 J[1]	16 J[1]
Beryllium	2,000[d]	0.26 UJ	0.11 UJ	0.12 UJ	0.070 UJ	0.12 UJ	0.10 UJ
Cadmium	810[e]	0.59 U	0.57 U	0.53 U	0.56 U	0.54 U	0.58 U
Calcium	NE	210 J[1]	410 J[1]	230 J[1]	160 J[1]	160 J[1]	230 J[1]
Chromium	1,400[f]	18	11	2.2	7.7	4.7	9.7
Cobalt	300	1.1 UJ	0.075 UJ	1.3 UJ	0.30 UJ	0.90 UJ	0.39 UJ
Copper	41,000	5.9	2.3 J[1]	1.1 J[1]	2.0 J[1]	1.5 J[1]	2.3 J[1]
Iron	720,000	12,000	11,000	2,000	7,200	3,700	8,100
Lead	800[g]	11	5.3	3.6	4.1	5.2	5.5
Magnesium	NE	88 J[1]	100 J[1]	59 J[1]	68 J[1]	75 J[1]	140 J[1]
Manganese	23,000[h]	260	7.5	89	4.1	63	8.9
Mercury	24[i]	0.050 UJ	0.045 UJ	0.055 UJ	0.056 UJ	0.078 UJ	0.10 UJ
Nickel	20,000[j]	1.7 J[1]	0.91 J[1]	0.81 J[1]	1.0 J[1]	0.89 J[1]	1.3 J[1]
Potassium	NE	74 J[1]	160 J[1]	18 J[1]	30 J[1]	66 J[1]	41 J[1]
Selenium	5,100	R	R	R	R	R	R
Silver	5,100	1.2 U	1.1 U	1.1 U	1.1 U	1.1 U	1.2 U
Sodium	NE	13 J[1]	3.8 J[1]	3.3 J[1]	4.6 J[1]	5.7 J[1]	8.3 J[1]
Thallium	66[k]	0.37 UJ	0.37 UJ	0.21 UJ	0.38 UJ	0.20 UJ	0.37 UJ
Vanadium	7,200[l]	33 J-	29 J-	4.8 UJ	16 J-	8.8 J-	18 J-
Zinc	310,000[m]	22	6.2 UJ	2.0 UJ	3.2 UJ	5.3 UJ	3.3 UJ

TABLE 8
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	**Background**	**Former Location of the Mixing/Blending Houses**				
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-120-SB**	**AIP-121-SB**	**AIP-122-SB**	**AIP-123-SB**	**AIP-124-SB**
Metals (mg/kg)							
Aluminum	990,000	8,900	3,900	3,100	7,700	7,500	2,800
Antimony	410[b]	R	R	R	R	R	R
Arsenic	1.6[c]	1.9 J-	1.1 J-	0.95 J[1]	0.62 J[1]	1.3 J-	1.2 J-
Barium	190,000	34	31	31	17 J[1]	13 J[1]	33
Beryllium	2,000[d]	0.26 UJ	0.16 UJ	0.11 UJ	0.039 UJ	0.020 UJ	0.11 UJ
Cadmium	810[e]	0.59 U	0.54 U	**0.92**	0.60 U	0.59 U	0.024 UJ
Calcium	NE	210 J[1]	430 J[1]	350 J[1]	360 J[1]	310 J[1]	600
Chromium	1,400[f]	18	5.5	6.0	23	13	5.1
Cobalt	300	1.1 UJ	0.58 UJ	0.79 UJ	6.0 U	0.080 UJ	0.80 UJ
Copper	41,000	5.9	2.6 J[1]	5.3	3.6	2.9	2.9
Iron	720,000	12,000	4,400	4,400	22,000	11,000	3,500
Lead	800[g]	11	5.4	16	4.5	5.1	25
Magnesium	NE	*88 J[1]*	*89 J[1]*	*96 J[1]*	*100 J[1]*	*120 J[1]*	*74 J[1]*
Manganese	23,000[h]	260	38	82	2.6	3.1	140
Mercury	24[i]	0.050 UJ	0.063 UJ	**0.43**	**0.13**	0.12 U	**0.88**
Nickel	20,000[j]	1.7 J[1]	0.97 J[1]	0.88 J[1]	0.29 J[1]	0.76 J[1]	0.76 J[1]
Potassium	NE	74 J[1]	64 J[1]	45 J[1]	600 U	86 J[1]	24 J[1]
Selenium	5,100	R	R	R	R	R	R
Silver	5,100	1.2 U	1.1 U	**1.3**	1.2 U	1.2 U	1.1 U
Sodium	NE	13 J[1]	4.5 J[1]	3.7 J[1]	5.5 J[1]	3.2 J[1]	4.5 J[1]
Thallium	66[k]	0.37 UJ	0.20 UJ	0.16 UJ	0.98 UJ	0.57 UJ	0.17 UJ
Vanadium	7,200[l]	33 J-	12 J-	12 J-	53 J-	44 J-	11 J-
Zinc	310,000[m]	22	2.4 UJ	16	1.9 UJ	2.8 UJ	12

TABLE 8
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Former Location of the Mixing/Blending Houses	Area Near Building 5			
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-125-SB**	**AIP-126-SB**	**AIP-127-SB**	**AIP-128-SB**	**AIP-129-SB**
Metals (mg/kg)							
Aluminum	990,000	8,900	4,700	3,600	7,400	6,100	6,700
Antimony	410[b]	R	6.5 UJ	6.4 UJ	6.7 UJ	6.9 UJ	6.4 UJ
Arsenic	1.6[c]	1.9 J-	1.3	1.4 J-	2.0 J-	1.4 J-	1.3 J-
Barium	190,000	34	25	31	29	7.2 J[1]	17 J[1]
Beryllium	2,000[d]	0.26 UJ	0.16 UJ	0.13 J[1]	0.23 J[1]	0.071 J[1]	0.18 J[1]
Cadmium	810[e]	0.59 U	0.54 J	0.54 U	0.56 U	0.58 U	0.54 U
Calcium	NE	210 J[1]	320 J[1]	210 J[1]	440 J[1]	110 J[1]	510 J[1]
Chromium	1,400[f]	18	5.8	4.1	27	21	10
Cobalt	300	1.1 UJ	0.67 UJ	1.0 UJ	0.93 UJ	5.8 U	0.34 UJ
Copper	41,000	5.9	1.3 J[1]	1.5 J[1]	2.9	3.1	2.6 J[1]
Iron	720,000	12,000	5,000	3,400	9,500	16,000	8,800
Lead	800[g]	11	6.1	4.8	7.2	3.9	5.1
Magnesium	NE	88 J[1]	73 J[1]	56 J[1]	140 J[1]	56 J[1]	96 J[1]
Manganese	23,000[h]	260	37	120	40	4.4	8.2
Mercury	24[i]	0.050 UJ	0.065 UJ	0.030 UJ	0.084 UJ	0.12 U	0.064 UJ
Nickel	20,000[j]	1.7 J[1]	0.98 J[1]	0.88 J[1]	1.8 J[1]	0.46 J[1]	1.3 J[1]
Potassium	NE	74 J[1]	31 J[1]	60 J[1]	92 J[1]	48 J[1]	75 J[1]
Selenium	5,100	R	3.8 U	3.8 UJ	3.9 UJ	4.0 UJ	3.7 UJ
Silver	5,100	1.2 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U
Sodium	NE	13 J[1]	5.7 J[1]	540 U	8.6 J[1]	21 J[1]	11 J[1]
Thallium	66[k]	0.37 UJ	0.32 UJ	0.21 UJ	0.40 UJ	0.31 UJ	0.30 UJ
Vanadium	7,200[l]	33 J-	12 J-	8.3 J-	23 J-	42 J-	21 J-
Zinc	310,000[m]	22	2.6 UJ	2.1 UJ	4.5 UJ	2.0 UJ	2.9 UJ

TABLE 8
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Area Near theTransformer House (Building 4)	Area Near the Transformer House (Building 104)	Oil Recovery Area		Water Treatment Plant Area
Analyte	Industrial Soil	AIP-100-SB	AIP-130-SB	AIP-131-SB	AIP-132-SB	AIP-133-SB	AIP-134-SB
Metals (mg/kg)							
Aluminum	990,000	8,900	3,000	5,300	5,700	4,800	4,500
Antimony	410[b]	R	6.8 UJ	7.0 UJ	6.9 UJ	6.9 UJ	R
Arsenic	1.6[c]	1.9 J-	1.9 J-	2.2 J-	1.6 J-	1.8 J-	2.1 J-
Barium	190,000	34	27	6.4 J[1]	22 J[1]	21 J[1]	31
Beryllium	2,000[d]	0.26 UJ	0.15 J[1]	0.073 J[1]	0.14 J[1]	0.13 J[1]	0.18 UJ
Cadmium	810[e]	0.59 U	0.57 U	0.59 U	0.57 U	0.57 U	0.56 U
Calcium	NE	210 J[1]	600	250 J[1]	**1,400**	600	470 J[1]
Chromium	1,400[f]	18	6.7	32	14	22	10
Cobalt	300	1.1 UJ	0.92 UJ	5.9 U	0.48 UJ	0.48 UJ	4.3 UJ
Copper	41,000	5.9	1.9 J[1]	2.7 J[1]	3.0	**100**	2.4 J[1]
Iron	720,000	12,000	4,900	25,000	12,000	18,000	7,000
Lead	800[g]	11	30	6.7	9.2	18	9.7
Magnesium	NE	88 J[1]	58 J[1]	54 J[1]	120 J[1]	53 J[1]	110 J[1]
Manganese	23,000[h]	260	190	34	87	130	390
Mercury	24[i]	0.050 UJ	0.12 U	0.12 U	0.12 U	0.032 UJ	0.028 UJ
Nickel	20,000[j]	1.7 J[1]	0.67 J[1]	0.40 J[1]	1.0 J[1]	1.9 J[1]	1.1 J[1]
Potassium	NE	74 J[1]	48 J[1]	36 J[1]	140 J[1]	75 J[1]	140 J[1]
Selenium	5,100	R	4.0 UJ	4.1 UJ	4.0 UJ	4.0 UJ	R
Silver	5,100	1.2 U	1.1 U	1.2 U	1.1 U	1.1 U	1.1 U
Sodium	NE	13 J[1]	6.1 J[1]	7.2 J[1]	20 J[1]	6.1 J[1]	3.8 J[1]
Thallium	66[k]	0.37 UJ	2.8 U	0.37 UJ	0.27 UJ	0.23 UJ	0.24 UJ
Vanadium	7,200[l]	33 J-	14 J-	68 J-	31 J-	41 J-	17 J-
Zinc	310,000[m]	22	4.0 UJ	2.5 UJ	3.2 UJ	**69**	4.1 UJ

TABLE 8
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	**Background**	**Water Treatment Plant Area**		**Northwest Drainage Area**	**Northeast Drainage Area**	**South of Blair Moving & Storage Company**
Analyte	**Industrial Soil**	**AIP-100-SB**	**AIP-134-SB-DUP**	**AIP-135-SB**	**AIP-136-SB**	**AIP-137-SB**	**AIP-138-SB**
Metals (mg/kg)							
Aluminum	990,000	8,900	4,100	3,200	5,500	9,700	6,200
Antimony	410[b]	R	R	R	R	0.32 J	6.7 UJ
Arsenic	1.6[c]	1.9 J-	1.9 J-	0.42 J^{1}	2.3 J-	2.0	2.0 J-
Barium	190,000	34	31	12 J^{1}	42	43	29
Beryllium	2,000[d]	0.26 UJ	0.15 UJ	0.081 UJ	0.18 UJ	0.28 J^{1}	0.18 J^{1}
Cadmium	810[e]	0.59 U	0.55 U	0.53 U	**2.8**	0.62 UJ	0.55 U
Calcium	NE	210 J^{1}	490 J^{1}	110 J^{1}	500 J^{1}	290 J^{1}	690
Chromium	1,400[f]	18	6.9	3.8	9.8	14	12
Cobalt	300	1.1 UJ	1.1 UJ	0.47 UJ	1.4 UJ	1.3 J^{1}	0.97 UJ
Copper	41,000	5.9	2.0 J^{1}	1.0 J^{1}	5.4	5.2	2.9
Iron	720,000	12,000	5,800	3,200	8,400	10,000	10,000
Lead	800[g]	11	6.8	3.6	**50**	14	8.6
Magnesium	NE	88 J^{1}	110 J^{1}	52 J^{1}	82 J^{1}	110 J^{1}	98 J^{1}
Manganese	23,000[h]	260	240	43	310	310	100
Mercury	24[i]	0.050 UJ	0.11 U	0.042 UJ	0.070 UJ	0.075 UJ	0.063 UJ
Nickel	20,000[j]	1.7 J^{1}	0.96 J^{1}	0.55 J^{1}	1.5 J^{1}	1.8 J^{1}	1.4 J^{1}
Potassium	NE	74 J^{1}	140 J^{1}	36 J^{1}	120 J^{1}	92 J^{1}	160 J^{1}
Selenium	5,100	R	R	R	R	4.4 UJ	3.9 UJ
Silver	5,100	1.2 U	1.1 U	1.1 U	1.1 U	1.2 U	1.1 U
Sodium	NE	13 J^{1}	4.4 J^{1}	3.4 J^{1}	5.1 J^{1}	18 J^{1}	4.7 J^{1}
Thallium	66[k]	0.37 UJ	0.18 UJ	0.14 UJ	0.36 UJ	0.49 J^{1}	0.35 UJ
Vanadium	7,200[l]	33 J-	15 J-	9.9 J-	21 J-	30 J-	26 J-
Zinc	310,000[m]	22	3.5 UJ	3.3 UJ	**120**	10	4.4 UJ

TABLE 8
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

	EPA April 2009 Regional Screening Level	Background	Northeast of Blair Moving & Storage Company	Southeast of Blair Moving & Storage Company		East of James Resch Trust Property (Gulfside Supply, Inc.)	East of the David Thornton Property
Analyte	Industrial Soil	AIP-100-SB	AIP-139-SB	AIP-140-SB	AIP-140-SB-DUP	AIP-141-SB	AIP-142-SB
Metals (mg/kg)							
Aluminum	990,000	8,900	5,100	6,900	6,900	5,900	5,700
Antimony	410[b]	R	R	6.9 UJ	R	R	6.6 UJ
Arsenic	1.6[c]	1.9 J-	2.0	2.6	2.7 J-	2.4 J-	1.2
Barium	190,000	34	31	10 J[1]	9.6 J[1]	7.3 J[1]	26
Beryllium	2,000[d]	0.26 UJ	0.20 UJ	0.057 UJ	0.059 UJ	0.023 UJ	0.15 J[1]
Cadmium	810[e]	0.59 U	0.54 U	0.57 UJ	0.58 U	0.58 U	0.55 UJ
Calcium	NE	210 J[1]	400 J[1]	350 J[1]	280 J[1]	200 J[1]	180 J[1]
Chromium	1,400[f]	18	8.3	29	24	29	6.7
Cobalt	300	1.1 UJ	0.97 UJ	5.7 U	5.8 U	5.8 U	0.95 J[1]
Copper	41,000	5.9	2.4 UJ	3.5 J+	3.8	3.6	1.6 J[1]
Iron	720,000	12,000	6,800	24,000	25,000	24,000	5,600
Lead	800[g]	11	6.4	7.0	7.1	6.0	5.6
Magnesium	NE	88 J[1]	90 J[1]	66 J[1]	60 J[1]	70 J[1]	81 J[1]
Manganese	23,000[h]	260	190	42	43	18	62
Mercury	24[i]	0.050 UJ	0.081 UJ	0.032 UJ	0.099 UJ	0.082 UJ	0.071 UJ
Nickel	20,000[j]	1.7 J[1]	0.98 J[1]	0.79 J[1]	0.76 J[1]	0.34 J[1]	1.4 J[1]
Potassium	NE	74 J[1]	72 UJ	41 J[1]	31 J[1]	580 U	79 J[1]
Selenium	5,100	R	3.8 UJ	4.0 U	R	R	3.8 UJ
Silver	5,100	1.2 U	1.1 U	1.1 U	1.2 U	1.2 U	1.1 U
Sodium	NE	13 J[1]	5.1 J[1]	5.8 J[1]	3.6 J[1]	4.9 J[1]	3.6 J[1]
Thallium	66[k]	0.37 UJ	2.7 U	1.1 UJ	1.0 UJ	1.1 UJ	0.31 J[1]
Vanadium	7,200[l]	33 J-	18 J-	63 J-	64 J-	67 J-	14 J-
Zinc	310,000[m]	22	2.8 J[1]	3.0 UJ	2.9 UJ	2.5 UJ	3.3 UJ

TABLE 8
EXPANDED SITE INSPECTION
INORGANIC ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES

Notes:

b	EPA April 2009 Regional Screening Level for metallic antimony.
c	EPA April 2009 Regional Screening Level for inorganic arsenic.
d	EPA April 2009 Regional Screening Level for beryllium and compounds.
e	EPA April 2009 Regional Screening Level for dietary cadmium.
f	EPA April 2009 Regional Screening Level for total chromium.
g	EPA April 2009 Regional Screening Level for lead and compounds.
h	EPA April 2009 Regional Screening Level for manganese (water).
i	EPA April 2009 Regional Screening Level for elemental mercury.
j	EPA April 2009 Regional Screening Level for soluble salts of nickel.
k	EPA April 2009 Regional Screening Level for soluble salts of thallium.
l	EPA April 2009 Regional Screening Level for metallic vanadium.
m	EPA April 2009 Regional Screening Level for metallic zinc.
AIP	Allied Industrial Park
DUP	Field duplicate
EPA	U.S. Environmental Protection Agency
J	The identification of the analyte is acceptable; the reported value is an estimate.
J+	The identification of the analyte is acceptable; the reported value is an estimate with a possible high bias.
J-	The identification of the analyte is acceptable; the reported value is an estimate with a possible low bias.
J^1	Concentration reported is less than the lowest standard on the calibration curve.

mg/kg	Milligrams per kilogram
NE	Not established
R	The sample results are unusable based on the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
SB	Subsurface soil sample
U	The analyte was not detected at or above the minimum reporting limit.
UJ	The analyte was not detected at or above the minimum reporting limit; the reported value is an estimate.
BOLD	Bolded values are elevated, meaning that the values are three times the concentration of detected constituents in the background sample or greater than or equal to the non-detect concentration in the background sample.
▨	Shaded values are above the EPA April 2009 Regional Screening Level.

TABLE 9
EXPANDED SITE INSPECTION
FIELD PARAMETERS FOR GROUND WATER SAMPLES

Station ID	USACE Well ID	Depth to Water (feet bgs)	Total Well Depth (feet bgs)	Purge Volume (gallons)	Temperature (°C)	pH Standard Units	Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)
AIP144	MW-45	19.5	28.21	4.4	19.02	5.16	93	6.4	67.3
AIP145	MW-57	35.8	42.35	3.2	23.40	4.08	41	8.2	316
AIP146	MW-66	28.6	37.3	4.35	20.42	5.31	106	3.79	144
AIP147	MW-70	29.10	38.42	3.1	21.36	4.26	60	5.56	680
AIP148	MW-30	36	43.33	3.5	22.75	4.90	83	7.73	87.4
AIP149	MW-80	34.05	42.85	4.4	17.97	4.47	NR	4.02	10.7

Notes:

*	Reading was collected before the well ran dry. Sample was collected after the well was allowed to recharge.
AIP	Allied Industrial Park
bgs	Below ground surface
°C	Degrees Celsius
FML	Former Macon Naval Ordnance Landfill
ID	Identification
µg/L	Micrograms per liter
µS/cm	Microsiemens per centimeter
MW	Monitoring well
NR	Not recorded
NTU	Nephelometric turbidity units
USACE	U.S. Army Corps of Engineers

USACE installed all of the permanent monitoring wells located on the AIP property.

TABLE 10
EXPANDED SITE INSPECTION
ANALYTICAL RESULTS FOR GROUND WATER SAMPLES

Analyte	MCL	Background (USACE MW-30)	South of AIP WWTP (USACE MW-45)	North of Drainage Ditch 3 (USACE MW-57)		West of Drainage Ditch 3, North of the Railroad Spur (USACE MW-66)
		AIP-148-MW	AIP-144-MW	AIP-145-MW	AIP-145-MW-DUP	AIP-146-MW
Volatile Organic Compounds (µg/L)						
1,1,1-Trichloroethane	200	5.0 U	0.88 J[1]	5.0 U	5.0 U	5.0 U
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	NE	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,2-Trichloroethane	5.0	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon Tetrachloride	5.0	5.0 U	0.84 J[1]	5.0 U	5.0 U	5.0 U
cis-1,2-Dichloroethene	70	5.0 U	**78**	3.5 J[1]	3.4 J[1]	**18**
Tetrachloroethene	5.0	0.58 J[1]	**11**	5.0 U	5.0 U	0.76 J[1]
trans-1,2-Dichloroethene	100	5.0 U	0.53 J[1]	5.0 U	5.0 U	5.0 U
Trichloroethene	5.0	1.7 J[1]	**20,000**	**220**	**210**	**3,400**
Vinyl chloride	5.0	5.0 U	**7.0**	5.0 U	5.0 U	5.0 U
Perchlorate (µg/L)						
Perchlorate	NE	0.8 J[1]	NA	NA	NA	1.0 U
Explosives (µg/L)						
Nitrobenzene	NE	2.2 U	NA	NA	NA	2.0 U
Metals (µg/L)						
Aluminum	50,200[a]	9,900	920	460	400	180 J[1]
Arsenic	10	3.7 J[1]	10 U	10 U	10 U	10 U
Barium	2,000	130 J[1]	22 J[1]	28 J[1]	28 J[1]	34 J[1]
Beryllium	4.0	0.16 J[1]	5.0 U	5.0 U	5.0 U	5.0 U
Calcium	NE	7,200	3,000 J[1]	2,400 J[1]	2,400 J[1]	7,700
Chromium	100	110	2.5 J[1]	3.2 J[1]	3.2 J[1]	2.3 J[1]
Copper	1,300	19 J[1]	3.2 J[1]	4.6 J[1]	4.7 J[1]	25 U
Iron	NE	15,000	10,000	810	750	130
Lead	15	21	1.9 J[1]	2.0 J[1]	10 U	10 U
Magnesium	NE	1,900 J[1]	1,400 J[1]	1,400 J[1]	1,400 J[1]	2,400 J[1]
Manganese	NE	310	110	62	62	36

TABLE 10
EXPANDED SITE INSPECTION
ANALYTICAL RESULTS FOR GROUND WATER SAMPLES

		Background (USACE MW-30)	South of AIP WWTP (USACE MW-45)	North of Drainage Ditch 3 (USACE MW-57)		West of Drainage Ditch 3, North of the Railroad Spur (USACE MW-66)
Analyte	**MCL**	**AIP-148-MW**	**AIP-144-MW**	**AIP-145-MW**	**AIP-145-MW-DUP**	**AIP-146-MW**
Metals (µg/L)						
Mercury	2.0	0.27	0.20 U	0.20 U	0.20 U	0.20 U
Nickel	NE	65	40 U	1.9 UJ	1.5 UJ	40 U
Potassium	NE	2,100 J[1]	2,000 J[1]	1,600 J[1]	1,500 J[1]	2,800 J[1]
Sodium	NE	7,200	6,600	4,900 J[1]	4,900 J[1]	7,700
Vanadium	NE	53	5.2 J[1]	3.5 J[1]	3.2 J[1]	50 U

TABLE 10
EXPANDED SITE INSPECTION
ANALYTICAL RESULTS FOR GROUND WATER SAMPLES

Analyte	MCL	Background (USACE MW-30)	North of Drainage Ditch 4 and Railroad Spur (USACE MW-70)	South of Drainage Ditch 3, North of Railroad Spur (USACE MW-80)
		AIP-148-MW	AIP-147-MW	AIP-149-MW
Volatile Organic Compounds (µg/L)				
1,1,1-Trichloroethane	200	5.0 U	5.0 U	5.0 U
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113)	NE	5.0 U	3.7 J[1]	5.0 U
1,1,2-Trichloroethane	5.0	5.0 U	0.66 J[1]	1.1 J[1]
Carbon Tetrachloride	5.0	5.0 U	5.0 U	5.0 U
cis-1,2-Dichloroethene	70	5.0 U	5.0 U	**280 J**
Tetrachloroethene	5.0	0.58 J[1]	5.0 U	3.2 J[1]
trans-1,2-Dichloroethene	100	5.0 U	5.0 U	**5.1**
Trichloroethene	5.0	1.7 J[1]	**350**	**11,000**
Vinyl chloride	5.0	5.0 U	5.0 U	5.0 U
Perchlorate (µg/L)				
Perchlorate	NE	0.8 J[1]	**4.3**	1.2
Explosives (µg/L)				
Nitrobenzene	NE	2.2 U	2.4 U	0.24 JN
Metals (µg/L)				
Aluminum	50,200[a]	9,900	1,500	530
Arsenic	10	3.7 J[1]	10 U	10 U
Barium	2,000	130 J[1]	64 J[1]	35 J[1]
Beryllium	4.0	0.16 J[1]	5.0 U	5.0 U
Calcium	NE	7,200	8,600	1,600 J[1]
Chromium	100	110	6.4 J[1]	10 U
Copper	1,300	19 J[1]	9.6 J[1]	2.9 J[1]
Iron	NE	15,000	1,400	61 J[1]
Lead	15	21	6.7 J[1]	10 U
Magnesium	NE	1,900 J[1]	950 J[1]	1,400 J[1]
Manganese	NE	310	27	48

TABLE 10
EXPANDED SITE INSPECTION
ANALYTICAL RESULTS FOR GROUND WATER SAMPLES

		Background (USACE MW-30)	North of Drainage Ditch 4 and Railroad Spur (USACE MW-70)	South of Drainage Ditch 3, North of Railroad Spur (USACE MW-80)
Analyte	**MCL**	**AIP-148-MW**	**AIP-147-MW**	**AIP-149-MW**
Metals (µg/L)				
Mercury	2.0	0.27	0.040 UJ	0.41
Nickel	NE	65	7.2 J[1]	1.2 J[1]
Potassium	NE	2,100 J[1]	650 J[1]	1,600 J[1]
Sodium	NE	7,200	7,100	15,000
Vanadium	NE	53	9.7 J[1]	50 U

TABLE 10
EXPANDED SITE INSPECTION
ANALYTICAL RESULTS FOR GROUND WATER SAMPLES

Notes:

[a]	Value represents a secondary standard
AIP	Allied Industrial Park
DUP	Field duplicate
J	The identification of the analyte is acceptable; the reported value is an estimate.
J^1	Concentration reported is less than the lowest standard on the calibration curve.
JN	The result is presumptive (tentatively identified), but a confirmation was not performed because the result was greater than the method detection limit, but less than the reporting limit.
MCL	EPA May 2009 Maximum Contaminant Level
MW	Monitoring well
µg/L	Micrograms per liter
NA	Not analyzed
NE	Not established
U	The analyte was not detected at or above the minimum or method reporting limit.
UJ	The analyte was not detected at or above the minimum or method reporting limit; the reported value is an estimate.
USACE	U.S. Army Corps of Engineers
BOLD	Bolded values are elevated, meaning that the values are three times the concentration of detected constituents in the background sample or greater than or equal to the non-detect concentration in the background sample.
BOLD ▨	Shaded and bolded values are elevated and are above the EPA May 2009 MCL.
▨	Shaded values are above the EPA May 2009 MCL.

USACE installed all of the permanent monitoring wells located on the AIP property.

TABLE 11
EXPANDED SITE INSPECTION
COMPARISON OF ANALYTICAL RESULTS FOR GROUND WATER SAMPLES
1996 to 2009

		Background (MW-30)			Near WWTP (MW-45)				Between Drainage Ditch 3 and Building 198 (MW-57)					Near Drainage Ditch 3, Before the Railroad Tracks (MW-66)			Near Drainage Ditch 4 (MW-70)			Near Drainage Ditch 3, Just North of Railroad Spur (MW-80)	
		USACE			USACE				USACE				EPA 2009 (DUP)	USACE			USACE			USACE	
Analyte	MCL	RUST 1996	SAIC^{1} 1998	EPA 2009	RUST 1996	SAIC^{1} 1998	SAIC^{2} 2004	EPA 2009	RUST 1996	SAIC^{1} 1998	SAIC^{2} 2004	EPA 2009		SAIC^{1} 1998	SAIC^{2} 2004	EPA 2009	SAIC^{1} 1998	SAIC^{2} 2004	EPA 2009	SAIC^{2} 2004	EPA 2009
Volatile Organic Compounds (µg/L)																					
1,2-Dichloroethene	NE	NA	5.0 U	NA	NA	2,500 U	NA	NA	NA	2.1 J	NA	NA	NA	**83.9**	NA	NA	0.98 J	NA	NA	NA	NA
cis-1,2-Dichloroethene	70	1.8 U	NA	5.0 U	1.8 U	NA	2,820	**78**	1.8 U	NA	1.2	3.5 J^{1}	3.4 J^{1}	NA	200	**18**	NA	U	5.0 U	128 J	**280 J**
Tetrachloroethene	5.0	0.49 U	2.0 J	0.58 J^{1}	0.49 U	2,500 U	20.4	**11**	0.49 U	5.0 U	U	5.0 U	5.0 U	2.2 J	6.4	0.76 J^{1}	5.0 U	U	5.0 U	4.3	3.2 J^{1}
trans-1,2-Dichloroethene	100	0.55 U	NA	5.0 U	0.55 U	NA	7.9	0.53 J^{1}	0.55 U	NA	U	5.0 U	5.0 U	NA	1.8	5.0 U	NA	U	5.0 U	1.6	**5.1**
Trichloroethene	5.0	550	5.0 U	1.7 J^{1}	0.42 U	**59,900**	33,900	**20,000**	12	**136**	245	**220**	**210**	**3,910**	14,100	**3,400**	**284**	206	**350**	12,400	**11,000**
Vinyl chloride	2.0	0.47 U	10.0 U	5.0 U	0.47 U	5,000 U	4.9	**7.0**	0.47 U	10 U	U	5.0 U	5.0 U	10 U	U	5.0 U	10 U	U	5.0 U	U	5.0 U

Notes:

DUP	Field duplicate
EPA	U.S. Environmental Protection Agency
J	The identification of the analyte is acceptable; the reported value is an estimate.
J^{1}	Concentration reported is less than the lowest standard on the calibration curve.
MCL	Maximum Contaminant Level
MW	Monitoring well
µg/L	Micrograms per liter
NA	Not analyzed
NE	Not established
RUST	RUST Environment and Infrastructure, Inc., Final Site Investigation Report, Allied Industrial Park Site, Macon, Georgia, Prepared for the Savannah District, USACE. May 1997.
SAIC^{1}	Science Applications International Corportation, Draft Hazardous Site Response Act (HSRA) Compliance Report, Former Macon Naval Ordnance Plant, Allied Industrial Park, Macon, Georgia, Prepared for the USACE, Savannah District. August 2000.
SAIC^{2}	Science Applications International Corportation, Letter with Attachments to Julie Hiscox, P.E., Project Manager, USACE, Savannah District. Subject: Monitoring Report for Post-Test Groundwater Sampling (October-November 2004) Pilot-Scale Alternatives Assessment and Implementation Plan for Groundwater VOC Reduction at the Former Macon Naval Ordnance Plant, DERP-FUDS Project No. I04GA081302, Macon, Georgia. January 19, 2005.
U	The analyte was not detected at or above the minimum reporting limit.
USACE	U.S. Army Corps of Engineers
WWTP	Waste water treatment plant
BOLD	Bolded values are elevated, meaning that the values are three times the concentrations detected in the background sample or greater than or equal to the sample quantifation limit if the constituent was not detected in the background sample.
BOLD	Shaded and bolded values are elevated and above the EPA May 2009 MCL.
▨	Shaded values are above the EPA May 2009 MCL.

TABLE 12
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES

	EPA Region 4 Freshwater Surface Water Screening Value		**Drainage Easement that Receives Drainage from AIP and Armstrong**	**Drainage Easement that Receives Drainage from AIP, Armstrong, and FMNOL**	**Receives Drainage from AIP, South of the Railroad Spur**	**Receives Drainage from AIP, Armstrong, and FMNOL, North of Rocky Creek**
Analyte	**Acute**	**Chronic**	**DD-507-SW**	**DD-508-SW**	**DD-513-SW**	**DD-514-SW**
Volatile Organic Compounds (µg/L)						
cis-1,2-Dichloroethene	NE	NE	5.0 U	5.0 U	5.0 U	15
Trichloroethene (Trichloroethylene)	NE	NE	5.0 U	5.0 U	1.0 J[1]	3.6 J[1]
Vinyl chloride	NE	NE	5.0 U	5.0 U	5.0 U	7.9
Pesticides (µg/L)						
gamma-Chlordane	2.4[a]	0.0043[a]	0.050 U	0.050 U	0.050 U	0.15
Polychlorindated Biphenyls (µg/L)						
PCB-1248 (Aroclor 1248)	0.2	0.014	1.0 U	1.0 U	1.0 U	2.2
Perchlorates (µg/L)						
Perchlorates	NE	NE	1.5	1.0 U	1.8	NA
Explosives (µg/L)						
2,4,6-Trinitrotoluene	NE	NE	0.40 JN	2.4 U	2.0 U	NA
Total Metals (µg/L)						
Aluminum	750	87	58 J[1]	84 J[1]	200 U	790
Arsenic	360[b]	190[b]	10 U	4.4 J[1]	2.8 J[1]	2.3 J[1]
Barium	NE	NE	34 J[1]	100 J[1]	37 J[1]	58 J[1]
Calcium	NE	NE	120,000	89,000	130,000	66,000
Copper	9.22	6.54	25 U	2.6 J[1]	25 U	2.6 J[1]
Iron	NE	1,000	140	3,400	120	3,200
Lead	33.78	1.32	10 U	1.9 J[1]	10 U	6.2 J[1]
Magnesium	NE	NE	4,000 J[1]	3,500 J[1]	4,200 J[1]	2,900 J[1]
Manganese	NE	NE	22	440	18	260
Nickel	789.00	87.71	1.8 J[1]	2.9 J[1]	2.7 J[1]	2.4 J[1]

TABLE 12
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES

	EPA Region 4 Freshwater Surface Water Screening Value		Drainage Easement that Receives Drainage from AIP and Armstrong	Drainage Easement that Receives Drainage from AIP, Armstrong, and FMNOL	Receives Drainage from AIP, South of the Railroad Spur	Receives Drainage from AIP, Armstrong, and FMNOL, North of Rocky Creek
Analyte	**Acute**	**Chronic**	**DD-507-SW**	**DD-508-SW**	**DD-513-SW**	**DD-514-SW**
Total Metals (µg/L)						
Potassium	NE	NE	2,400 J[1]	3,100 J[1]	2,200 J[1]	2,300 J[1]
Silver	1.23	0.012	10 U	10 U	2.9 J[1]	10 U
Sodium	NE	NE	29,000	22,000	27,000	18,000
Vanadium	NE	NE	12 J[1]	3.4 J[1]	13 J[1]	6.8 J[1]
Zinc	65.04	58.91	8.9 UJ	120	8.4 UJ	24 UJ
Dissolved Metals (µg/L)						
Arsenic	360[b]	190[b]	NA	10 U	2.6 J[1]	10 U
Barium	NE	NE	NA	86 J[1]	41 J[1]	38 J[1]
Calcium	NE	NE	NA	91,000	120,000	60,000
Copper	9.22	6.54	NA	2.6 J[1]	1.3 J[1]	1.4 J[1]
Iron	NE	1,000	NA	220	57 UJ	430
Magnesium	NE	NE	NA	3,600 J[1]	4,200 J[1]	2,700 J[1]
Manganese	NE	NE	NA	440	16	140
Nickel	789.00	87.71	NA	2.2 J[1]	2.1 J[1]	1.3 J[1]
Potassium	NE	NE	NA	3,200 J[1]	2,300 J[1]	2,200 J[1]
Silver	1.23	0.012	NA	2.8 J[1]	10 U	10 U
Sodium	NE	NE	NA	21,000	28,000	18,000
Zinc	65.04	58.91	NA	98	9.7 UJ	8.8 UJ

TABLE 12
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES

Notes:

[a]	EPA Region 4 November 2001 Freshwater Surface Water Screening Value entry used is for chlordane.
[b]	EPA Region 4 November 2001 Freshwater Surface Water Screening Value entry used is for arsenic III.
AIP	Allied Industrial Park
Armstrong	Armstrong World Industries, Inc.
DD	Drainage ditches
EPA	U.S. Environmental Protection Agency
FMNOL	Former Macon Naval Ordnance Landfill
J[1]	Concentration reported is less than the lowest standard on the calibration curve.
JN	The result is presumptive (tentatively identified), but a confirmation was not performed because the result was greater than the method detection limit, but less than the reporting limit.
µg/L	Micrograms per liter
NA	Not analyzed
NE	Not established
SW	Surface water sample
U	The analyte was not detected at or above the minimum or method reporting limit.
UJ	The analyte was not detected at or above the minimum or method reporting limit; the reported value is an estimate.
▨	Shaded values are above the EPARegion 4 November 2001 Freshwater Surface Water Screening Value.

The surface water screeing values were obtained from the EPA Region 4, Waste Management Division, Freshwater Surface Water Screening Values for Hazardous Waste Sites, last updated November 2001.

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		AIP Western Boundary Drainage, West of AIP WWTP	AIP Western Boundary Drainage, East of Armstrong WWTP	Drainage Easement that Receives Drainage from AIP and Armstrong
		DD-502-SD	DD-503-SD	DD-504-SD	DD-505-SD	DD-506-SD
Volatile Organic Compounds (µg/kg)						
Acetone	NE	R	R	26 J	R	R
Methyl Acetate	NE	6.8	2.1 J[1]	3.3 J[1]	8.4 U	6.6 U
Methyl Ethyl Ketone	NE	13 U	12 U	16 U	17 U	13 U
Methylcyclohexane	NE	6.4 U	5.8 U	8.2 U	8.4 U	6.6 U
Tetrachloroethene (Tetrachloroethylene)	NE	6.4 U	5.8 U	8.2 U	8.4 U	6.6 U
Semivolatile Organic Compounds (µg/kg)						
(3-and/or 4-)Methylphenol	NE	210 U	200 U	270 U	**300**	220 U
Acenaphthene	330	210 U	200 U	270 U	270 U	220 U
Acenaphthylene	330	210 U	74 J[1]	270 U	270 U	220 U
Acetophenone	NE	210 U	200 U	270 U	270 U	220 U
Anthracene	330	210 U	23 J[1]	270 U	31 J[1]	220 U
Benzaldehyde	NE	210 U	46 J[1]	270 U	270 U	220 U
Benzo(a)anthracene	330	210 U	220	120 J[1]	210 J[1]	33 J[1]
Benzo(a)pyrene	330	61 J[1]	230	100 J[1]	220 J[1]	47 J[1]
Benzo(b)fluoranthene	NE	100 J[1]	330 J	180 J[1]	280 J	43 J[1]
Benzo(g,h,i)perylene	NE	72 J[1]	210	92 J[1]	180 J[1]	62 J[1]
Benzo(k)fluoranthene	NE	38 J[1]	230	72 J[1]	210 J[1]	31 J[1]
Bis(2-ethylhexyl) phthalate	182	240 J	270 J	270 UJ	270 UJ	220 UJ
Carbazole	NE	210 U	200 U	270 U	31 J[1]	220 U
Chrysene	330	68 J[1]	260	130 J[1]	280	45 J[1]
Dibenzo(a,h)anthracene	330	210 U	97 J[1]	270 U	63 J[1]	220 U
Fluoranthene	330	87 J[1]	310	240 J[1]	440	54 J[1]
Indeno (1,2,3-cd) pyrene	NE	92 J[1]	270 J	130 J[1]	230 J[1]	34 J[1]
Pentachlorophenol	NE	410 U	390 U	520 U	530 U	430 U

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		AIP Western Boundary Drainage, West of AIP WWTP	AIP Western Boundary Drainage, East of Armstrong WWTP	Drainage Easement that Receives Drainage from AIP and Armstrong
		DD-502-SD	DD-503-SD	DD-504-SD	DD-505-SD	DD-506-SD
Semivolatile Organic Compounds (µg/kg)						
Phenanthrene	330	35 J[1]	69 J[1]	51 J[1]	170 J[1]	28 J[1]
Pyrene	330	79 J[1]	270	200 J[1]	380	51 J[1]
Chlorinated Pesticides (µg/kg)						
4,4'-DDD (p,p'-DDD)	3.3	4.1 U	3.9 U	5.2 U	2.8 J[1]	4.3 U
4,4'-DDE (p,p'-DDE)	3.3	2.7 J[1]	16	7.1 U	2.7 J[1]	4.3 U
4,4'-DDT (p,p'-DDT)	3.3	2.4 J[1]	2.0 J[1]	**7.8 J**	6.5 UJ	4.3 U
alpha-Chlordane	1.7[a]	2.1 U	2.0 U	4.7 U	2.7 U	2.2 U
beta-BHC	NE	2.1 U	2.0 U	2.7 U	2.7 U	2.2 U
Dieldrin	NE	4.1 U	3.9 U	4.7 J[1]	5.3 U	4.3 U
Endosulfan II (beta)	NE	4.1 U	3.9 U	5.2 U	3.7 J[1]	4.3 U
Endosulfan Sulfate	NE	4.1 U	3.9 U	5.2 U	5.3 U	**14**
Endrin	3.3	4.1 U	3.9 U	5.2 U	5.3 U	4.3 U
gamma-BHC (Lindane)	3.3	2.1 U	2.0 U	2.7 U	2.7 U	2.2 U
gamma-Chlordane	1.7[a]	2.1 U	2.0 U	2.7 U	2.2 J[1]	**13**
Heptachlor epoxide	NE	2.1 U	2.0 U	2.7 U	2.7 U	2.2 U
Methoxychlor	NE	21 U	20 U	27 U	27 U	22 U
Polychlorinated Biphenyls (µg/kg)						
PCB-1248 (Aroclor 1248)	33[b]	41 U	39 U	52 U	53 U	**360**
PCB-1254 (Aroclor 1254)	33[b]	41 U	39 U	52 U	53 U	43 U
PCB-1260 (Aroclor 1260)	33[b]	41 U	39 U	52 U	53 U	43 U
Explosives (mg/kg)						
4-Nitrotoluene	NE	NA	NA	NA	NA	NA
1,3,5-Trinitrobenzene	NE	NA	NA	NA	NA	NA

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Drainage Easement that Receives Drainage from AIP and Armstrong	Drainage Easement that Receives Drainage from AIP, Armstrong, and FMNOL	
		DD-502-SD	DD-503-SD	DD-507-SD	DD-508-SD	DD-509-SD
Volatile Organic Compounds (µg/kg)						
Acetone	NE	R	R	R	17 UJ	6.0 UJ
Methyl Acetate	NE	6.8	2.1 J^{1}	6.0 U	8.5 U	3.0 U
Methyl Ethyl Ketone	NE	13 U	12 U	12 U	17 U	6.0 U
Methylcyclohexane	NE	6.4 U	5.8 U	6.0 U	8.5 U	3.0 U
Tetrachloroethene (Tetrachloroethylene)	NE	6.4 U	5.8 U	6.0 U	8.5 U	3.0 U
Semivolatile Organic Compounds (µg/kg)						
(3-and/or 4-)Methylphenol	NE	210 U	200 U	200 U	530 U	210 U
Acenaphthene	330	210 U	200 U	200 U	530 U	56 J^{1}
Acenaphthylene	330	210 U	74 J^{1}	43 J^{1}	530 U	210 U
Acetophenone	NE	210 U	200 U	200 U	140 J^{1}	47 J^{1}
Anthracene	330	210 U	23 J^{1}	48 J^{1}	530 UJ	120 J^{1}
Benzaldehyde	NE	210 U	46 J^{1}	200 U	120 J^{1}	210 UJ
Benzo(a)anthracene	330	210 U	220	410	**710 J-**	**910**
Benzo(a)pyrene	330	61 J^{1}	230	410	**1,400**	**1,500**
Benzo(b)fluoranthene	NE	100 J^{1}	330 J	640 J	**1,000**	**1,400**
Benzo(g,h,i)perylene	NE	72 J^{1}	210	320	**680**	560
Benzo(k)fluoranthene	NE	38 J^{1}	230	430	610	640
Bis(2-ethylhexyl) phthalate	182	240 J	270 J	200 UJ	**2,200**	**2,500**
Carbazole	NE	210 U	200 U	40 J^{1}	530 UJ	120 J^{1}
Chrysene	330	68 J^{1}	260	480	**1,200 J-**	**1,300**
Dibenzo(a,h)anthracene	330	210 U	97 J^{1}	130 J^{1}	130 J^{1}	140 J^{1}
Fluoranthene	330	87 J^{1}	310	750	920 J-	**1,300**
Indeno (1,2,3-cd) pyrene	NE	92 J^{1}	270 J	390 J	290 J^{1}	270
Pentachlorophenol	NE	410 U	390 U	400 U	1,000 U	410 U

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Drainage Easement that Receives Drainage from AIP and Armstrong	Drainage Easement that Receives Drainage from AIP, Armstrong, and FMNOL	
		DD-502-SD	DD-503-SD	DD-507-SD	DD-508-SD	DD-509-SD
Semivolatile Organic Compounds (µg/kg)						
Phenanthrene	330	35 J[1]	69 J[1]	**230**	360 J[1]	**570**
Pyrene	330	79 J[1]	270	**820**	**950 J-**	**1,200**
Chlorinated Pesticides (µg/kg)						
4,4'-DDD (p,p'-DDD)	3.3	4.1 U	3.9 U	4.0 U	**34**	4.1 U
4,4'-DDE (p,p'-DDE)	3.3	2.7 J[1]	16	4.0 U	**230**	16 U
4,4'-DDT (p,p'-DDT)	3.3	2.4 J[1]	2.0 J[1]	4.0 U	**210 J**	33 U
alpha-Chlordane	1.7[a]	2.1 U	2.0 U	2.0 U	**27**	**13**
beta-BHC	NE	2.1 U	2.0 U	2.0 U	32 U	**22**
Dieldrin	NE	4.1 U	3.9 U	4.0 U	88 U	48 U
Endosulfan II (beta)	NE	4.1 U	3.9 U	4.0 U	10 U	5.2 U
Endosulfan Sulfate	NE	4.1 U	3.9 U	4.0 U	10 U	4.1 U
Endrin	3.3	4.1 U	3.9 U	4.0 U	21 U	**17**
gamma-BHC (Lindane)	3.3	2.1 U	2.0 U	2.0 U	19 U	**7.2**
gamma-Chlordane	1.7[a]	2.1 U	2.0 U	**16**	19 U	6.4 U
Heptachlor epoxide	NE	2.1 U	2.0 U	2.0 U	34 U	14 U
Methoxychlor	NE	21 U	20 U	20 U	**24**	11 J[1]
Polychlorinated Biphenyls (µg/kg)						
PCB-1248 (Aroclor 1248)	33[b]	41 U	39 U	**550**	**14,000 J-**	**3,700 J-**
PCB-1254 (Aroclor 1254)	33[b]	41 U	39 U	40 U	100 U	41 U
PCB-1260 (Aroclor 1260)	33[b]	41 U	39 U	40 U	**750**	**470**
Explosives (mg/kg)						
4-Nitrotoluene	NE	NA	NA	2.5 U	4.6 U	2.5 U
1,3,5-Trinitrobenzene	NE	NA	NA	2.5 U	4.6 U	2.5 U

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Drainage Easement that Receives Drainage from AIP, Armstrong, and FMNOL	Receives Drainage from AIP, South of Politex US, Inc.	Receives Drainage from AIP, North of the Railroad Spur
		DD-502-SD	DD-503-SD	DD-510-SD	DD-511-SD	DD-512-SD
Volatile Organic Compounds (µg/kg)						
Acetone	NE	R	R	R	R	R
Methyl Acetate	NE	6.8	2.1 J[1]	16 U	8.3 U	8.2 U
Methyl Ethyl Ketone	NE	13 U	12 U	31 U	17 U	16 U
Methylcyclohexane	NE	6.4 U	5.8 U	16 U	8.3 U	8.2 U
Tetrachloroethene (Tetrachloroethylene)	NE	6.4 U	5.8 U	16 U	8.3 U	8.2 U
Semivolatile Organic Compounds (µg/kg)						
(3-and/or 4-)Methylphenol	NE	210 U	200 U	3,700 U	200 U	190 U
Acenaphthene	330	210 U	200 U	3,700 U	200 U	190 U
Acenaphthylene	330	210 U	74 J[1]	3,700 U	200 U	190 U
Acetophenone	NE	210 U	200 U	3,700 U	200 U	190 U
Anthracene	330	210 U	23 J[1]	3,700 U	200 U	190 U
Benzaldehyde	NE	210 U	46 J[1]	3,700 U	200 U	190 U
Benzo(a)anthracene	330	210 U	220	1,500 J[1]	200 U	190 U
Benzo(a)pyrene	330	61 J[1]	230	3,700 J[1]	200 U	190 U
Benzo(b)fluoranthene	NE	100 J[1]	330 J	1,200 J[1]	200 U	190 U
Benzo(g,h,i)perylene	NE	72 J[1]	210	**7,100**	200 U	190 U
Benzo(k)fluoranthene	NE	38 J[1]	230	3,700 U	200 U	190 U
Bis(2-ethylhexyl) phthalate	182	240 J	270 J	3,700 UJ	200 UJ	190 UJ
Carbazole	NE	210 U	200 U	3,700 U	200 U	190 U
Chrysene	330	68 J[1]	260	2,500 J[1]	200 U	190 U
Dibenzo(a,h)anthracene	330	210 U	97 J[1]	3,700 U	200 U	190 U
Fluoranthene	330	87 J[1]	310	3,700 U	200 U	190 U
Indeno (1,2,3-cd) pyrene	NE	92 J[1]	270 J	1,800 J[1]	200 U	190 U
Pentachlorophenol	NE	410 U	390 U	1,600 J[1]	390 UJ	370 UJ

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Drainage Easement that Receives Drainage from AIP, Armstrong, and FMNOL	Receives Drainage from AIP, South of Politex US, Inc.	Receives Drainage from AIP, North of the Railroad Spur
		DD-502-SD	DD-503-SD	DD-510-SD	DD-511-SD	DD-512-SD
Semivolatile Organic Compounds (µg/kg)						
Phenanthrene	330	35 J[1]	69 J[1]	370 J[1]	200 U	190 U
Pyrene	330	79 J[1]	270	1,400 J[1]	200 U	190 U
Chlorinated Pesticides (µg/kg)						
4,4'-DDD (p,p'-DDD)	3.3	4.1 U	3.9 U	7.1 U	3.9 U	3.7 U
4,4'-DDE (p,p'-DDE)	3.3	2.7 J[1]	16	7.1 U	3.9 U	5.4
4,4'-DDT (p,p'-DDT)	3.3	2.4 J[1]	2.0 J[1]	7.1 U	3.9 U	3.7 U
alpha-Chlordane	1.7[a]	2.1 U	2.0 U	3.7 U	2.0 U	1.9 U
beta-BHC	NE	2.1 U	2.0 U	3.7 U	2.0 U	1.9 U
Dieldrin	NE	4.1 U	3.9 U	7.1 U	3.9 U	3.7 U
Endosulfan II (beta)	NE	4.1 U	3.9 U	7.1 U	3.9 U	3.7 U
Endosulfan Sulfate	NE	4.1 U	3.9 U	7.1 U	3.9 U	3.7 U
Endrin	3.3	4.1 U	3.9 U	7.1 U	3.9 U	3.7 U
gamma-BHC (Lindane)	3.3	2.1 U	2.0 U	3.7 U	2.0 U	1.9 U
gamma-Chlordane	1.7[a]	2.1 U	2.0 U	**56**	2.0 U	1.9 U
Heptachlor epoxide	NE	2.1 U	2.0 U	3.7 U	2.0 U	1.9 U
Methoxychlor	NE	21 U	20 U	37 U	20 U	19 U
Polychlorinated Biphenyls (µg/kg)						
PCB-1248 (Aroclor 1248)	33[b]	41 U	39 U	**1,800**	39 U	37 U
PCB-1254 (Aroclor 1254)	33[b]	41 U	39 U	71 U	39 U	37 U
PCB-1260 (Aroclor 1260)	33[b]	41 U	39 U	71 U	39 U	37 U
Explosives (mg/kg)						
4-Nitrotoluene	NE	NA	NA	4.4 U	2.3 U	2.3 U
1,3,5-Trinitrobenzene	NE	NA	NA	0.82 JN	2.3 U	2.3 U

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Receives Drainage from AIP, South of the Railroad Spur	Receives Drainage from AIP, Armstrong, and FMNOL, North of Rocky Creek	Receives Drainage from AIP, West of Michael R. Smith Property
		DD-502-SD	DD-503-SD	DD-513-SD	DD-514-SD	DD-515-SD
Volatile Organic Compounds (µg/kg)						
Acetone	NE	R	R	25 U	R	180 J
Methyl Acetate	NE	6.8	2.1 J[1]	13 U	31 U	3.0 U
Methyl Ethyl Ketone	NE	13 U	12 U	25 U	62 U	7.7
Methylcyclohexane	NE	6.4 U	5.8 U	13 UJ	31 U	3.0 U
Tetrachloroethene (Tetrachloroethylene)	NE	6.4 U	5.8 U	13 U	31 U	0.39 J[1]
Semivolatile Organic Compounds (µg/kg)						
(3-and/or 4-)Methylphenol	NE	210 U	200 U	290 U	8,300 U	210 U
Acenaphthene	330	210 U	200 U	290 U	8,300 U	210 U
Acenaphthylene	330	210 U	74 J[1]	290 U	8,300 U	210 U
Acetophenone	NE	210 U	200 U	290 U	8,300 U	47 J[1]
Anthracene	330	210 U	23 J[1]	53 J[1]	8,300 U	210 UJ
Benzaldehyde	NE	210 U	46 J[1]	290 U	8,300 U	210 U
Benzo(a)anthracene	330	210 U	220	**680**	8,300 U	210 U
Benzo(a)pyrene	330	61 J[1]	230	**1,300**	1,900 J[1]	210 U
Benzo(b)fluoranthene	NE	100 J[1]	330 J	730	8,300 U	210 U
Benzo(g,h,i)perylene	NE	72 J[1]	210	**1,600**	2,800 J[1]	210 U
Benzo(k)fluoranthene	NE	38 J[1]	230	220 J[1]	8,300 U	210 U
Bis(2-ethylhexyl) phthalate	182	240 J	270 J	**910 J**	8,300 UJ	270 J
Carbazole	NE	210 U	200 U	59 J[1]	8,300 U	210 UJ
Chrysene	330	68 J[1]	260	**1,000**	1,200 J[1]	41 J[1]
Dibenzo(a,h)anthracene	330	210 U	97 J[1]	280 J[1]	8,300 U	210 U
Fluoranthene	330	87 J[1]	310	580	8,300 U	58 J[1]
Indeno (1,2,3-cd) pyrene	NE	92 J[1]	270 J	600	8,300 U	210 U
Pentachlorophenol	NE	410 U	390 U	57 J[1]	16,000 U	410 U

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Receives Drainage from AIP, South of the Railroad Spur	Receives Drainage from AIP, Armstrong, and FMNOL, North of Rocky Creek	Receives Drainage from AIP, West of Michael R. Smith Property
		DD-502-SD	DD-503-SD	DD-513-SD	DD-514-SD	DD-515-SD
Semivolatile Organic Compounds (µg/kg)						
Phenanthrene	330	35 J[1]	69 J[1]	**370**	8,300 U	210 U
Pyrene	330	79 J[1]	270	**880**	8,300 U	210 U
Chlorinated Pesticides (µg/kg)						
4,4'-DDD (p,p'-DDD)	3.3	4.1 U	3.9 U	5.5 U	16 U	**6.6**
4,4'-DDE (p,p'-DDE)	3.3	2.7 J[1]	16	5.5 U	16 U	15
4,4'-DDT (p,p'-DDT)	3.3	2.4 J[1]	2.0 J[1]	5.5 U	16 U	**19**
alpha-Chlordane	1.7[a]	2.1 U	2.0 U	2.8 U	8.3 U	2.3 U
beta-BHC	NE	2.1 U	2.0 U	2.8 U	8.3 U	2.1 U
Dieldrin	NE	4.1 U	3.9 U	5.5 U	16 U	4.1 U
Endosulfan II (beta)	NE	4.1 U	3.9 U	5.5 U	16 U	4.1 U
Endosulfan Sulfate	NE	4.1 U	3.9 U	5.5 U	16 U	4.1 U
Endrin	3.3	4.1 U	3.9 U	5.5 U	16 U	4.1 U
gamma-BHC (Lindane)	3.3	2.1 U	2.0 U	7.5 U	**8.5**	2.1 U
gamma-Chlordane	1.7[a]	2.1 U	2.0 U	**86**	**72**	0.93 J[1]
Heptachlor epoxide	NE	2.1 U	2.0 U	2.8 U	8.3 U	2.1 U
Methoxychlor	NE	21 U	20 U	28 U	83 U	21 U
Polychlorinated Biphenyls (µg/kg)						
PCB-1248 (Aroclor 1248)	33[b]	41 U	39 U	55 U	**2,400 J**	41 UJ
PCB-1254 (Aroclor 1254)	33[b]	41 U	39 U	**2,000**	160 U	41 U
PCB-1260 (Aroclor 1260)	33[b]	41 U	39 U	55 U	160 U	41 U
Explosives (mg/kg)						
4-Nitrotoluene	NE	NA	NA	3.2 U	NA	2.3 U
1,3,5-Trinitrobenzene	NE	NA	NA	3.2 U	NA	2.3 U

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Receives Drainage from AIP, West of the Rail Spur Receiving Area		Receives Drainage from AIP, South of the Rail Spur Receiving Area
		DD-502-SD	DD-503-SD	DD-516-SD	DD-516-SD-DUP	DD-517-SD
Volatile Organic Compounds (µg/kg)						
Acetone	NE	R	R	27 J	43 J	6.8 U
Methyl Acetate	NE	6.8	2.1 J[1]	2.9 U	3.5 U	3.4 U
Methyl Ethyl Ketone	NE	13 U	12 U	5.8 U	7.0 U	6.8 U
Methylcyclohexane	NE	6.4 U	5.8 U	2.9 U	3.5 U	3.4 U
Tetrachloroethene (Tetrachloroethylene)	NE	6.4 U	5.8 U	2.9 UJ	0.57 J[1]	3.4 U
Semivolatile Organic Compounds (µg/kg)						
(3-and/or 4-)Methylphenol	NE	210 U	200 U	180 U	190 U	190 U
Acenaphthene	330	210 U	200 U	180 U	190 U	190 U
Acenaphthylene	330	210 U	74 J[1]	180 U	190 U	190 U
Acetophenone	NE	210 U	200 U	180 U	70 J[1]	190 U
Anthracene	330	210 U	23 J[1]	180 UJ	190 UJ	190 UJ
Benzaldehyde	NE	210 U	46 J[1]	180 U	120 J[1]	190 U
Benzo(a)anthracene	330	210 U	220	30 J[1]	190 U	190 U
Benzo(a)pyrene	330	61 J[1]	230	180 U	190 U	190 U
Benzo(b)fluoranthene	NE	100 J[1]	330 J	180 U	190 U	190 U
Benzo(g,h,i)perylene	NE	72 J[1]	210	180 U	190 U	190 U
Benzo(k)fluoranthene	NE	38 J[1]	230	180 U	190 U	190 U
Bis(2-ethylhexyl) phthalate	182	240 J	270 J	180 UJ	190 UJ	190 UJ
Carbazole	NE	210 U	200 U	180 UJ	190 UJ	190 UJ
Chrysene	330	68 J[1]	260	31 J[1]	190 U	190 U
Dibenzo(a,h)anthracene	330	210 U	97 J[1]	180 U	190 U	190 U
Fluoranthene	330	87 J[1]	310	58 J[1]	42 J[1]	190 U
Indeno (1,2,3-cd) pyrene	NE	92 J[1]	270 J	180 U	190 U	190 U
Pentachlorophenol	NE	410 U	390 U	360 U	380 U	380 U

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Receives Drainage from AIP, West of the Rail Spur Receiving Area		Receives Drainage from AIP, South of the Rail Spur Receiving Area
		DD-502-SD	DD-503-SD	DD-516-SD	DD-516-SD-DUP	DD-517-SD
Semivolatile Organic Compounds (µg/kg)						
Phenanthrene	330	35 J[1]	69 J[1]	180 U	190 U	190 U
Pyrene	330	79 J[1]	270	180 U	190 U	190 U
Chlorinated Pesticides (µg/kg)						
4,4'-DDD (p,p'-DDD)	3.3	4.1 U	3.9 U	3.6 U	**8.9**	3.8 U
4,4'-DDE (p,p'-DDE)	3.3	2.7 J[1]	16	2.2 J[1]	3.8	1.6 J[1]
4,4'-DDT (p,p'-DDT)	3.3	2.4 J[1]	2.0 J[1]	3.6 U	2.1 J[1]	2.0 J[1]
alpha-Chlordane	1.7[a]	2.1 U	2.0 U	1.8 U	1.9 U	1.9 U
beta-BHC	NE	2.1 U	2.0 U	1.8 U	1.9 U	1.9 U
Dieldrin	NE	4.1 U	3.9 U	3.6 U	3.8 U	3.8 U
Endosulfan II (beta)	NE	4.1 U	3.9 U	3.6 U	3.8 U	3.8 U
Endosulfan Sulfate	NE	4.1 U	3.9 U	3.6 U	3.8 U	3.8 U
Endrin	3.3	4.1 U	3.9 U	3.6 U	3.8 U	3.8 U
gamma-BHC (Lindane)	3.3	2.1 U	2.0 U	1.8 U	1.9 U	1.9 U
gamma-Chlordane	1.7[a]	2.1 U	2.0 U	1.8 U	1.9 U	1.9 U
Heptachlor epoxide	NE	2.1 U	2.0 U	1.8 U	1.9 U	1.9 U
Methoxychlor	NE	21 U	20 U	18 U	19 U	19 U
Polychlorinated Biphenyls (µg/kg)						
PCB-1248 (Aroclor 1248)	33[b]	41 U	39 U	36 UJ	38 UJ	38 UJ
PCB-1254 (Aroclor 1254)	33[b]	41 U	39 U	36 U	38 U	38 U
PCB-1260 (Aroclor 1260)	33[b]	41 U	39 U	36 U	38 U	38 U
Explosives (mg/kg)						
4-Nitrotoluene	NE	NA	NA	NA	NA	2.2 U
1,3,5-Trinitrobenzene	NE	NA	NA	NA	NA	2.2 U

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Receives Drainage from AIP, North of Rocky Creek Water Reclamation Facility	Receives Drainage from AIP, North of PPE 3
		DD-502-SD	DD-503-SD	DD-518-SD	DD-519-SD
Volatile Organic Compounds (µg/kg)					
Acetone	NE	R	R	250 J-	180
Methyl Acetate	NE	6.8	2.1 J[1]	5.9 J-	20 U
Methyl Ethyl Ketone	NE	13 U	12 U	24 J-	**46**
Methylcyclohexane	NE	6.4 U	5.8 U	3.9 UJ	3.6 J[1]
Tetrachloroethene (Tetrachloroethylene)	NE	6.4 U	5.8 U	3.9 UJ	5.1 J[1]
Semivolatile Organic Compounds (µg/kg)					
(3-and/or 4-)Methylphenol	NE	210 U	200 U	230 U	650 U
Acenaphthene	330	210 U	200 U	230 U	650 U
Acenaphthylene	330	210 U	74 J[1]	67 J[1]	650 U
Acetophenone	NE	210 U	200 U	54 J[1]	650 U
Anthracene	330	210 U	23 J[1]	170 J[1]	650 UJ
Benzaldehyde	NE	210 U	46 J[1]	230 U	320 J[1]
Benzo(a)anthracene	330	210 U	220	63 J[1]	270 J[1]
Benzo(a)pyrene	330	61 J[1]	230	270	**700**
Benzo(b)fluoranthene	NE	100 J[1]	330 J	860	420 J[1]
Benzo(g,h,i)perylene	NE	72 J[1]	210	200 J[1]	620 J[1]
Benzo(k)fluoranthene	NE	38 J[1]	230	620 J	650 U
Bis(2-ethylhexyl) phthalate	182	240 J	270 J	230 UJ	**3,400 J**
Carbazole	NE	210 U	200 U	230 UJ	650 UJ
Chrysene	330	68 J[1]	260	140 J[1]	570 J[1]
Dibenzo(a,h)anthracene	330	210 U	97 J[1]	110 J[1]	140 J[1]
Fluoranthene	330	87 J[1]	310	82 J[1]	650 U
Indeno (1,2,3-cd) pyrene	NE	92 J[1]	270 J	320	170 J[1]
Pentachlorophenol	NE	410 U	390 U	450 U	1,300 U

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Receives Drainage from AIP, North of Rocky Creek Water Reclamation Facility	Receives Drainage from AIP, North of PPE 3
		DD-502-SD	DD-503-SD	DD-518-SD	DD-519-SD
Semivolatile Organic Compounds (µg/kg)					
Phenanthrene	330	35 J[1]	69 J[1]	230 U	650 U
Pyrene	330	79 J[1]	270	230 U	650 U
Chlorinated Pesticides (µg/kg)					
4,4'-DDD (p,p'-DDD)	3.3	4.1 U	3.9 U	4.5 U	4.3 J[1]
4,4'-DDE (p,p'-DDE)	3.3	2.7 J[1]	16	4.5 U	29 U
4,4'-DDT (p,p'-DDT)	3.3	2.4 J[1]	2.0 J[1]	4.5 U	**25**
alpha-Chlordane	1.7[a]	2.1 U	2.0 U	2.3 U	6.5 U
beta-BHC	NE	2.1 U	2.0 U	2.3 U	6.5 U
Dieldrin	NE	4.1 U	3.9 U	**120 J-**	21 U
Endosulfan II (beta)	NE	4.1 U	3.9 U	4.5 U	13 U
Endosulfan Sulfate	NE	4.1 U	3.9 U	4.5 U	13 U
Endrin	3.3	4.1 U	3.9 U	4.5 U	13 U
gamma-BHC (Lindane)	3.3	2.1 U	2.0 U	2.3 U	6.5 U
gamma-Chlordane	1.7[a]	2.1 U	2.0 U	2.3 U	14 U
Heptachlor epoxide	NE	2.1 U	2.0 U	0.64 J[1]	9.3 U
Methoxychlor	NE	21 U	20 U	23 U	65 U
Polychlorinated Biphenyls (µg/kg)					
PCB-1248 (Aroclor 1248)	33[b]	41 U	39 U	45 U	**990 J-**
PCB-1254 (Aroclor 1254)	33[b]	41 U	39 U	45 U	**920**
PCB-1260 (Aroclor 1260)	33[b]	41 U	39 U	45 U	**230**
Explosives (mg/kg)					
4-Nitrotoluene	NE	NA	NA	0.19 JN	8.1 U
1,3,5-Trinitrobenzene	NE	NA	NA	2.6 U	8.1 U

TABLE 13
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Notes:

[a]	EPA Region 4 November 2001 Sediment Screening Value entry used is for chlordane
[b]	EPA Region 4 November 2001 Sediment Screening Value entry used is for total PCBs.
AIP	Allied Industrial Park
Armstrong	Armstrong World Industries, Inc.
DD	Drainage ditches
DUP	Field duplicate
EPA	U.S. Environmental Protection Agency
FMNOL	Former Macon Naval Ordnance Landfill
J	The identification of the analyte is acceptable; the reported value is an estimate.
J-	The identification of the analyte is acceptable; the reported value is an estimate with a possible low bias.
J^1	Concentration reported is less than the lowest standard on the calibration curve.
JN	The result is presumptive (tentatively identified), but a confirmation was not performed because the result was greater than the method detection limit, but less than the reporting limit.
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
NA	Not analyzed
NE	Not established
PPE	Probable point of entry
R	The sample results are unusable based on the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
SD	Sediment sample
U	The analyte was not detected at or above the minimum or method reporting limit.
UJ	The analyte was not detected at or above the minimum or method reporting limit; the reported value is an estimate.
WWTP	Waste water treatment plant
BOLD	Bolded values are elevated, meaning that the values are three times the concentration of detected constituents in the background sample or greater than or equal to the non-detect concentration in the background sample.
▨ **BOLD**	Shaded and bolded values are elevated and are above the EPA Region 4 November 2001 Sediment Screening Value.
▨	Shaded values are above the EPA Region 4 November 2001 Sediment Screening Value.

The sediment screeing values were obtained from the EPA Region 4, Waste Management Division, Sediment Screening Values for Hazardous Waste Sites, last updated November 2001.

TABLE 14
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
INORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	**EPA Region 4 Sediment Screening Value**	**Background**		**AIP Western Boundary Drainage, West of AIP WWTP**	**AIP Western Boundary Drainage, East of Armstrong WWTP**	**Drainage Easement that Receives Drainage from AIP and Armstrong**		**Drainage Easement that Receives Drainage from AIP, Armstrong, and FMNOL**
		DD-502-SD	**DD-503-SD**	**DD-504-SD**	**DD-505-SD**	**DD-506-SD**	**DD-507-SD**	**DD-508-SD**
Metals (mg/kg)								
Aluminum	NE	6,900	3,800	3,000	6,000	2,200	1,400	4,500
Antimony	12	0.37 J[1]	7.1 UJ	R	0.81 J[1]	8.0 UJ	1.9 J[1]	0.47 J[1]
Arsenic	7.24	2.8	1.1 J[1]	2.2	2.0	1.3 U	1.3 U	0.63 J[1]
Barium	NE	89	25	47	55	13 J[1]	15 J[1]	57
Beryllium	NE	0.22 J[1]	0.056 J[1]	0.19 UJ	0.20 UJ	0.11 UJ	0.13 UJ	0.16 J[1]
Cadmium	0.676	1.2	0.36 UJ	0.097 UJ	0.98 J	0.94 J	0.90 J	**8.4**
Calcium	NE	1,200	970	**3,700**	2,100	1,700	2,700	**3,600**
Chromium	52.3	26	9.1	7.4	13	17	2.6	18
Cobalt	NE	2.5 J[1]	0.37 J[1]	1.1 UJ	1.7 UJ	0.28 UJ	0.33 UJ	1.3 J[1]
Copper	18.7	13	3.9	6.6	22 J+	5.0 J+	7.1 J+	38
Iron	NE	*10,000*	*6,800*	4,300	8,500	*6,600*	*1,400*	5,000
Lead	30.2	80	10	18	72	19	45	110
Magnesium	NE	650	180 J[1]	570 J[1]	670 J[1]	350 J[1]	590 J[1]	470 J[1]
Manganese	NE	490	94	220	180	39	42	67
Mercury	0.13	0.088 UJ	0.030 UJ	0.15 UJ	0.087 UJ	0.027 UJ	0.13 UJ	**0.24**
Nickel	15.9	3.3 J[1]	0.85 J[1]	1.4 J[1]	4.0 J[1]	0.85 J[1]	0.71 J[1]	3.7 J[1]
Potassium	NE	330 J[1]	95 J[1]	600 J[1]	200 J[1]	20 J[1]	50 J[1]	100 J[1]
Silver	2	1.2 U	1.2 U	0.57 J[1]	1.7 U	1.3 U	1.3 U	1.5 U
Sodium	NE	15 J[1]	6.2 J[1]	17 J[1]	38 J[1]	26 J	49 J[1]	79 J[1]
Thallium	NE	0.40 J[1]	0.16 J[1]	3.9 U	0.26 UJ	3.3 U	3.2 U	3.6 U
Vanadium	NE	28 J-	19 J-	11 J-	25 J-	20 J-	4.2 UJ	17 J-
Zinc	124	150	12	36	130 J	27 J	15 J	390

TABLE 14
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
INORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Drainage Easement that Receives Drainage from AIP, Armstrong, and FMNOL		Receives Drainage from AIP, South of Politex US, Inc.	Receives Drainage from AIP, North of the Railroad Spur	Receives Drainage from AIP, South of the Railroad Spur
		DD-502-SD	DD-503-SD	DD-509-SD	DD-510-SD	DD-511-SD	DD-512-SD	DD-513-SD
Metals (mg/kg)								
Aluminum	NE	6,900	3,800	5,700	8,900	910	2,900	6,200
Antimony	12	0.37 J[1]	7.1 UJ	2.8 J[1]	0.53 J[1]	4.7 J[1]	R	R
Arsenic	7.24	2.8	1.1 J[1]	0.91 J[1]	2.7	1.2 U	1.3	2.6
Barium	NE	89	25	100	140	3.5 J[1]	22 J[1]	69
Beryllium	NE	0.22 J[1]	0.056 J[1]	0.45 J[1]	0.59 UJ	0.043 UJ	0.21 UJ	0.35 UJ
Cadmium	0.676	1.2	0.36 UJ	**12**	**4.5**	0.59 U	0.56 U	**5.8**
Calcium	NE	1,200	970	**9,300**	1,200	140 J[1]	350 J[1]	**6,700**
Chromium	52.3	26	9.1	16	31	3.4	5.1	18
Cobalt	NE	2.5 J[1]	0.37 J[1]	1.0 J[1]	8.1 UJ	0.19 UJ	1.0 UJ	2.3 UJ
Copper	18.7	13	3.9	28	20	2.5 J[1]	3.4	34
Iron	NE	*10,000*	*6,800*	4,800	*18,000*	*1,700*	3,400	8,100
Lead	30.2	80	10	77	49	1.1 J[1]	11	87
Magnesium	NE	650	180 J[1]	1,700	760 J[1]	200 J[1]	140 J[1]	1,000
Manganese	NE	490	94	180	960	13	140	210
Mercury	0.13	0.088 UJ	0.030 UJ	**0.27**	**0.35 J-**	0.11 UJ	0.034 UJ	**0.39**
Nickel	15.9	3.3 J[1]	0.85 J[1]	3.3 J[1]	4.5 J[1]	0.69 J[1]	1.0 J[1]	4.2 J[1]
Potassium	NE	330 J[1]	95 J[1]	280 J[1]	460 J[1]	160 J[1]	130 J[1]	280 J[1]
Silver	2	1.2 U	1.2 U	1.6 U	2.3 U	1.2 U	1.1 U	1.7 U
Sodium	NE	15 J[1]	6.2 J[1]	160 J[1]	46 J[1]	38 J[1]	30 J[1]	120 J[1]
Thallium	NE	0.40 J[1]	0.16 J[1]	4.1 U	0.50 UJ	2.9 U	0.14 UJ	4.2 U
Vanadium	NE	28 J-	19 J-	13 J-	43 J-	4.1 UJ	9.3 J-	22 J-
Zinc	124	150	12	150	56	78	28	150

TABLE 14
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
INORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Receives Drainage from AIP, Armstrong, and FMNOL, North of Rocky Creek	Receives Drainage from AIP, West of Michael R. Smith Property	Receives Drainage from AIP, West of the Rail Spur Receiving Area		Receives Drainage from AIP, South of the Rail Spur Receiving Area
		DD-502-SD	DD-503-SD	DD-514-SD	DD-515-SD	DD-516-SD	DD-516-SD-DUP	DD-517-SD
Metals (mg/kg)								
Aluminum	NE	6,900	3,800	11,000	3,300	3,500	3,800	3,900
Antimony	12	0.37 J[1]	7.1 UJ	R	7.4 UJ	6.5 UJ	R	0.34 J[1]
Arsenic	7.24	2.8	1.1 J[1]	4.4 J[1]	1.1 J[1]	0.78 J[1]	1.2 J-	1.9
Barium	NE	89	25	110 J[1]	83	59	78	18 J[1]
Beryllium	NE	0.22 J[1]	0.056 J[1]	0.73 UJ	0.13 J[1]	0.10 J[1]	0.13 UJ	0.086 J[1]
Cadmium	0.676	1.2	0.36 UJ	**12**	1.7	0.058	0.56 U	0.042
Calcium	NE	1,200	970	**11,000**	3,500	1,300	1,800	**21,000**
Chromium	52.3	26	9.1	29	7.5	4.3	5.2	8.8
Cobalt	NE	2.5 J[1]	0.37 J[1]	5.1 UJ	1.1 J[1]	0.84 J[1]	1.2 UJ	0.85 J[1]
Copper	18.7	13	3.9	**45**	**40**	4.1	6.0	8.4
Iron	NE	*10,000*	*6,800*	*11,000*	*3,600*	*3,300*	*3,900*	*6,800*
Lead	30.2	80	10	110	20	20	28	10
Magnesium	NE	650	180 J[1]	1,200 J[1]	240 J[1]	130 J[1]	160 J[1]	610
Manganese	NE	490	94	220	300	180	290	88
Mercury	0.13	0.088 UJ	0.030 UJ	**0.63 J-**	**0.19**	0.064 UJ	0.062 UJ	0.082 UJ
Nickel	15.9	3.3 J[1]	0.85 J[1]	8.6 J[1]	1.6 J[1]	1.2 J[1]	1.5 J[1]	1.7 J[1]
Potassium	NE	330 J[1]	95 J[1]	410 J[1]	100 J[1]	81 J[1]	120 J[1]	290 J[1]
Silver	2	1.2 U	1.2 U	5.4 U	1.2 U	1.1 U	1.1 U	1.1 U
Sodium	NE	15 J[1]	6.2 J[1]	260 J[1]	9.2 J[1]	6.1 J[1]	10 J[1]	28 J[1]
Thallium	NE	0.40 J[1]	0.16 J[1]	14 U	3.1 U	0.17 J[1]	2.8 U	2.8 U
Vanadium	NE	28 J-	19 J-	47 J-	12 J-	8.7 J-	11 J-	15 J-
Zinc	124	150	12	300	52	110	130	28

TABLE 14
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
INORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Background		Receives Drainage from AIP, North of Rocky Creek Water Reclamation	Receives Drainage from AIP, North of PPE 3
		DD-502-SD	DD-503-SD	DD-518-SD	DD-519-SD
Metals (mg/kg)					
Aluminum	NE	6,900	3,800	3,500	7,100
Antimony	12	0.37 J[1]	7.1 UJ	8.0 UJ	1.6 J[1]
Arsenic	7.24	2.8	1.1 J[1]	1.2 J	3.0 J[1]
Barium	NE	89	25	60	110
Beryllium	NE	0.22 J[1]	0.056 J[1]	0.11 J[1]	0.35 J[1]
Cadmium	0.676	1.2	0.36 UJ	0.086 UJ	**11**
Calcium	NE	1,200	970	2,400	**5,600**
Chromium	52.3	26	9.1	6.1	24
Cobalt	NE	2.5 J[1]	0.37 J[1]	0.81 J[1]	4.1 J[1]
Copper	18.7	13	3.9	5.9	32
Iron	NE	*10,000*	*6,800*	*5,100*	*11,000*
Lead	30.2	80	10	20	53
Magnesium	NE	650	180 J[1]	200 J[1]	560 J[1]
Manganese	NE	490	94	150	320
Mercury	0.13	0.088 UJ	0.030 UJ	0.042 UJ	**0.62**
Nickel	15.9	3.3 J[1]	0.85 J[1]	2.1 J[1]	3.3 J[1]
Potassium	NE	330 J[1]	95 J[1]	130 J[1]	130 J[1]
Silver	2	1.2 U	1.2 U	1.3 U	3.5 U
Sodium	NE	15 J[1]	6.2 J[1]	13 J[1]	170 J[1]
Thallium	NE	0.40 J[1]	0.16 J[1]	3.3 U	8.8 U
Vanadium	NE	28 J-	19 J-	13 J-	35 J-
Zinc	124	150	12	26	59

TABLE 14
EXPANDED SITE INSPECTION
DRAINAGE DITCHES
INORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Notes:

AIP	Allied Industrial Park
Armstrong	Armstrong World Industries, Inc.
DD	Drainage ditches
DUP	Field duplicate
EPA	U.S. Environmental Protection Agency
FMNOL	Former Macon Naval Ordnance Landfill
J	The identification of the analyte is acceptable; the reported value is an estimate.
J+	The identification of the analyte is acceptable; the reported value is an estimate with a possible high bias.
J-	The identification of the analyte is acceptable; the reported value is an estimate with a possible low bias.
J^{1}	Concentration reported is less than the lowest standard on the calibration curve.
mg/kg	Milligrams per kilogram
NA	Not analyzed
NE	Not established
PPE	Probable point of entry
R	The sample results are unusable based on the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
SD	Sediment sample
U	The analyte was not detected at or above the minimum reporting limit.
UJ	The analyte was not detected at or above the minimum reporting limit; the reported value is an estimate.
WWTP	Waste water treatment plant
BOLD	Bolded values are elevated, meaning that the values are three times the concentration of detected constituents in the background sample or greater than or equal to the non-detect concentration in the background sample.
▨ **BOLD**	Shaded and bolded values are elevated and are above the EPA Region 4 November 2001 Sediment Screening Value.
▨	Shaded values are above the EPA Region 4 November 2001 Sediment Screening Value.

The sediment screeing values were obtained from the EPA Region 4, Waste Management Division, Sediment Screening Values for Hazardous Waste Sites, last updated November 2001.

TABLE 15
EXPANDED SITE INSPECTION
ROCKY CREEK
ANALYTICAL RESULTS FOR BACKGROUND SURFACE WATER SAMPLES

Analyte	Background Locations					Highest Background Value[1]
	RC-400-SW	RC-401-SW	RC-402-SW	RC-403-SW	RC-403-SW-DUP	
Total Metals (µg/L)						
Aluminum	750	420	560	660	390	750
Barium	56 J[1]	49 J[1]	54 J[1]	56 J[1]	48 J[1]	56 J[1]
Calcium	3,900 J[1]	6,500	5,000 J[1]	5,000	4,800 J[1]	6,500
Copper	1.3 J[1]	25 U	25 U	1.1 J[1]	1.0 J[1]	1.3 J[1]
Iron	2,500	3,200	2,300	2,500	1,800	3,200
Lead	10 U	10 U	10 U	10 U	10 U	10 U
Magnesium	1,500 J[1]	1,800 J[1]	1,800 J[1]	1,800 J[1]	1,700 J[1]	1,800 J[1]
Manganese	380	360	560	620	420	620
Potassium	2,400 J[1]	2,000 J[1]	2,400 J[1]	2,400 J[1]	2,400 J[1]	2,400 J[1]
Sodium	2,800 J[1]	3,800 J[1]	3,200 J[1]	3,300 J[1]	3,200 J[1]	3,800 J[1]
Thallium	25 U	25 U	25 U	25 U	25 U	25 U
Vanadium	3.3 J[1]	1.9 J[1]	2.3 J[1]	2.3 J[1]	2.1 J[1]	3.3 J[1]
Dissolved Metals (µg/L)						
Barium	49 J[1]	42 J[1]	45 J[1]	38 J[1]	36 J[1]	49 J[1]
Calcium	4,000 J[1]	6,600	5,500	4,700 J[1]	4,800 J[1]	6,600
Copper	1.0 J[1]	1.3 J[1]	1.7 J[1]	25 U	1.4 J[1]	1.7 J[1]
Iron	1,000	1,400	940	950	900	1,400
Magnesium	1,500 J[1]	1,900 J[1]	1,700 J[1]	1,700 J[1]	1,700 J[1]	1,900 J[1]
Manganese	300	250	110	110	50	300
Potassium	2,500 J[1]	2,200 J[1]	2,500 J[1]	2,400 J[1]	2,400 J[1]	2,500 J[1]
Sodium	3,000 J[1]	3,800 J[1]	3,500 J[1]	3,200 J[1]	3,500 J[1]	3,800 J[1]

TABLE 15
EXPANDED SITE INSPECTION
ROCKY CREEK
ANALYTICAL RESULTS FOR BACKGROUND SURFACE WATER SAMPLES

Notes:

1	The background value listed is either the highest detection or, if the analyte was not detected in any background sample, the non-detect with the highest minimum reporting limit.
DUP	Field duplicate
J[1]	Concentration reported is less than the lowest standard on the calibration curve.
µg/L	Micrograms per liter
NA	Not analyzed
RC	Rocky Creek
SW	Surface water sample
U	The analyte was not detected at or above the minimum reporting limit.

TABLE 16
EXPANDED SITE INSPECTION
ROCKY CREEK
ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES

Analyte	EPA Region 4 Freshwater Surface Water Screening Value		Highest Background Value[1]	South of Armstrong Remote Landfill	Downstream from PPE 1	At PPE 2	Between PPE 2 and PPE 3	At PPE 3	Downstream from PPE 3
	Acute	Chronic		RC-404-SW	RC-405-SW	RC-406-SW	RC-407-SW	RC-408-SW	RC-409-SW
Total Metals (µg/L)									
Aluminum	750	87	750	460	400	750	220	380	410
Barium	NE	NE	56 J[1]	52 J[1]	55 J[1]	51 J[1]	50 J[1]	48 J[1]	54 J[1]
Calcium	NE	NE	6,500	5,200	5,600	5,600	6,100	7,600	8,200
Copper	9.22	6.54	1.3 J[1]	0.91 J[1]	25 U	1.3 J[1]	25 U	25 U	25 U
Iron	NE	1,000	3,200	2,200	2,200	3,000	2,900	2,100	2,500
Lead	33.78	1.32	10 U	10 U	10 U	2.1 J[1]	10 U	10 U	10 U
Magnesium	NE	NE	1,800 J[1]	1,800 J[1]	2,000 J[1]	1,700 J[1]	1,800 J[1]	1,900 J[1]	2,000 J[1]
Manganese	NE	NE	620	560	710	320	390	490	630
Potassium	NE	NE	2,400 J[1]	2,400 J[1]	2,400 J[1]	2,300 J[1]	2,100 J[1]	2,300 J[1]	2,200 J[1]
Sodium	NE	NE	3,800 J[1]	3,300 J[1]	3,400 J[1]	3,200 J[1]	3,500 J[1]	3,700 J[1]	3,800 J[1]
Thallium	140.00	4.00	25 U	25 U	25 U	1.7 J[1]	25 U	25 U	25 U
Vanadium	NE	NE	3.3 J[1]	1.7 J[1]	1.2 J[1]	3.6 J[1]	1.5 J[1]	1.6 J[1]	1.8 J[1]
Dissolved Metals (µg/L)									
Barium	NE	NE	49 J[1]	42 J[1]	41 J[1]	43 J[1]	42 J[1]	46 J[1]	50 J[1]
Calcium	NE	NE	6,600	5,100	5,400	5,300	6,000	7,100	8,100
Copper	9.22	6.54	1.7 J[1]	1.4 J[1]	1.2 J[1]	0.98 J[1]	0.93 J[1]	1.0 J[1]	1.9 J[1]
Iron	NE	1,000	1,400	1,100	1,100	810	930	1,000	1,100
Magnesium	NE	NE	1,900 J[1]	1,800 J[1]	1,900 J[1]	1,600 J[1]	1,700 J[1]	1,800 J[1]	2,000 J[1]
Manganese	NE	NE	300	200	240	230	290	410	520
Potassium	NE	NE	2,500 J[1]	2,500 J[1]	2,400 J[1]	2,200 J[1]	2,100 J[1]	2,400 J[1]	2,400 J[1]
Sodium	NE	NE	3,800 J[1]	3,300 J[1]	3,400 J[1]	3,200 J[1]	3,500 J[1]	3,800 J[1]	3,900 J[1]

TABLE 16
EXPANDED SITE INSPECTION
ROCKY CREEK
ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES

Notes:

^{1}	The background values listed were obtained from Table 15.
EPA	U.S. Environmental Protection Agency
J^1	Concentration reported is less than the lowest standard on the calibration curve.
µg/L	Micrograms per liter
NA	Not analyzed
NE	Not established
PPE	Probable point of entry
RC	Rocky Creek
SW	Surface water sample
U	The analyte was not detected at or above the minimum reporting limit.
▨	Shaded values are above the EPA Region 4 November 2001 Freshwater Surface Water Screening Value.

The surface water screeing values were obtained from the EPA Region 4, Waste Management Division, Freshwater Surface Water Screening Values for Hazardous Waste Sites, last updated November 2001.

TABLE 17
EXPANDED SITE INSPECTION
ROCKY CREEK
ORGANIC ANALYTICAL RESULTS FOR BACKGROUND SEDIMENT SAMPLES

Analyte	Background Locations					Highest Background Value[1]
	RC-400-SD	RC-401-SD	RC-402-SD	RC-403-SD	RC-403-SD-DUP	
Volatile Organic Compounds (µg/kg)						
Dichlorodifluoromethane (Freon 12)	4.5 U	1.6 J[1]	11 UJ	14 UJ	15 UJ	1.6 J[1]
Trichlorofluoromethane (Freon 11)	4.5 UJ	1.2 J[1]	11 U	14 U	15 U	1.2 J[1]
Semivolatile Organic Compounds (µg/kg)						
2-Methylnaphthalene	77 J[1]	220 U	290 U	350 U	350 U	77 J[1]
Acenaphthene	430	220 U	290 U	350 U	350 U	430
Acenaphthylene	75 J[1]	220 U	290 U	350 U	350 U	75 J[1]
Acetophenone	200 U	220 U	290 U	350 U	350 U	350 U
Anthracene	2,000 J-	220 UJ	290 U	350 U	350 U	2,000 J-
Benzaldehyde	200 UJ	220 UJ	290 U	350 U	350 U	350 U
Benzo(a)anthracene	4,900	220 U	290 U	350 U	350 U	4,900
Benzo(a)pyrene	2,800	220 U	290 U	350 U	350 U	2,800
Benzo(b)fluoranthene	3,900	220 U	290 U	350 U	350 U	3,900
Benzo(g,h,i)perylene	520	220 U	290 U	350 U	350 U	520
Benzo(k)fluoranthene	1,600	220 U	290 U	350 U	350 U	1,600
Bis(2-ethylhexyl) phthalate	570	220 U	290 UJ	350 UJ	350 UJ	570
Carbazole	560 J	220 UJ	290 U	350 U	350 U	560 J
Chrysene	4,400	220 U	290 U	350 U	350 U	4,400
Dibenzo(a,h)anthracene	340	220 U	290 U	350 U	350 U	340
Dibenzofuran	340	220 U	290 U	350 U	350 U	340
Fluoranthene	15,000	220 U	290 U	350 U	350 U	15,000
Fluorene	600 J-	220 UJ	290 U	350 U	350 U	600 J-
Indeno (1,2,3-cd) pyrene	900	220 U	290 U	350 U	350 U	900
Naphthalene	43 J[1]	220 U	290 U	350 U	350 U	43 J[1]
Pentachlorophenol	380 U	R	570 UJ	670 UJ	680 UJ	680 UJ
Phenanthrene	11,000	220 U	290 U	350 U	350 U	11,000
Pyrene	9,900	220 U	290 U	350 U	350 U	9,900

TABLE 17
EXPANDED SITE INSPECTION
ROCKY CREEK
ORGANIC ANALYTICAL RESULTS FOR BACKGROUND SEDIMENT SAMPLES

Analyte	Background Locations					Highest Background Value[1]
	RC-400-SD	RC-401-SD	RC-402-SD	RC-403-SD	RC-403-SD-DUP	
Chlorinated Pesticides (µg/kg)						
4,4'-DDE (p,p'-DDE)	3.8 U	4.3 U	5.7 U	6.7 U	6.8 U	6.8 U
4,4'-DDT (p,p'-DDT)	4.0 U	4.3 U	5.7 U	6.7 U	6.8 U	6.8 U
alpha-Chlordane	3.2 U	2.2 U	2.9 U	3.5 U	3.5 U	3.5 U
beta-BHC	2.6 U	2.2 U	2.9 U	3.5 U	3.5 U	3.5 U
Endosulfan I (alpha)	0.45 J[1]	2.2 U	2.9 U	3.5 U	3.5 U	0.45 J[1]
Endosulfan II (beta)	3.8 U	4.3 U	5.7 U	6.7 U	6.8 U	6.8 U
Endosulfan Sulfate	1.5 J[1]	4.3 U	5.7 U	6.7 U	6.8 U	1.5 J[1]
Endrin	2.1 J[1]	4.3 U	5.7 U	6.7 U	6.8 U	2.1 J[1]
Endrin ketone	3.7 J[1]	4.3 U	5.7 U	6.7 U	6.8 U	3.7 J[1]
gamma-Chlordane	2.3	2.2 U	2.9 U	3.5 U	3.5 U	2.3
Methoxychlor	20 U	22 U	29 U	35 U	35 U	35 U
Polychlorinated Biphenyls (µg/kg)						
PCB-1248 (Aroclor 1248)	38 UJ	43 UJ	57 U	67 U	68 U	68 U
PCB-1254 (Aroclor 1254)	38 U	43 U	57 U	67 U	68 U	68 U
Explosives (mg/kg)						
3-Nitrotoluene	NA	NA	2.7 U	NA	NA	2.7 U
RDX	NA	NA	2.7 U	NA	NA	2.7 U
1,3,5-Trinitrobenzene	NA	NA	2.7 U	NA	NA	2.7 U

TABLE 17
EXPANDED SITE INSPECTION
ROCKY CREEK
ANALYTICAL RESULTS FOR BACKGROUND SEDIMENT SAMPLES

Notes:

[1]	The background value listed is either the highest detection or, if the analyte was not detected in any background sample, the non-detect with the highest minimum or method reporting limit.
DUP	Field duplicate
J	The identification of the analyte is acceptable; the reported value is an estimate.
J-	The identification of the analyte is acceptable; the reported value is an estimate with a possible low bias.
J^1	Concentration reported is less than the lowest standard on the calibration curve.
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
NA	Not analyzed
R	The sample results are unusable based on the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
RC	Rocky Creek
SD	Sediment sample
U	The analyte was not detected at or above the minimum or method reporting limit.
UJ	The analyte was not detected at or above the minimum or method reporting limit; the reported value is an estimate.

TABLE 18
EXPANDED SITE INSPECTION
ROCKY CREEK
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Highest Background Value[1]	South of Armstrong Remote Landfill	Downstream from PPE 1	At PPE 2
			RC-404-SD	RC-405-SD	RC-406-SD
Volatile Organic Compounds (µg/kg)					
Dichlorodifluoromethane (Freon 12)	NE	1.6 J[1]	12 UJ	7.7 UJ	9.1 U
Trichlorofluoromethane (Freon 11)	NE	1.2 J[1]	12 U	7.7 U	9.1 U
Semivolatile Organic Compounds (µg/kg)					
2-Methylnaphthalene	330	77 J[1]	310 U	230 U	290 U
Acenaphthene	330	430	310 U	230 U	290 U
Acenaphthylene	330	75 J[1]	310 U	230 U	290 U
Acetophenone	NE	350 U	310 U	230 U	77 J[1]
Anthracene	330	2,000 J-	310 U	230 U	290 UJ
Benzaldehyde	NE	350 U	310 U	33 J[1]	290 UJ
Benzo(a)anthracene	330	4,900	310 U	53 J[1]	110 J[1]
Benzo(a)pyrene	330	2,800	310 U	130 J[1]	240 J[1]
Benzo(b)fluoranthene	NE	3,900	310 U	230 U	97 J[1]
Benzo(g,h,i)perylene	NE	520	310 U	200 J[1]	260 J[1]
Benzo(k)fluoranthene	NE	1,600	310 U	230 U	290 U
Bis(2-ethylhexyl) phthalate	182	570	310 UJ	230 UJ	290 U
Carbazole	NE	560 J	310 U	230 U	290 UJ
Chrysene	330	4,400	310 U	92 J[1]	200 J[1]
Dibenzo(a,h)anthracene	330	340	310 U	230 U	290 U
Dibenzofuran	NE	340	310 U	230 U	290 U
Fluoranthene	330	15,000	97 J[1]	230 U	53 J[1]
Fluorene	330	600 J-	310 U	230 U	290 UJ
Indeno (1,2,3-cd) pyrene	NE	900	310 U	230 U	54 J[1]
Naphthalene	330	43 J[1]	310 U	230 U	290 U
Pentachlorophenol	NE	680 UJ	600 UJ	450 U	570 U
Phenanthrene	330	11,000	310 U	230 U	290 U
Pyrene	330	9,900	75 J[1]	51 J[1]	290 U

TABLE 18
EXPANDED SITE INSPECTION
ROCKY CREEK
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Highest Background Value[1]	South of Armstrong Remote Landfill	Downstream from PPE 1	At PPE 2
			RC-404-SD	**RC-405-SD**	**RC-406-SD**
Chlorinated Pesticides (µg/kg)					
4,4'-DDE (p,p'-DDE)	3.3	6.8 U	6.0 U	4.5 U	5.7 U
4,4'-DDT (p,p'-DDT)	3.3	6.8 U	6.0 U	4.5 U	**8.8**
alpha-Chlordane	1.7[a]	3.5 U	3.1 U	2.3 U	2.9 U
beta-BHC	NE	3.5 U	3.1 U	2.3 U	2.9 J[1]
Endosulfan I (alpha)	NE	0.45 J[1]	3.1 U	2.3 U	2.9 U
Endosulfan II (beta)	NE	6.8 U	6.0 U	4.5 U	5.7 U
Endosulfan Sulfate	NE	1.5 J[1]	6.0 U	4.5 U	5.7 U
Endrin	3.3	2.1 J[1]	6.0 U	4.5 U	2.4 J[1]
Endrin ketone	NE	3.7 J[1]	6.0 U	4.5 U	5.7 U
gamma-Chlordane	1.7[a]	2.3	3.1 U	**10**	4.6 U
Methoxychlor	NE	35 U	31 U	23 U	29 U
Polychlorinated Biphenyls (µg/kg)					
PCB-1248 (Aroclor 1248)	33[b]	68 U	60 U	**370**	**290 J-**
PCB-1254 (Aroclor 1254)	33[b]	68 U	60 U	45 U	**140**
Explosives (mg/kg)					
3-Nitrotoluene	NE	2.7 U	NA	2.4 U	3.4 U
RDX	NE	2.7 U	NA	0.32 JN	3.4 U
1,3,5-Trinitrobenzene	NE	2.7 U	NA	2.4 U	3.4 U

TABLE 18
EXPANDED SITE INSPECTION
ROCKY CREEK
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Highest Background Value[1]	Between PPE 2 and PPE 3	At PPE 3	Downstream from PPE 3
			RC-407-SD	RC-408-SD	RC-409-SD
Volatile Organic Compounds (µg/kg)					
Dichlorodifluoromethane (Freon 12)	NE	1.6 J[1]	12 UJ	9.2 U	7.9 U
Trichlorofluoromethane (Freon 11)	NE	1.2 J[1]	12 U	9.2 U	7.9 U
Semivolatile Organic Compounds (µg/kg)					
2-Methylnaphthalene	330	77 J[1]	3,800 U	1,500 U	610 U
Acenaphthene	330	430	3,800 U	1,500 U	610 U
Acenaphthylene	330	75 J[1]	3,800 U	1,500 U	610 U
Acetophenone	NE	350 U	3,800 U	500 J[1]	140 J[1]
Anthracene	330	2,000 J-	3,800 U	1,500 UJ	130 J[1]
Benzaldehyde	NE	350 U	3,800 U	1,300 J[1]	590 J[1]
Benzo(a)anthracene	330	4,900	1,600 J[1]	2,200	1,900
Benzo(a)pyrene	330	2,800	3,800 J[1]	6,600	5,100
Benzo(b)fluoranthene	NE	3,900	990 J[1]	2,200	2,000
Benzo(g,h,i)perylene	NE	520	**5,400**	**5,000 J**	**3,100 J**
Benzo(k)fluoranthene	NE	1,600	510 J[1]	670 J[1]	420 J[1]
Bis(2-ethylhexyl) phthalate	182	570	3,800 UJ	**13,000 J**	**3,100 J**
Carbazole	NE	560 J	3,800 U	1,500 UJ	610 UJ
Chrysene	330	4,400	2,700 J[1]	4,100	3,400
Dibenzo(a,h)anthracene	330	340	3,800 U	790 J[1]	580 J[1]
Dibenzofuran	NE	340	3,800 U	1,500 U	610 U
Fluoranthene	330	15,000	420 J[1]	360 J[1]	320 J[1]
Fluorene	330	600 J-	3,800 U	1,500 UJ	610 UJ
Indeno (1,2,3-cd) pyrene	NE	900	1,100 J[1]	990 J[1]	670 J
Naphthalene	330	43 J[1]	3,800 U	1,500 U	610 U
Pentachlorophenol	NE	680 UJ	7,500 U	**3,300**	**1,300**
Phenanthrene	330	11,000	540 J[1]	720 J[1]	570 J[1]
Pyrene	330	9,900	1,600 J[1]	2,400	2,000

TABLE 18
EXPANDED SITE INSPECTION
ROCKY CREEK
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Highest Background Value[1]	Between PPE 2 and PPE 3	At PPE 3	Downstream from PPE 3
			RC-407-SD	RC-408-SD	RC-409-SD
Chlorinated Pesticides (µg/kg)					
4,4'-DDE (p,p'-DDE)	3.3	6.8 U	7.5 U	**77**	5.9 UJ
4,4'-DDT (p,p'-DDT)	3.3	6.8 U	7.5 U	**72**	**25 J-**
alpha-Chlordane	1.7[a]	3.5 U	3.9 U	**9.9**	2.8 J[1]
beta-BHC	NE	3.5 U	3.9 U	12 U	5.1 UJ
Endosulfan I (alpha)	NE	0.45 J[1]	3.9 U	5.2 U	3.0 UJ
Endosulfan II (beta)	NE	6.8 U	7.5 U	10 U	2.1 J[1]
Endosulfan Sulfate	NE	1.5 J[1]	7.5 U	10 U	5.9 UJ
Endrin	3.3	2.1 J[1]	7.5 U	10 U	5.9 UJ
Endrin ketone	NE	3.7 J[1]	7.5 U	10 U	5.9 UJ
gamma-Chlordane	1.7[a]	2.3	**93**	**94**	**28 J-**
Methoxychlor	NE	35 U	39 U	21 J[1]	9.0 J[1]
Polychlorinated Biphenyls (µg/kg)					
PCB-1248 (Aroclor 1248)	33[b]	68 U	**3,500**	**7,800 J-**	**5,000 J-**
PCB-1254 (Aroclor 1254)	33[b]	68 U	75 U	100 U	59 U
Explosives (mg/kg)					
3-Nitrotoluene	NE	2.7 U	NA	0.91 JN	NA
RDX	NE	2.7 U	NA	6.4 U	NA
1,3,5-Trinitrobenzene	NE	2.7 U	NA	3.9 JN	NA

TABLE 18
EXPANDED SITE INSPECTION
ROCKY CREEK
ORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Notes:

[1]	The background values listed were obtained from Table 17.
[a]	EPA Region 4 November 2001 Sediment Screening Value entry used is for chlordane
[b]	EPA Region 4 November 2001 Sediment Screening Value entry used is for total PCBs
EPA	U.S. Environmental Protection Agency
J	The identification of the analyte is acceptable; the reported value is an estimate.
J-	The identification of the analyte is acceptable; the reported value is an estimate with a possible low bias.
J[1]	Concentration reported is less than the lowest standard on the calibration curve.
JN	The result is presumptive (tentatively identified), but a confirmation was not performed because the result was greater than the method detection limit, but less than the reporting limit.
µg/kg	Micrograms per kilogram
mg/kg	Milligrams per kilogram
NA	Not analyzed for
NE	Not established
PCB	Polychlorinated biphenyl
PPE	Probable point of entry
RC	Rocky Creek
SD	Sediment sample
U	The analyte was not detected at or above the minimum or method reporting limit.
UJ	The analyte was not detected at or above the minimum or method reporting limit; the reported value is an estimate.
BOLD	Bolded values are elevated, meaning that the values are three times the concentration of detected constituents in the background sample or greater than or equal to the non-detect concentration in the background sample.
BOLD	Shaded and bolded values are elvated and are above the EPA Region 4 November 2001 Sediment Screening Value.
▨	Shaded values are above the EPA Region 4 November 2001 Sediment Screening Value.

The sediment screeing values were obtained from the EPA Region 4, Waste Management Division, Sediment Screening Values for Hazardous Waste Sites, last updated November 2001.

TABLE 19
EXPANDED SITE INSPECTION
ROCKY CREEK
INORGANIC ANALYTICAL RESULTS FOR BACKGROUND SEDIMENT SAMPLES

Analyte	Background Locations					Highest Background Value[1]
	RC-400-SD	RC-401-SD	RC-402-SD	RC-403-SD	RC-403-SD-DUP	
Metals (mg/kg)						
Aluminum	2,300	1,400	13,000	9,600	9,200	13,000
Antimony	11 UJ	7.6 UJ	R	R	R	11 UJ
Arsenic	1.1 J[1]	0.55 J[1]	5.2	5.8	5.6	5.8
Barium	53	44	240	550	400	550
Beryllium	0.078 J[1]	0.12 J[1]	0.95	0.73 UJ	0.68 UJ	0.95
Cadmium	0.93 UJ	0.63 UJ	0.86 U	1.1 U	1.0 U	1.1 U
Calcium	390 J[1]	510 J[1]	720 J[1]	1,600	1,500	1,600
Chromium	5.7	3.1	23	17	16	23
Cobalt	2.5 J[1]	4.1 J[1]	21	28	23	28
Copper	3.7 J[1]	2.3 J[1]	16	11	11	16
Iron	6,900	5,500	41,000	37,000	34,000	41,000
Lead	32	6.7	39	29	24	39
Magnesium	220 J[1]	240 J[1]	1,300	1,100	1,000	1,300
Manganese	740	1,000	3,700	11,000	8,700	11,000
Mercury	0.20 U	0.13 U	0.059 UJ	0.21 UJ	0.038 UJ	0.21 UJ
Nickel	1.0 J[1]	0.88 J[1]	6.2 J[1]	6.3 J[1]	5.7 J[1]	6.3 J[1]
Potassium	93 J[1]	99 J[1]	900	720 J[1]	670 J[1]	900
Sodium	6.4 J[1]	20 J[1]	43 J[1]	50 J[1]	53 J[1]	53 J[1]
Thallium	0.28 J[1]	0.54 J[1]	0.77 UJ	1.4 UJ	0.95 UJ	0.54 J[1]
Vanadium	16 J-	7.5 J-	62 J-	51 J-	48 J-	62 J-
Zinc	19	16	72	83	76	83

TABLE 19
EXPANDED SITE INSPECTION
ROCKY CREEK
INORGANIC ANALYTICAL RESULTS FOR BACKGROUND SEDIMENT SAMPLES

Notes:

1	The background value listed is either the highest detection or, if the analyte was not detected in any background sample, the non-detect with the highest minimum reporting limit.
DUP	Field duplicate
J-	The identification of the analyte is acceptable; the reported value is an estimate with a possible low bias.
J1	Concentration reported is less than the lowest standard on the calibration curve.
mg/kg	Milligrams per kilogram
R	The sample results are unusable based on the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
RC	Rocky Creek
SD	Sediment sample
U	The analyte was not detected at or above the minimum reporting limit.
UJ	The analyte was not detected at or above the minimum reporting limit; the reported value is an estimate.

TABLE 20
EXPANDED SITE INSPECTION
ROCKY CREEK
INORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Analyte	EPA Region 4 Sediment Screening Value	Highest Background Value[1]	South of Armstrong Remote Landfill	Downstream from PPE 1	At PPE 2	Between PPE 2 and PPE 3	At PPE 3	Downstream from PPE 3
			RC-404-SD	RC-405-SD	RC-406-SD	RC-407-SD	RC-408-SD	RC-409-SD
Metals (mg/kg)								
Aluminum	NE	13,000	13,000	1,800	5,000	6,500	10,000	12,000
Antimony	12	11 UJ	R	R	7.3 UJ	0.60 J[1]	R	R
Arsenic	7.24	5.8	4.2	0.91 J[1]	1.7	1.8 J[1]	5.0	4.0
Barium	NE	550	300	38	110	170	160	160
Beryllium	NE	0.95	0.92 UJ	0.14 UJ	0.33 J[1]	0.55 UJ	0.59 UJ	0.74 UJ
Cadmium	0.676	1.1 U	0.98 U	0.13 UJ	0.22 UJ	**6.0 J**	**15**	**6.2**
Calcium	NE	1,600	1,300	72 J[1]	450 J[1]	2,400	2,600	1,400
Chromium	52.3	23	21	4.5	11	22	38	30
Cobalt	NE	28	21	1.7 UJ	10 J[1]	9.9 UJ	9.4 UJ	15
Copper	18.7	16	15	3.0 J[1]	4.6	14 J+	39	24
Iron	NE	41,000	35,000	3,800	17,000	17,000	17,000	25,000
Lead	30.2	39	46	12	23	32	77	55
Magnesium	NE	1,300	1,300	130 J[1]	480 J[1]	820 J[1]	800 J[1]	980
Manganese	NE	11,000	5,800	120	2,000	2,900	1,900	2,700
Mercury	0.13	0.21 UJ	0.039 UJ	0.13 UJ	0.11 UJ	**0.94 J**	**1.9**	**0.77**
Nickel	15.9	6.3 J[1]	6.1 J[1]	0.84 J[1]	2.5 J[1]	4.5 J[1]	5.4 J[1]	5.4 J[1]
Potassium	NE	900	750 J[1]	110 J[1]	220 J[1]	270 J[1]	430 J[1]	600 J[1]
Sodium	NE	53 J[1]	43 J[1]	8.9 J[1]	29 J[1]	55 J[1]	61 J[1]	50 J[1]
Thallium	NE	0.54 J[1]	0.78 UJ	3.3 U	1.2 J[1]	1.2 UJ	0.41 UJ	0.33 UJ
Vanadium	NE	62 J-	57 J-	11 J-	30 J-	30 J-	41 J-	49 J-
Zinc	124	83	62	9.8	34	60 J	98	76

TABLE 20
EXPANDED SITE INSPECTION
ROCKY CREEK
INORGANIC ANALYTICAL RESULTS FOR SEDIMENT SAMPLES

Notes:

^{1}	The background values listed were obtained from Table 19.
EPA	U.S. Environmental Protection Agency
J	The identification of the analyte is acceptable; the reported value is an estimate.
J+	The identification of the analyte is acceptable; the reported value is an estimate with a possible high bias.
J-	The identification of the analyte is acceptable; the reported value is an estimate with a possible low bias.
J^1	Concentration reported is less than the lowest standard on the calibration curve.
mg/kg	Milligrams per kilogram
NE	Not established
PPE	Probable point of entry
R	The sample results are unusable based on the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
RC	Rocky Creek
SD	Sediment sample
U	The analyte was not detected at or above the minimum reporting limit.
UJ	The analyte was not detected at or above the minimum reporting limit; the reported value is an estimate.
BOLD	Shaded and bolded values are elevated, meaning that the values are three times the concentration of detected constituents in the background sample or greater than or equal to the non-detect concentration in the background sample; and are above the EPA Region 4 November 2001 Sediment Screening Value.
▨	Shaded values are above the EPA Region 4 November 2001 Sediment Screening Value.

The sediment screeing values were obtained from the EPA Region 4, Waste Management Division, Sediment Screening Values for Hazardous Waste Sites, last updated November 2001.

APPENDIX C

FIELD LOGBOOK NOTES

(24 Pages)

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CONTENTS

PAGE	REFERENCE	DATE
	All samples were collected in accordance with the EPA Region 4 SESD Field Branches Quality Systems & Technical Procedures, February 2008.	

5/11/09 Allied Industrial Park L. Shaver

1415 START Shaver ad Jones to Station ID AIP110, Geoprobe crew sets up equipment

1425 Geoprobe crew pushes to 4ft BGS

0-6in Soil description: ~25% medium brown silty clay ~75% red clay: AIP 110 SF

12-24 in ~100% red clay: AIP 110 SB

1500 Crew moves to station AIP 109

AIP 109 SF: soil description ~75% medium brown sandy clayey silt and ~25% red clay

AIP 109 SB: soil description ~100% red clay trace tan silty sand

1525 Crew moves to station AIP 108

AIP108SF - soil description - 1-6in 50% medium brown silty sandy clay ad 50% red clay

AIP108SB - soil description - 12-24in red clay with trace tan sand

1548 Crew moves to Station ID AIP 107

AIP107SF - soil description - 1-6in medium brown sandy clayey silt

AIP 107 SB - soil description: red clay with ~10% tan sand

1610 Crew moves to AIP 106

5/11/09 Allied Industrial Park L. Shaver

AIP 106 SF - soil description - 0-6" in ~50% medium brown silty sandy clay ~50% red clay

AIP 106 SF - soil description - 12-24in ~30% medium brown silty sandy clay ~70% medium brown silty clay

1650 End of Sampling for day

Leslie Shaver 5/11/09

5/12/09 Allied Industrial Park L. Shaver

0730 START on site

Weather - warm, cloudy 70s

0745 Geoprobe crew moves to Station ID AIP101

AIP101 SF - ~50% medium brown sandy silty clay

AIP101 SB - red clay ~10% tan sand

AIP101 SF collected at 0752

AIP101 SB - collected at 0755

0815 Crew moves to Station AIP 102

0849 Crew pushes to 4ft at AIP 102

0853 AIP102 SF collected - soil is a medium brown sandy clayey silt ~~D8~~ with ~10% red clay

0855 AIP102 SB collected - soil is red clay with trace tan sand

GPS coordinated collected for all station IDs

0905 Crew moves to AIP 103 - station ID

0915 AIP 103 SF is collected - soil is ~50% medium brown sandy silty clay & ~50% red clay

0917 AIP 103 SB is collected; soil is red clay with trace <5% tan silty sand

0930 Crew moves to AIP 104

AIP 104 SF is collected at 0941 soil is ~50% medium brown sandy clayey silt

5/12/09 Allied Industrial Park L. Shaver

0944 AIP 104 SB and AIP104 SB duplicate is collected; soil is a red clay with ~10% tan silty sand

1004 Crew moves to AIP105

1012 Sample AIP 105 SB is collected; soil is red clay and 10% red clayey sand

1015 Sample AIP 105 SF is collected soil is medium brown silty sand with <5% red clay

Previous sample discarded - core re collected, samples re collected

1024 Sample AIP 105 SB is collected soil is 50% red sandy clay with ~50% tan sandy clay

1026 Sample AIP-105-SF is medium brown silty sand with ~20% red clay

1040 Crew moves to AIP 131

1051 Sample AIP-131-SF is collected - soil is a red sandy clay with ~10% tan sandy clay

1052 Sample AIP-131-SB is collected - soil is a ~~red~~ medium brown silty clayey sand with ~25% red clay

1104 Crew moves to AIP-128

1114 Sample AIP-128-SF is collected soil is a medium brown sandy silt with ~10% red clay

5/12/09 Allied Industrial Park L. Shaver

1117 Sample AIP-128-SB is collected; soil is a red to tan silty clay

1131 Crew moves to AIP-127

1136 Sample AIP-127-SF is collected: soil is a medium brown silty clayey sand with trace red clay

1140 Sample AIP-127-SB is collected: soil is a red sandy silty clay

1150 Crew moves to station AIP-126

1152 Sample AIP-126-SF is collected; soil is Medium brown clayey silty sand with <5% red clay

1155 Sample AIP-126-SB is collected: soil is ~50% medium brown ~~clk~~ silty sandy clay with ~50% red silty sandy clay

1210 Break for Lunch

1403 Crew has moved to AIP-133

1410 Sample AIP-133-SF is collected soil is 50% red silty sandy clay ad ~25% medium brown sandy silt, gravel (photo)

1412 Sample AIP-133-SB is collected soil is ~~~50%~~ red silty sandy clay trace ~~trace~~ tan sand ad 10% medium brown Sandy silt

1419 AIP 132 station ID is located

5/12/09 Allied Industrial Park L. Shaver

is an area covered by concrete: START Kelley notified, she will advise

1427 ~~CLK~~ Crew moves to AIP 129

1439 Sample AIP-129-SF is collected soil is medium brown sandy silty clay

1441 Sample AIP-129-SB is collected; soil is a reddish tan silty sandy clay

1456 Crew moves to AIP-130

1501 ~~1301~~ Sample AIP-130-SF is collected; soil is 50% medium brown silty clayey sand ad 50% red silty clay

1504 ~~1304~~ Sample AIP-130-SB is collected: soil is 50% red silty clay ad 50% medium to light brown sandy silt

1514 Crew moves to AIP-132; START Kelley has advised to attempt to: photo collect core beneath concrete ad if ~~un~~ unable due to thickness of concrete, to offset sample station to beside concrete

Geoprobe drilled through concrete, void space beneath the concrete, ~~recovery of~~ ~4 ft beneath ground surface had recovery of approx. 14 in: photo; oily stain, saturated, petroleum like odor (also described as "creosote smell")

5/12/09 Allied Industrial Park L. Shaver

"asphalt smell"

Because of poor recovery sample point will be offset ad 2nd collection taken

1539 Sample AIP-132-SF~~D~~ is collected soil is a wet dark brown to black clayey silt with mostly gravel ~~ss~~ not gravel some solidified substance, peice jarred for reference

petroleum smell

1542 Crew offsets (per START Kelley) ad attempts collection for AIP-132-SB - core collected ~50% recovery

1548 sample AIP-132-SF - dark brown to black silty sand, gravel, ~10% tan clay "petroleum" "smell"

1548 sample AIP-132-SB collected; soil is ~75% red clay with 25% medium brown sandy silty clay

1550 Crew moves to AIP-139

1632 Sample AIP-139-SF ~25% medium brown silty sandy clay ad 75% red silty sandy clay

1635 Sample AIP-139-SB ~75% light red silty sandy clay ad ~25% red to dark brown silty sand clay

Photo log

1409, core from AIP-133,

1529, drilling through concrete at AIP-132

1533, poor recovery at AIP-132

1546, 2nd attempt at AIP-132

5/12/09 Allied Industrial Park L. Shaver

1640 Crew moves to AIP 138

1650 Sample AIP-138-SF is collected; soil is a red silty sandy clay 0-6 in

1653 Sample AIP-138-SB is collected; soil is a red silty sandy clay trace medium brown silty sand

1738 START Jones and Shaver offsite to hotel

L. Shaver 5/12/09

5/13/09 Allied Industrial Park L. Shaver

0735 START Shaver ad Jones to Allied Industrial Park - will need to meet with Freudenberg Texbond Health ad Safety officer before collecting samples or entering their property

0825 START meets with H&S officer - gain access ad badges

0847 Crew moves to station AIP-120
Weather: cool, warming up, clear, few clouds

0901 Sample AIP-120 SF is collected; soil is a medium brown silty sand

0903 Sample AIP-120 SB is collected; soil is a tan with slight reddish tint silty clayey sand
Sample AIP-120SF will be 0 to 8 ins BGS

0911 START ad Geoprobe crew move to station AIP121

0915 Sample AIP-121 SF is collected; soil is a reddish tan silty clayey sand
sample will be 0 to 8 ins BGS

0918 Sample AIP-121 SB is collected; soil is a medium brown ~~so~~ clayey silty sand
subsurface sample appears like a surface sample, while surface sample appears because of color ad clay content like a subsurface sample

0929 Crew moves to Station AIP-125

LS

5/13/09 Allied Industrial Park L. Shaver

0936 Sample AIP-125-SF is collected, soil is a medium brown clayey silty sand

0939 Sample AIP-125-SB is collected. soil is a tan with slight reddish tint silty clayey sand

- Sample AIP-125-SF was collected at 0 to 7 in BGS

0950 Crew moves to station AIP-124

0954 Sample AIP-124-SF is collected soil is reddish to brown(light) silty clayey sandy sample will be 0-7 in BGS

0955 Sample AIP-124-SB is collected; soil is a medium brown silty sand with ~ 10% red clay

1005 Crew moves to station ~~12~~ AIP-123

1011 Sample AIP-123-SF is collected at 0 to 8 in BGS; soil is ~ 75% medium brown clayey silty sand

1014 Sample AIP-123-SB is collected @ 12 to 24 in ~~BGS~~ BGS, soil is a tan with slight reddish tint clayey sand

1024 Crew moves to station AIP-122

1030 Sample AIP-122-SF is collected @ 0-8 in ~~BGS~~ BGS; soil is ~75% medium brown clayey silty sand with ~ 25% reddish tan silty clayey sand

5/13/09 Allied Industrial Park L. Shaver

1032 Sample ~~122-SB~~ AIP-122-SB is collected at 12 to 24 in BGS. soil is a reddish tan silty clay

1046 Crew moves to AIP-119 station

1101 Sample AIP-119-SF is collected @ 0 to 8 in BGS; soil is 50% medium brown silty sand and 50% brownish red clayey sand

1104 Sample AIP-119-SB is collected @ ~~8~~ 12 to 24 in BGS. soil is light brown with slight reddish tint silty clayey sand

1120 Crew breaks for lunch and to decon equipment

1405 Crew moves to station AIP-119

1418 Sample AIP-118-SF is collected from 0-8 in BGS; soil is a grey to medium brown silty sand

1419 Sample AIP-118-SB is collected from 12 to 24 in BGS; soil is a ~~brownish~~ tannish red silty clayey sand

Sample AIP-118-SF contain ~20% gravel

1426 Crew moves to AIP-116 · Station ID

1434 Sample ~~AIP-119-SB~~ AIP-116-SF is collected from 0 to 8 in BGS soil is a reddish brown silty clayey sand

1435 Sample AIP-116-SB is collected from

5/13/09 Allied Industrial Park L. Shaver

12 to 24 in BGS; soil is a light brownish red silty clayey sand

~~1243~~ 1443 Crew moves to AIP-117 LS

1450 Sample AIP-117-SF is collected from 0 to 8 in BGS; soil is a medium brown clayey silty sand with ~40% red clayey sand

1453 Sample AIP-117-SB is collected from 12-24 in BGS soil is tan silty clayey sand with ~20% red clayey sand

1505 Crew moves to AIP-140; station ID

1522 Sample AIP-140-SF is collected ~~for~~ LS from 0-8 in BGS; soil is 75% medium brown silty sand

1525 Samples AIP-140-SB and AIP-140-SB-Dup are collected from 12-24 in BGS; soil is a red silty clayey sand with ~10% tan silty sand

1535 Crew moves to Station AIP-141

1547 Sample AIP-141-SF is collected from 0 to 8 in BGS; soil is 75% red silty sandy clay and 25% medium brown silty ~~sandy~~ LS clayey sand

1549 Samples AIP-141-SB and AIP-141-SB-MS/MSD are collected from 12-24 in BGS; soil is red silty sandy clay with ~10% tan sandy clay LS

5/13/09 Allied Industrial Park L. Shaver

1600 START Jones & Shaver finished collecting Samples for day; will collect GPS coordinates for samples that were missed earlier

5/13/09

L. Shaver

5/14/09 Allied Industrial Park L. Shaver

0738 START Shaver and Jones meet Geoprobe crew on site

Weather - warming to 80°s, overcast

0742 Crew moves to station AIP 142

0753 Sample AIP142-SF is collected from 0-6 in BGS; soil is a medium brown silty sand

0755 Sample AIP-142-SB is collected from 12 to 24 in BGS; soil a light brown to tan silty clayey sand

0806 Crew moves to Station ID: AIP-114

0825 Sample AIP-114-SF is collected from ~~0-6in~~ 0-8in BGS - Soil is a medium brown clayey silty sand with ~25% red silty sandy clay

0829 Sample AIP-114-SB is collected from 12-24 in BGS; soil is red to tan silty clayey sand

0835 Crew moves to Station AIP-115

0846 Sample AIP-115-SF is collected from 0 to 8 in BGS; soil is a medium brown silty clayey sand

0848 Sample AIP-115-SB is collected from 12 to 24 in BGS; soil is a tannish red sandy clay

0855 Crew moves to station AIP-113

5/14/09 Allied Industrial Park L. Shaver

0916 Sample AIP-113-SF is collected from 0 to 8 in BGS; soil is a ~~medium brown~~ red silty sandy clay

0918 Sample AIP-113-SB is collected from 12-24 in BGS; soil is a red sandy clay

0931 Crew moves to station AIP-134

0943 Sample AIP-134-SF is collected from 0 to 6 in BGS; soil is a medium brown sandy silt 5-10% sand

0945 Samples AIP-134-SB and AIP-134-SB-Dup are collected from 12-24 in BGS; soil is ~50% medium brown silt and 50% red sandy clay

0952 Crew moves to station AIP-135

1009 Sample AIP-135-SF is ~~collected~~ collected from 0-6 in BGS, soil is a medium brown clayey sandy silt

1011 Sample AIP-135-SB is collected from 12 to 24 in BGS; soil is tan to ~~lt br~~ light brown clayey sand

1020 Crew moves to station AIP-136

1131 Sample AIP-136-SF is collected from 0-6 in BGS soil is a medium to dark brown clayey sandy silt

LS

5/14/09 Allied Industrial Park L. Shaver

1134 Sample AIP-136-SB is collected from 12-24 in BGS; soil is reddish brown silty sandy clay

1215 Crew breaks for lunch

1320 Crew moves to Station ~~112~~ LH AIP-112

1348 Sample AIP-112-SF is collected from 0 to 8 in BGS: soil is ~~light to medium brown sandy silt trace red clay~~ LH see note *

1351 Samples AIP-112-SB and AIP-112-SB-MS/MSD are collected from 12-24 in BGS; soil is red silty clay

* soil is a red orange silty clay trace medium brown silt

1409 Crew moves to AIP-111

1416 Sample AIP-111-SF is collected from 0 to 8 in BGS. soil is ~75% medium brown clayey silty sand and ~25% red silty clay

1418 Sample AIP-111-SB is collected from 12 to 24 in BGS; soil is tan to brown silty clayey sand

1437 LH ~~1237~~ Crew moves to Station AIP-137

1445 Sample AIP-137-SF is collected from 0 to 6 in BGS soil is ~50% medium brown clayey silty sand

1448 Sample AIP-137-SB is collected from

LH

5/14/09 Allied Industrial Park L. Shaver

12 to 24 in BGS; soil is ~50% medium brown silty sandy clay and ~50% red sandy clay

1453 Crew moves to station AIP-100

1501 Sample AIP-100-SF is collected from 0 to 8 in BGS; soil is medium brown silty clayey sand with ~10% red clay

1504 Samples AIP-100-SB and AIP-100-SB-MS/MSD are collected from 12-24 in BGS soil is a medium brown silty clayey sand with ~10% red clayey sand

1530 - Last GPS coordinate set collected End of Sampling - START Shaver and Jones off site

5/14/09

L. Shaver

5/16/09 Saturday

AIP-148-MW

TD - 43.33

DTW - 36.00

VOC - 0.0

0900 - START arrives on-site and prepares ground water sampling equipment. There is only equipment available to sample one well ~~at~~ @ a time so two teams consolidate.

1015 - START arrives @ MW-148 or AIP-148-MW

1045 Begin pumping AIP-148-MW

1100 Well ran dry after 1 gal, wait for well to recharge

1112 Resume purging

Time	pH	Temp	Cond	D.O.	Turbidity
1116	4.78	21.75°C	85 µS/cm	6.68 mg/L	98.2
1142	4.90	22.75	83	7.73	87.4

1148 Sample well due to the well running dry. Approx 3.5 gal removed Well ran dry while sampling AIP-148-MW sampled @ 1300.

1400 - START arrives @ AIP-143-MW.

VOC - 4.6

Total depth reached was 42' Pump was unable to purge water. START Jone Claims the well dry.

C. Rod

05/16/09 Saturday

1430 - START aborts ground water sampling While severe storm passes.

1515 - Storm now passed. START attempts to perform ground water sampling @ Station location AIP-144-MW. (MW-45). FID ran out of hydrogen, unable to measure VOCs. DTW-19.5', Purge Volume = 4.4 gal, TD-28.21'

~~Time Temp Ph pH~~

Time	Temp	pH	Cond	D.O.	Turbidity
1540	18.95°C	5.45	112	9.6 mg/L	450
1548	19.01°C	5.22	100	7.2 mg/L	140
1553	19.02°C	5.16	93	6.4 mg/L	67.3

1610 START finishes Sampling AIP-144-MW

1620 START arrives @ station location AIP-145-MW and sets up equipment to sample MW-57.

DTW-35.8', TWD-42.35'

Purge Volume - 3.2 gal

Time	Temp	pH	Cond	D.O	Turbidity
1635	23.25°C	4.14	64 µS/cm	71.8%	>999
1640	23.41°C	4.11	68	71.6%	832
1645	23.40°C	4.08	41	71.4%	316

Note AIP-145-MW was sampled @ 1600.

1650 START samples ~~taken~~ @ AIP-145-MW

1655 Duplicate was taken @ AIP-145-MW-Dup

C. Rod

05/16/09 Saturday ~~Sunday~~ ~~Saturday~~

1715 Equipment put up, START offsite to hotel.

05/17/09 Sunday

0830 START arrives on-site and prepares equipment for ground water sampling.

0930- START performs ground water sampling on
AIP-146-MW (SAIC MW-66)
DTW- 28.6'
TWD- 37.3'
Purge Volume - 4.35'

Time	Temp	pH	Cond	D.O	Turbidity
0955	20.22°C	5.36	112 µS/cm	~~50%~~ 3.95 mg/L	586
1005	20.28°C	5.33	107 µS/cm	3.83 mg/L	230
1010	20.42°C	5.31	106 µS/cm	3.79 mg/L	144

AIP-146-MW sampled @ 1015

1040 @ AIP-147-MW (MW-70)
DTW- 29.1
TD- 38.42
Purge vol - 3.1 gal

1058 begin purging

C Roden

05/16/09 Sunday ~~Saturday~~

Time	Temp	pH	Cond	D.O.	Turbidity
1122	21.53°	4.41	57	5.2	855
1127	21.42°	4.34	61	5.55	510
1140	21.36	4.26	60	5.56	680

· Turbidity is not dropping after 45 min of purging and 8 gal removed, START samples well AIP-147-MW sampled @ 1145

1500 - START arrives @ station location FML-312-MW (RUST MW-7) after careful maneouvering w/ ATV through wetlands after rain. (Sidenote) START had to refill air in tire on one of the ATVs after lunch as well as refuel both ATVs.
DTW- 3'
TWD- 9.1
Purge Volume- 3 gal

1520- Begin Purging

Time	Temp	pH	Cond	D.O	Turbidity
1533	19.86°C	6.76	245 µS/cm	4.20 mg/L	>999

1545- well seems to be running dry. START waits for well to recharge. START claims well dry, will try to collect sample at 1.5 volume (gal).

1552- ~~AIP~~ FML-312-MW sampled @ 1550.

C. Roden

MONDAY 5/18/09

0800 START PROCURED A COME-ALONG TO REMOVE ATUS FROM SWAMP.

1130 START BREAKS FOR LUNCH

1200 START RETURNS TO SITE. LOADS ATV TO GO COLLECT DRAINAGE DITCH SAMPLES

1430 START COLLECTS DD-509-SD. NO WATER WAS IN DRAINAGE AREA SO NO SURFACE WATER WAS COLLECTED.

1500 START COLLECTS DD-508-SD, AND SW WATER WAS LOCATED NEAR WATER

1530 START MEETS REST OF TEAM TO LOAD SAMPLES AND CANOE IN VAN.

1650 START RETURNS TO HOTEL TO CONTINUE SAMPLE PREP AND PACK COOLERS

TUES MAY 19

0730 START ARRIVES ONSITE, LOADS UP ATU WITH SAMPLING EQUIPMENT. HEADS TO COLLECT DD POINTS

0830 ARRIVE AT POINT ON MAP FOR DD-507-SD, & XR SW

0850 START COLLECTS SW SAMPLE FOR 507

0910 START COLLECTS SD SAMPLE.

VOA A - 31.051 G
B - 31.123 G
C - 30.927 G

1000 START ARRIVES AT POINT ON MAP TO COLLECT DD-506-SD

1005 START COLLECTS DD-506-SD

VOA-A - 31.003 G
B - 31.164 G
C - 31.097 G

1140 DD-501-SD COLLECTED, MS/MSD ALSD COLLECTED

VOA-A 30.974	A 31.024	C ~~A~~ - 31.102
B 30.942	B 31.126	B - 31.146
C 31.872	C 31.262	A ~~C~~ - 31.147

1200 START BREAKS FOR LUNCH

1250 START BACK ONSITE

1410 START COLLECTS DD-505-SD

TUESDAY 05/19/09

VOA-A 30.937
B 30.988
C 30.903

WEDS 05/20/ 2009

1150 START ARRIVES AT MW-80, AIP-149-M
w. DEPTH TO WATER 8.00FT.
WATER TO PURGE 4.4 GALS
1200 BEGAN PURGING WELL AT 0.25 GALS
WATER VERY TURBID
1205 TEMP 17.92°C
pH 4.56
DO% 4.[illegible]01
ORP 217.9
TURBIDITY - 275
1215 TEMP - 17.56°C
pH - 4.48
DO% 3.98
ORP 244.1
TURBIDITY - 51.8
1220 17.97 °C
pH - 4.47
DO% - 4.02
ORP - 252.4
TURBIDITY - 10.7
1230 COLLECT SAMPLE + MS/MSD
1250 START FINISHED COLLECTENG SAMPLE
1305 START ARRIVES AT AIP-143-SW MW-42
1330 START WAS HEADING BACK TO MEET
OTHER TEAM WHEN WE CAME UPON

WEDS 05/20/09

TWO GUYS WORKING FOR US TECHNOLOGY. THE TWO GUYS WERE IN THEIR TWENTY'S ONE CAUCASION THE OTHER HISPANIC. THEY WERE TOLD BY THEIR BOSS TO DRIVE BACK INTO THE SOUTHERN END OF AIP TO DUMP WOOD AND UNKNOWN MATERIAL. START TOLD THEM NOT TO DUMP THE MATERIAL BACK THERE. THE TWO MEN LEFT. US TECHNOLOGY SERVICES IS LOCATED AT 555 ALLIED INDUSTRIAL BLVD.

1350 ARRIVE AT AIP-143-SW AFTER CHECKING WELL DEPTH AND DETERMINING ITS EMPTY, START USED BAILERS TO TRY AND HAND BAIL. ONLY ABLE TO OBTAIN 10 IN OF WATER OUT OF WELL

1420 START TRIED MW-43. WELL WAS DRY. START DETERMINED THE LAST AIP WELL WOULD NOT BE SAMPLED

1430 START RUSSELL + VON BUSCH OFFSITE

12/3/09

LATE NOTE: START Von Busch and Russell collected two drainage ditch samples, DD-502-SD and DD-503-SD, on the last day of the ESI sampling event, 5/20/09. DD-502-SD was collected from 0-3 in bgs at 1040. DD-503-SD was collected from 0-3 in bgs at 1005. DD-502-SD was collected above a culvert that receives storm water from AIP.

Kelley 12/3/09

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No. 391

TTEMI-05-003-0022
TTEMI-05-003-0029
TTEMI-05-00~~0~~3-0030

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TTEM1-05-003-0030

CONTENTS

PAGE	REFERENCE	DATE
	All samples were collected in accordance with the EPA Region 4 SESD Field Branches Quality Systems & Technical Procedures, February 2008.	

05/12/09 Tuesday

0712 - START leaves hotel headed for site.

0740 - START arrives on-site and prepares sampling equipment and supplies for days work.

0900 - START Team sampling Rocky Creek (START Russell and Roden) head out for first sampling point RC-409.

1000 - Path cannot be found to RC-409 so START will walk path along railroad to Rock Creek and walk upstream to Station location RC-409

1015 - START Russell observes an abundance of wetland plants: stinging nettle, sycamore & Poplar. START also notices minnows in creek.

1100 - START unable to get to area of RC-409 as located on sample map. Sample taken at South bank on a bend approx 500 ft west of the railroad tracks.

1150 - START arrives back @ ATV and heads back to base to break for lunch.

1230 - START off-site for lunch.

1345 - START back on-site.

1430 - RC sampling team park ATV on trail and walk along drainage ditch to access RC-408. Wetland plants+animals noticed are maiden cane, sugar maple, red bud, Crayfish, small clams, tulip poplar

C. Roden

RC-407 05/19/09 1330 RC-407-SW & SD. 0-3"

Rocky Creek Sampling Log:

Station Location	Date	Time	Sample ID	SD Depth
RC-400	05/18/09	1345	RC-400-SW & SD	0-3"
RC-409	05/12/09	1100	RC-409-SW	N/A
RC-409	05/12/09	1110	RC-409-SD	0-3"
RC-408	05/12/09	1600	RC-408-SW	
RC-408	05/12/09	1630	RC-408-SD	0-3"
DD-513	05/13/09	1410	DD-~~SW~~ 513-SW	
DD-513	05/13/09	1415	DD-513-SD	0-3"
DD-519	05/14/09	1010	DD-519-SD	0-3"
DD-518	05/14/09	1100	DD-518-SD	0-6"
DD-515	05/14/09	1350	DD-515-SD	0-3"
DD-517	05/14/09	1145	DD-517-SD	0-4"
DD-516	05/14/09	1440	DD-516-SD	0-3"
DD-516	05/14/09	1445	DD-516-SD-Dup	0-3"
DD-518	05/14/09	1100	DD-518-SD-ms/msD	0-3"
RC-405	05/15/09	0935	~~RC~~ RC-405-SW	
RC-405	05/15/09	0940	RC-405-SD	0-3"
DD-510	05/15/09	1135	DD-510-SD	0-3"
RC-404	05/15/09	1335	RC-404-SW ms/msD	
RC-404	05/15/09	1340	RC-404-SD ms/msD	0-5"
RC-403	05/15/09	1430	RC-403-SW	
RC-403	05/15/09	1435	RC-403-SD	0-3"
RC-406	05/18/09	1020	RC-406-SW & SD	0-4"
RC-401	05/18/09	12~~30~~45	RC-401-SW & SD ms/msD	0-3"

C. Roden

05/12/09 Tuesday

1600- START Roden takes surface water sample ~~at~~ cr @ station location ~~408 SW~~ cr RC-408.

1630- START Roden takes sediment sample in the middle of creek @ confluence of drainage ditch and Rocky Creek, station loc. RC-408

1800- Rocky Creek sampling team arrives back @ base location and leaves site for the day.

1830 Sampling team arrives back @ hotel.

C. Roden

05/13/09 Wednesday

0753- Rocky Creek sampling team leaves hotel headed for site.

0820- RC sampling team arrives on-site and prepares sampling equipment for the day's samples.

0910- RC team parks ATV and walks to (or attempts to walk to) station location RC-407.

1030- START cannot find an accessible path to RC-407 or RC-406.

1100- Back at base to meet w/ START Jones to help w/ pump to filter water samples RC-409 & RC-408 from non-preserved poly.

1145- START Roden + Russell leave site for lunch.

1215- START back on-site and filters water samples for metal analysis.

1400- START prepares to sample DD513. RC-407, 406, 411 and 410 are inaccessible and therefore cannot be sampled.

1415- Surface water and sediment samples taken @ DD-513. Sediment sample taken on north bank of drainage ditch.

1445- START Roden and Russell arrive back at the van (ie. base) and filter water for metal analysis.

1515- START Roden + Russell leaves site headed back to hotel to aid process samples.

C. Roden

05/14/09 Thursday

0730 - START Roden and Russell leave hotel headed for site.

0800 - Arrive on-site and prepare for samples

0845 - START arrives @ Station location DD-519.

1010 - START has trouble obtaining satellite reception so ~~not~~ START collects sediment sample at a location that retrieved satellite communication. START did not observe any running water in the vicinity of point collected, only shallow pools of stagnant water observed. START determined there wasn't enough water to collect a surface water sample. Sediment sample collected on the west side of where the drainage ditch appeared on the map. The ground was too ~~indu~~ inundated w/ water to continue searching for running water.

1100 - START Roden and Russell collect sediment sample DD-518-SD on the south side of cleared path on the drainage ditch. No water or moisture observed. An ~~MS/MSD~~ MS/MSD collected at this station location. Terra Weights of VOAs for sample: DD-518-SD
A: 30.950g B: 31.152g C: 31.059g

Courtney Roden

05/14/09 Thursday

Terra Weight for DD-519-SD
A: 30.899g B: 31.016g C: 31.025g
Terra Weight for MS/MSD DD-518-SD (triple volume)
1) A: 30.952g B: 31.049g C: 30.967g
2) A: 31.012g B: 30.999g C: 30.901g

1145 - START takes sediment sample @ Station location DD-517. Sample taken on the South side of Culvert. No water observed. Slight moisture in soil. Terra Weight for VOAs:
A) 30.962g B) 31.093g C) 31.029g

1200 START heads back to base for lunch.

1215 START offsite for lunch

1315 START back on-site

1350 START Roden and Russell collect sediment sample @ station location DD-515. Sample point is in field a diversion channel rather than a drainage ditch. No water or moisture observed. Terra weight for VOAs
A) 31.204g B) 31.014g C) 30.943g

1~~4~~430 - START arrives @ Station Location DD-516 to collect sediment sample DD-516-SD + DD-516-SD-Dup. Terra weight for
DD-516-SD: A) 30.910g B) 30.970g C) 30.918g
DD-516-SD-Dup: A) 30.926g B) 31.036g C) 30.997g

C. Roden

05/14/09

1510- START Roden and Russell arrive back @ van /base and return ATV to be stored @ Blair Storing.

1520- START off-site ~~to~~ headed back to hotel to aid w/ sample processing.

Roden

05/15/09 Friday

0730- START Roden and Jones depart hotel for site.

0800- Arrive @ site and prepare for day's samples.

0930 - START collects samples @ station location RC-405. RC-405-SW collected @ 0935 and RC-405-SD collected @ 0940. Sediment sample taken on NW corner of the drainage ditch and Rocky Creek confluence.

1135- START takes sample DD-510-SD on western bank of drainage ditch.

1230- START meets w/ Steven to rent canoe to collect samples on Rocky Creek

1335- START Roden and Jones collect samples @ station location RC-404. RC-404-SW collected @ 1335 and RC-404-SD collected @ 1340. A ms/msp was collected for both surface water and sediment at RC-404. Sediment sample taken on the South Side of Rocky Creek, just off the creek approx 5".

1430- RC-403-SW collected @ 1430
RC-403-SD-collected @ 1435

CRod

05/18/09 Monday

0800- START Jones and Roden arrive on-site to meet w/ Canoe rental representative Steven Adams

0830- Prepare for sampling RC-406, 400 and 401. Weather is cloudy and 57°F.

1000- START Roden and Jones arrive @ station location ~~@~~ RC-406. Rains from yesterday and last night have made the water level rise at least a couple of feet. Sediment sample taken on NW corner of Rocky Creek and drainge ditch confluence. Sediment depth 0-4"

Sample collected @ 1020

Tara weights - A - 30.923
B - 31.043
C - 30.927

~~1220 - START~~

1220 - START ~~try~~ tries to find location to sample RC-401 station location. Due to recent heavy rains, area is flooded and making it difficult to find dry land to collect sediment sample. ~~START will collect sediment from a trunk of a fallen tree, the only dry sediment in vicinity of RC-401~~

Dry Sediment found on high ground in flooded area. START will collect sediment from here. (Refer to photograph)

C. Roden

05/18/09 Monday

1230 - START arrives @ station location RC-401. Sample collected @ 1245 SW & SD. Sediment depth is 0-3", MS/MSD collected.

1315 - Headed to find station location RC-400

1335 - START arrives @ station location RC-400. Since area is flooded, sediment sample will be taken from a high ground area that is not usually near the shoreline of creek. Sediment sample taken from south side of Rocky Creek approx. 50 yds from Broadway Rd on the east side. Weather is much warmer w/ clear skies. Sample collected @ 1345. Sediment 0-3"

1400 - START leaves station location RC-400 headed back to canoe drop-off area.

1550 - START off-site headed to hotel to help process samples

☆ Terra Weights.
RC-401 - A. 31.004g B. 31.214g C. 31.085g
D. 30.980g E. 31.014g F. 30.963g
G. 31.023g H. 30.996g I. 30.945g
RC-400 - A 30.979g B. 31.025g C. 31.073g

C. Roden

05/19/09 Tuesday

1130- START On-site.

1230- START Roden and Jones drop canoe in to collect FML-315-MW and RC-407.

1300- Creek becomes impassible by canoe. START gets out and walks to station location RC-407 Approx. 500 ft away. Weather = , Sunny.

1315- Ground is too inundated w/ water to walk to RC-407 as located on the sample map. START will have to collect RC-407 approx. 350' west of where RC-407 is located on the map.

1330- RC-407-SW + RC-407-SD collected @ 1330 Sediment depth 0-3" taken on the south side of creek. Water level in creeks seems to have gone down approx. 2' since yesterday. MS/MSD collected @ RC-407.
Terra Weights - A. 30.966g B. 30.970g C. 30.912
D. 31.116g E. 31.059 F. 31.009g
G. 30.919g H. 30.904g I. 30.995g

C. Rod

09/08/09 Tuesday

- Late note:
  - Tetra Tech collected surface water samples from the surface of the water by partially submerging the sampling container into the water. Surface water samples were filtered in the field using a peristaltic pump and a 0.45 micron filter. Sediment samples were collected from depositional areas at depths ranging from 0 to 5 inches.
- Late entry for May 15, 2009. (p. 9).
  - Sample RC-402-SW was collected at 1530 and RC-402-SD was collected at 1540. Sample was collected on North bank approx 3.5 ft from creek.

APPENDIX D

PHOTOGRAPHIC LOG

(24 Pages)

OFFICIAL PHOTOGRAPH NO. 1
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park (AIP)
Orientation:	Northeast	**Date:**	May 12, 2009
Photographer:	Leslie Shaver, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: Tetra Tech subcontractor operates a Geoprobe to collect a sample at station AIP132.

OFFICIAL PHOTOGRAPH NO. 2
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	Not Applicable	**Date:**	May 12, 2009
Photographer:	Leslie Shaver, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: Soil boring collected from station AIP132 contained soil saturated with oily substance. A petroleum odor was noted at this location.

OFFICIAL PHOTOGRAPH NO. 3
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number: TTEMI-05-003-0029

Location: Allied Industrial Park

Orientation: NA

Date: May 12, 2009

Photographer: Leslie Shaver, Tetra Tech

Witness: Chris Jones, Tetra Tech

Subject: Tetra Tech collects a soil sample using a Terra Core for volatile organic compound analysis at station AIP133.


05/16/2009

OFFICIAL PHOTOGRAPH NO. 4
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	Northwest	**Date:**	May 16, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Dale Von Busch, Tetra Tech

Subject: Tetra Tech uses a Grundfos pump to collect ground water sample AIP-144-MW from permanent monitoring well MW-45 located south of the AIP wastewater treatment plant.

OFFICIAL PHOTOGRAPH NO. 5
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	North	**Date:**	May 17, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: Tetra Tech collects ground water sample AIP-146-MW from permanent monitoring well MW-66 using a Grundfos pump.

OFFICIAL PHOTOGRAPH NO. 6
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	South	**Date:**	May 17, 2009
Photographer:	Chris Jones, Tetra Tech	**Witness:**	Courtney Roden, Tetra Tech

Subject: Tetra Tech collects water quality readings for ground water sample AIP-146-MW collected from permanent monitoring well MW-66 using a YSI water quality meter.

OFFICIAL PHOTOGRAPH NO. 7
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-005-003-0029	**Location:**	Allied Industrial Park
Orientation:	South	**Date:**	May 17, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Kyle Russell, Tetra Tech

Subject: Tetra Tech collects turbidity readings for ground water collected from permanent monitoring well MW-70 (AIP-147-MW).

OFFICIAL PHOTOGRAPH NO. 8
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	East	**Date:**	May 16, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: Tetra Tech collects background ground water sample AIP-148-MW from permanent monitoring well MW-30 located in the northeastern corner of the AIP.

OFFICIAL PHOTOGRAPH NO. 9
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	Northeast	**Date:**	May 15, 2009
Photographer:	Chris Jones, Tetra Tech	**Witness:**	Courtney Roden, Tetra Tech
Subject:	Tetra Tech collects sediment sample DD-510-SD from the Armstrong World Industries drainage easement.		

OFFICIAL PHOTOGRAPH NO. 10
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	West	**Date:**	May 14, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Kyle Russell, Tetra Tech

Subject: Tetra Tech collects sediment sample DD-515-SD from the drainage ditch that receives runoff from the northeastern portion of the AIP property.

OFFICIAL PHOTOGRAPH NO. 11
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	Northeast	**Date:**	May 14, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Kyle Russell, Tetra Tech

Subject: Tetra Tech homogenizes sediment sample DD-516-SD, collected from the drainage ditch that receives runoff from the east-central portion of the AIP property.

OFFICIAL PHOTOGRAPH NO. 12
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	Not Applicable	**Date:**	May 14, 2009
Photographer:	Kyle Russell, Tetra Tech	**Witness:**	Courtney Roden, Tetra Tech

Subject: Tetra Tech collects drainage ditch sample DD-517-SD, located south of the rail spur receiving area.

OFFICIAL PHOTOGRAPH NO. 13
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number: TTEMI-05-003-0029 **Location:** Allied Industrial Park

Orientation: Southeast **Date:** May 14, 2009

Photographer: Kyle Russell, Tetra Tech **Witness:** Courtney Roden, Tetra Tech

Subject: Tetra Tech collects drainage ditch sample DD-519-SD, located in the floodplain of Rocky Creek.

OFFICIAL PHOTOGRAPH NO. 14
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	Not Applicable	**Date:**	May 15, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: While the field crew canoed along Rocky Creek, Tetra Tech observed fishing paraphernalia hanging from a tree, west of the Central of Georgia railroad tracks.


05/18/2009

OFFICIAL PHOTOGRAPH NO. 15
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	Northwest	**Date:**	May 18, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

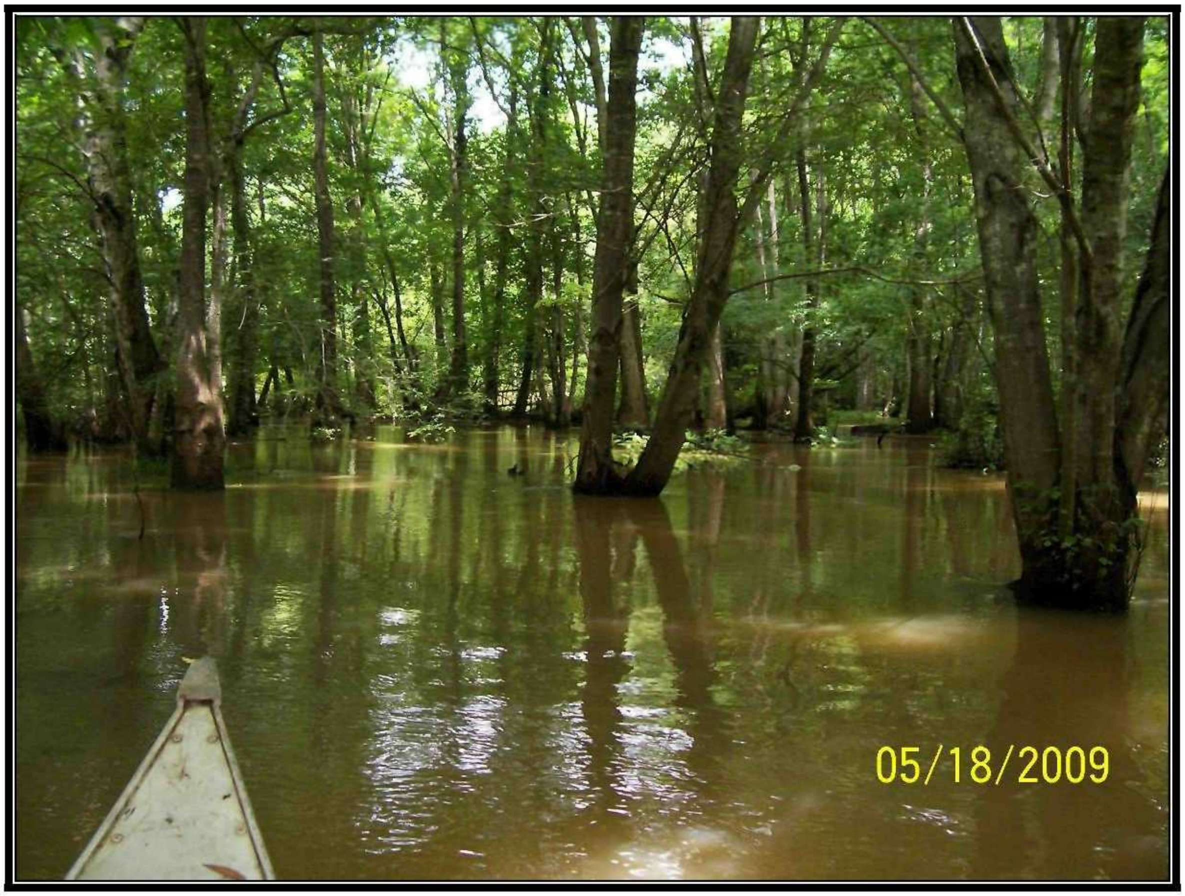
Subject: Sediment sample RC-401-SD was collected from a small patch of land (the only unsubmerged land in area) located on the north branch of Rocky Creek and east of Broadway.


05/18/2009

OFFICIAL PHOTOGRAPH NO. 16
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	East	**Date:**	May 18, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: Rocky Creek flood waters near sample station RC400, located on the south branch of Rocky Creek and east of Broadway. Note the water level on the trees.



OFFICIAL PHOTOGRAPH NO. 17
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	West	**Date:**	May 18, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: Rocky Creek flood waters near sample station RC401, located on the north branch of Rocky Creek and east of Broadway. Note the water level on the trees.

OFFICIAL PHOTOGRAPH NO. 18
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	Southwest	**Date:**	May 18, 2009
Photographer:	Chris Jones, Tetra Tech	**Witness:**	Courtney Roden, Tetra Tech

Subject: Tetra Tech collects Rocky Creek sediment sample RC-400-SD, located on the south branch of Rocky Creek and east of Broadway.

OFFICIAL PHOTOGRAPH NO. 19
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	North	**Date:**	May 18, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: Tetra Tech collects surface water sample RC-401-SW from the south branch of Rocky Creek and east of Broadway.

OFFICIAL PHOTOGRAPH NO. 20
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	South	**Date:**	May 15, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: Tetra Tech collects surface water sample RC-402-SW from Rocky Creek between Broadway and the Central of Georgia railroad tracks.


05/15/2009

OFFICIAL PHOTOGRAPH NO. 21
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	East-Northeast	**Date:**	May 15, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: Tetra Tech collects sediment sample RC-405-SD from the bank of Rocky Creek, downstream from probable point of entry (PPE) 1.

05/15/2009

OFFICIAL PHOTOGRAPH NO. 22
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	East-Northeast	**Date:**	May 15, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: Tetra Tech collects surface water sample RC-405-SW from Rocky Creek, downstream from PPE 1.

OFFICIAL PHOTOGRAPH NO. 23
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	Northeast	**Date:**	May 19, 2009
Photographer:	Courtney Roden, Tetra Tech	**Witness:**	Chris Jones, Tetra Tech

Subject: Tetra Tech collects surface water sample RC-407-SW from Rocky Creek, downstream from PPE 2. Note the down trees.

OFFICIAL PHOTOGRAPH NO. 24
U.S. ENVIRONMENTAL PROTECTION AGENCY

TDD Number:	TTEMI-05-003-0029	**Location:**	Allied Industrial Park
Orientation:	Northwest	**Date:**	May 15, 2009
Photographer:	Chris Jones, Tetra Tech	**Witness:**	Courtney Roden, Tetra Tech
Subject:	Flooding in Rocky Creek near sample station RC404, located east of the Central of Georgia railroad tracks and south of the Armstrong remote landfill.		

APPENDIX E

CONTRACT LABORATORY PROGRAM (CLP) ANALYTICAL DATA SHEETS

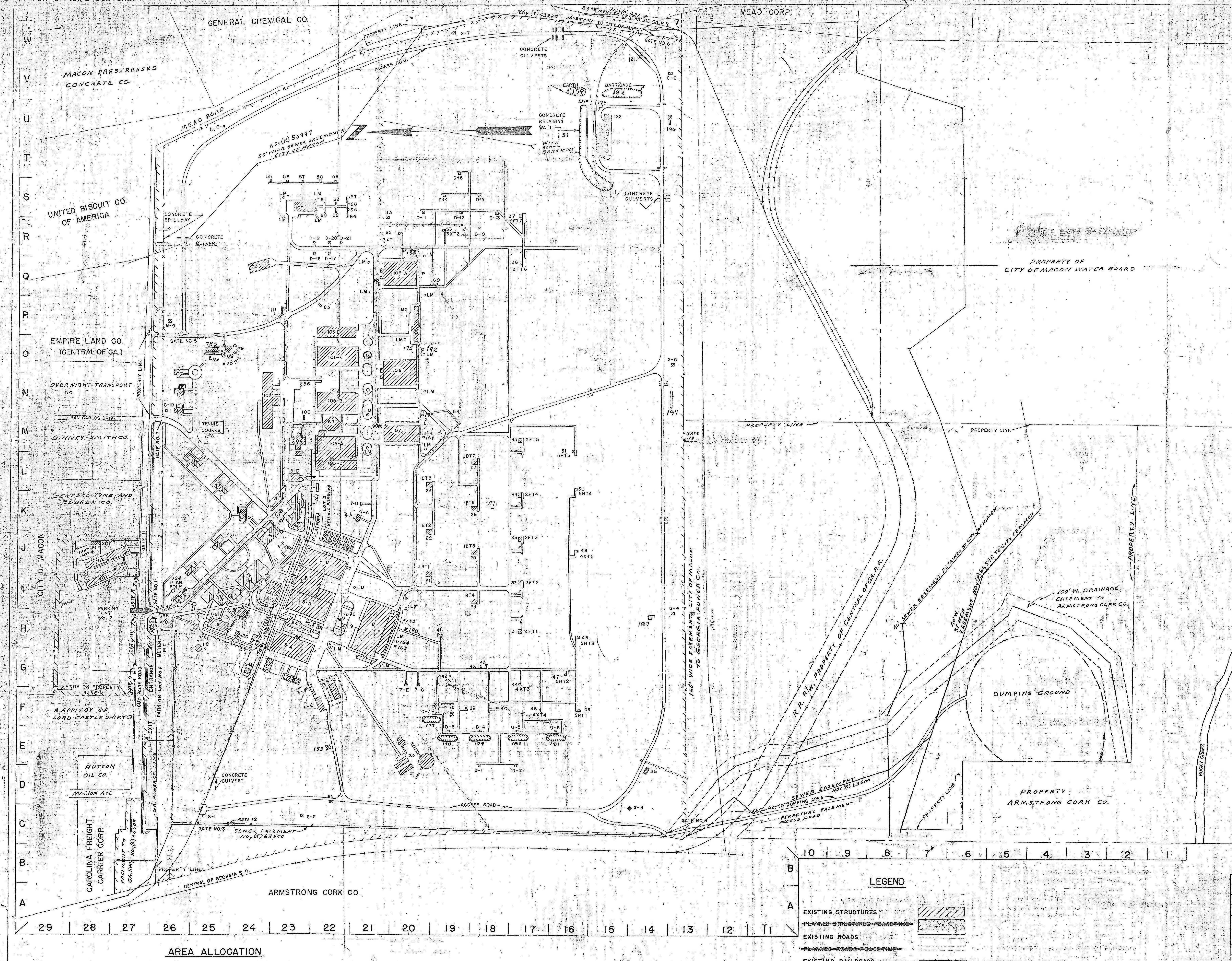
(1,788 Sheets)

APPENDIX F

NON-CLP DATA VALIDATION REPORT AND ANALYTICAL DATA SHEETS

(4,076 Sheets)

FOR OFFICIAL USE ONLY



AREA ALLOCATION

200 100 0 200 400 600
GRAPHIC SCALE IN FEET

LEGEND

EXISTING STRUCTURES	▨
~~PLANNED STRUCTURES PEACETIME~~	▨
EXISTING ROADS	═══
~~PLANNED ROADS PEACETIME~~	- - -
EXISTING RAILROADS	┼┼┼┼
~~PLANNED RAILROADS PEACETIME~~	┼ ┼ ┼
PROPERTY LINE	— - —
FENCE	—×—×—×—
LIGHTNING MASK	○LM
MAIN GATE	➡
FUNCTIONAL AREA	>>>>>>

SYMBOL	DESCRIPTION	DATE	APPROVAL
	Corrected to Existing Conditions	7-8-69	A.G.P.
	Corrected to existing conditions	17 MAR 1965	C.E.H.

REVISIONS

DPWO DRAWING NO.
DRAWN BY Walker
CHECKED BY Hamilton
IN CHARGE J.E.Ford

DEPARTMENT OF THE NAVY - BUREAU OF YARDS & DOC

U.S. NAVAL ORDNANCE PLANT
MACON, GA.

MASTER SHORE STATION
DEVELOPMENT PLAN

PART II SECTION 2

GENERAL DEVELOPMENT PLAN
EXISTING

APPROVED 19 March 1965
DATE
Alfred T. Gerkee
COMMANDING OFFICER

SCALE AS NOTED
SHEET 1 OF 2
Y. & D. DWG. NO. 521205

FOR OFFICIAL USE ONLY

Reference No. 8
Macon Naval Ordnance Plant
EPA ID No. GAD003302676

PROJECT NOTE

Date: September 1, 2011

Name: Quinn Kelley
Title: Environmental Scientist
Firm: Tetra Tech

Signature: Quinn Kelley

Subject: June 2011 Supplemental Sampling Event

PROJECT NOTE SUMMARY

On June 29 and 30, 2011, Tetra Tech conducted supplemental sampling at the Macon Naval Ordnance Plant (MNOP) (currently Allied Industrial Park). Tetra Tech collected 6 surface soil samples (including one background and one duplicate) from the eastern portion of the MNOP at 0 to 6 inches below ground surface (bgs) and 10 sediment samples (including one duplicate) from Drainage Ditch 4 (0 to 3 inches bgs) that flows south from the eastern portion of MNOP to Rocky Creek (see attached figure). Soil and sediment samples were collected using stainless steel spoons and aluminum pans dedicated to each sampling location. Drainage Ditch 4 is an intermittent drainage route.

The southern portion of Drainage Ditch 4 was accessed through the Rocky Creek water reclamation facility property. Due to its proximity to Rocky Creek, it is possible that runoff or drainage from this facility may discharge into Rocky Creek; although, no evidence of this was observed during supplemental sampling activities.

Tetra Tech conducted sampling activities in accordance with the Quality Assurance Project Plan (QAPP) dated June 20, 2011 (Reference 10). Soil samples were collected in accordance with the EPA Region 4 Science and Ecosystem Support Division (SESD) Field Branches Quality System and Technical Procedure for *Soil Sampling*, November 2007 (SESDPROC-300-R1) (Reference 24). Sediment samples were collected in accordance with the EPA Region 4 SESD Field Branches Quality System and Technical Procedure for *Sediment Sampling*, September 2010 (SESDPROC-200-R2) (Reference 25).

Soil and sediment samples were analyzed by the EPA Region 4 SESD laboratory for total mercury using EPA Method 245.5. Data validation of the analytical data package was conducted by the Office of Quality Assurance. Data validation was conducted in accordance with the EPA Method 245.5 for total mercury analysis and the EPA Region 4 Analytical Support Branch (ASB) Laboratory Operations and Quality Assurance Manual (LOQAM), January 2011.

Attachments:
1. Figure
2. Logbook Notes

RESPONSE REQUIRED

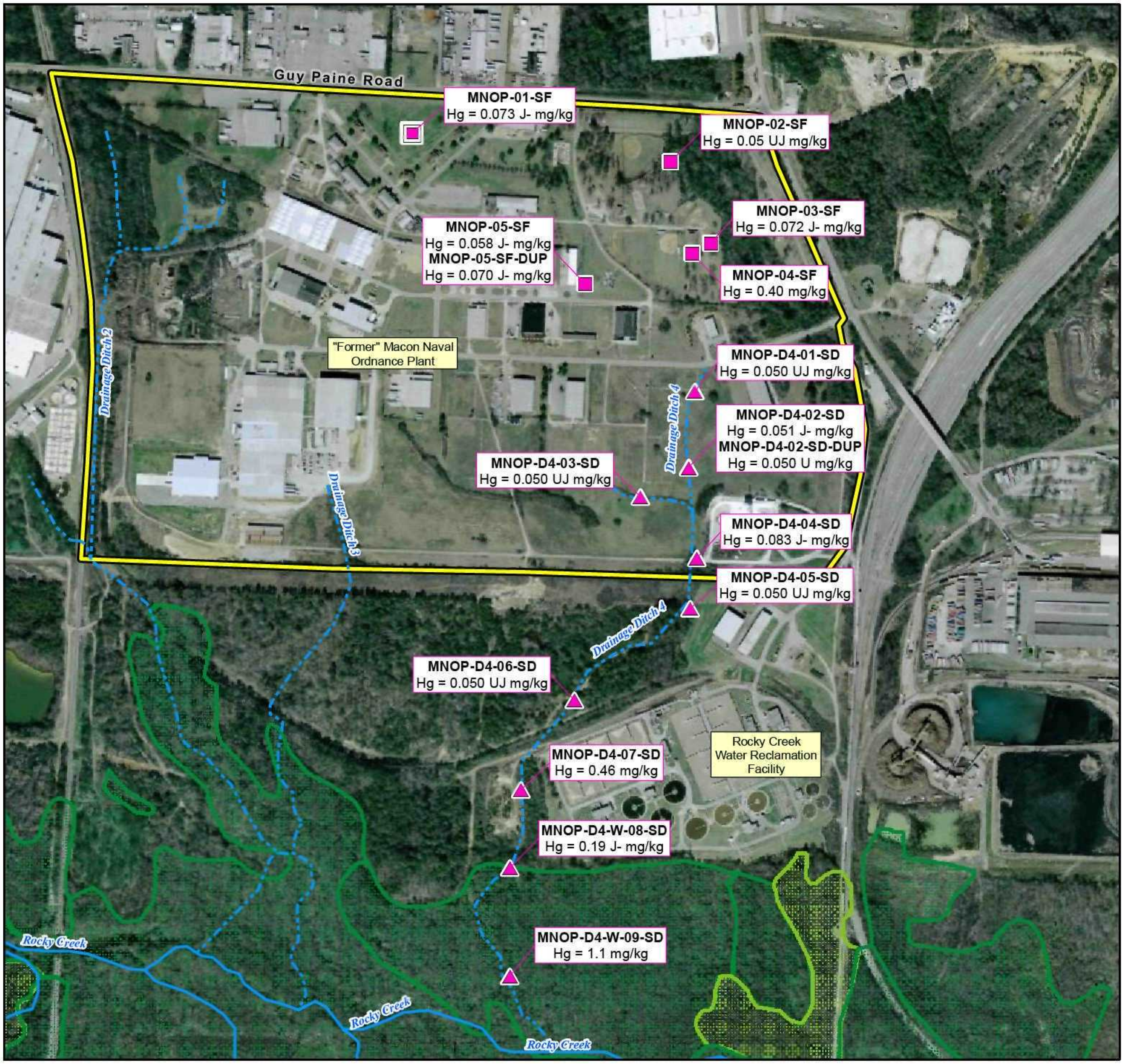
(x) None ( ) Phone Call ( ) Memo ( ) Letter ( ) Report

cc: File (x) Project Manager ( ) Principal Investigator ( ) Other (specify)

ATTACHMENT 1

FIGURE

(One Page)



Legend

June 2011 Sample Locations

▲ Sediment Sample

■ Soil Sample

▣ Background Soil Sample

Map Features

— Creek

- - - Drainage Ditch

▭ "Former" Macon Naval Ordnance Plant

Wetland Areas

▨ Freshwater Palustrine Emergent Wetland

▨ Freshwater Palustrine Forested/Shrub Wetland

N
W E
S

0 400 800
Feet
1:9,600

Map Source:
Aerial Photograph - ESRI I3 Imagery Prime, 2009.
Property Boundary - Macon-Bibb County Board of Tax Assessors.
Wetlands - U.S. Fish and Wildlife Service National Wetlands Inventory

Notes:
D - Drainage Ditch
Hg - Mercury
mg/kg - Milligrams per kilogram
MNOP - Macon Naval Ordnance Plant
SD - Sediment Sample
SF - Surface Soil Sample

United States
Environmental Protection Agency

MACON NAVAL ORDNANCE PLANT
MACON,
BIBB COUNTY,
GEORGIA
TDD No. TTEMI-05-003-0127

JUNE 2011 SUPPLEMENTAL SAMPLING LOCATIONS WITH MERCURY CONCENTRATIONS

TETRA TECH

Path: C:\GIS_Workspace\TTEMI-05-003-0127_Macon_Naval_Ordnance_Plant\Figures\GIS\MXDs\Mercury Concentration Maps\FMNOL SELECT Hg SMPLS 8.5x11 9-01-11.mxd Date Saved: 9/1/2011 1:07:33 PM User: dale.vonbusch

ATTACHMENT 2

LOGBOOK NOTES

(Six Pages)

a product of

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Macon Naval Ordnance Plant

TTEM1-05-003-0127

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6/29/11 - 6/30/11

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CONTENTS

PAGE	REFERENCE	DATE
	All samples were collected in accordance with EPA Region 4 SESD Field Branches Quality System & Technical Procedures, February 2008. Qui Kelley	6/30/11

Wednesday, June 29, 2011

0900 After packing up rental vehicle, START Quinn Kelley & Chris Jones mobilize to MNOP site in Macon, GA

1045 START arrives in Macon, GA. Before going to the site, START stops by the Macon Water Authority (MWA) to see if Mr. Robert Rojas, Executive Director, is available to sign the access agreement for the Rocky Creek Water Reclamation Facility Property. He is in meetings all morning, but will be able to sign the agreement later in the afternoon. START will return later.

1120 START arrives onsite & begins sampling at locations that are not on the MWA property. START conducts a Recon of the area before sampling.

1220 START collects soil sample MNOP-05-SF 0 to 6 in bgs.

1225 START collects duplicate soil sample MNOP-05-SFDUP 0 to 6 in bgs.

Scale: 1 square=_______ Quinn Kelley 6/29/11

Wednesday, June 29, 2011

1240 START collects background soil sample MNOP-01-SF 0 to 6 in bgs.

1315 START collects background sediment (ditch) sample MNOP-D2-01-SD 0 to 3 in bgs

1330 START goes back to the MWA to see if Mr. Rojas has signed the access agreement. He is in a meeting until 2:30. He will sign it when he gets back.

1400 START breaks for lunch.

1430 START back on site.

1440 START receives notice from EPA RPM Donna Seadler that the City of Macon has not yet signed the access agreement for their parcel (ID: Q103-0064). START attempts to track down someone with the City to sign the form.

1500 START receives word that Mr. Rojas has signed the access agreement for the MWA.

Quinn Kelley 6/29/11 Scale: 1 square=_______

Wednesday, June 29, 2011

1530 START picks up the ~~a~~ qk signed access agreement at MWA

1545 START speaks with Mr. Danny Tavakol, City Engineer w/the City of Macon's Engineering Dept. He says to bring the access agreement to his office & he will take a look.

1600 START arrives at Mr. Tavakol's office & explains to him why & how we are sampling at the MNOP. Mr. Tavakol says he will ask Mr. Bill Causey, Manager of Engineering - City of Macon to sign the agreement tomorrow morning. Mr. Tavakol also requests that he be present during sampling activities at the City of Macon property, which is now a park. START makes an appointment to meet Mr. Tavakol at the site at 8am tomorrow morning. START leaves the agreement w/ Mr. Tavakol.

Scale: 1 square= QuinKelly 6/29/11

Wednesday, June 29, 2011

1700 START back onsite to collect background wetland sample.

1740 START collects wetland sample, MNOP-W-01-SD 0 to 3 in bgs.

1800 START done for the day.

QuinKelly 6/29/11

Scale: 1 square=

Thursday, June 30, 2011

0800 START arrives on site & meets Mr. Tavakol to collect samples on the City of Macon property. Mr. Tavakol gives START the signed access agreement.

0815 START collects soil sample. MNOP-03-SF 0 to 6 in bgs.

0820 START collects soil sample MNOP-04-SF 0 to 6 in bgs.

0830 START collects soil sample MNOP-02-SF.

0845 Mr. Tavakol offsite. START goes to Rocky Creek Water ~~Reto~~ Reclamation Facility to begin sampling Drainage Ditch 4

0900 START signs in at the office. RCWRF personnel show START around the facility & also where they can enter the woods surrounding the property. START will have to navigate through trails in the woods to locate downstream DD4 sampling locations.

Quin Kelly 6/30/11

Thursday, June 30, 2011

1000 START collects sediment sample MNOP-D4-W-09-SD 0 to 3 in bgs. START continues moving upstream along DD4 to the next sampling location. Due to dense foliage, navigation is difficult.

1045 START collects sediment sample MNOP-D4-W-08-SD 0 to 3 in bgs

1115 START collects sediment sample MNOP-D4-07-SD 0 to 3 in bgs

1150 START collects sediment sample MNOP-D4-06-SD 0 to 3 in bgs.

1210 START collects sediment sample MNOP-D4-05-SD 0 to 3 in bgs

1225 START collects sediment sample MNOP-D4-04-SD 0 to 3 in bgs.

1240 START collects sediment sample MNOP-D4-03-SD 0 to 3 in bgs

1255 START collects sediment sample MNOP-D4-02-SD 0 to 3 in bgs

1257 START collects duplicate sediment sample MNOP-D4-02-SD-DUP 0 to 3 in bgs.

Quin Kelly 6/30/11

Thursday, June 30, 2011

1305 START collects sediment sample MWOP-D4-01-SD 0 to 3 in bgs.

1310 START offsite. START returns to hotel to check out & then demobilize from the site.

1600 START back at Duluth office. START processes samples for shipment to the Region 4 Lab.

1800 START ships samples to lab. START done.

6/30/11

Scale: 1 square=

City of Macon
Engineering Department

DANNY TAVAKOL
~~Interim City~~ Engineer

682 Cherry Street
Suite 800
Macon, Georgia 31201

Phone (478) 751-7180
Fax (478) 751-7998
E-mail:danny.tavakol@macon.ga.us

Scale: 1 square=

Reference No. 10
Macon Naval Ordnance Plant
EPA ID No. GAD003302676

DRAFT
QUALITY ASSURANCE PROJECT PLAN (SHORT FORM)

MACON NAVAL ORDNANCE PLANT
MACON, BIBB COUNTY, GEORGIA

Revision 0

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Region 4
Atlanta, GA 30303

Contract No.	:	EP-W-05-054
TDD No.	:	TTEMI-05-003-0127
Date Prepared	:	June 20, 2011
EPA Task Monitor	:	Donna Seadler
Telephone No.	:	(404) 562-8870
Prepared by	:	Tetra Tech, Inc.
START III Project Manager	:	Sandra Harrigan
Telephone No.	:	(678) 775-3088

Prepared by	Reviewed by	Approved by
Quinn Kelley	Jessica A. Vickers	
Quinn Kelley START III Site Manager	Jessica Vickers START III Technical Reviewer	Andrew F. Johnson START III Program Manager

CONTENTS

QAPP TABLES

APPENDICES

QUALITY ASSURANCE PROJECT PLAN (SHORT FORM)
U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION 4 & TETRA TECH, INC.
SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM CONTRACT NO. EP-W-05-054

Site Name:	Macon Naval Ordnance Plant	**City, County:** Macon, Bibb County	**State:** Georgia
Prepared By:	Tetra Tech, Inc. (Tetra Tech)	**Date:** June 20, 2011	
Approved By: **Title:**	Sandra Harrigan **Date:** 06/20/11 Tetra Tech Project Manager	**Signature:** Sandra J Harrigan	
Approved By: **Title:**	Jessica Vickers **Date:** 06/20/11 Tetra Tech Quality Assurance (QA) Manager	**Signature:** Jessica A. Vickers	
Approved By: **Title:**	Andrew Johnson **Date:** 06/20/11 Tetra Tech START III Program Manager	**Signature:** Andrew J Johnson	
Approved By: **Title:**	Donna Seadler **Date:** Environmental Protection Agency (EPA) Remedial Project Manager (RPM) and EPA Region 4 QA Manager's Designated Approving Official (DAO)	**Signature:**	

1.0 PROJECT INFORMATION

1.1 Distribution List:

EPA Region 4:	Tetra Tech:
Donna Seadler, EPA RPM Katrina Jones, EPA Project Officer	Angel Reed, Tetra Tech Document Control Coordinator

1.2 Project/Task Organization

Donna Seadler, will serve as the EPA RPM for the activities described in this Quality Assurance Project Plan (QAPP). Quinn Kelley of Tetra Tech will serve as the Tetra Tech site manager and is responsible for maintaining an approved version of this QAPP. Jessica Vickers of Tetra Tech will serve as the Tetra Tech QA manager and is responsible for providing Tetra Tech approval of this QAPP. Specific Tetra Tech field personnel will be determined before mobilization, including a senior scientist as defined under the Superfund Technical Assessment and Response Team (START III) Contract No. EP-W-05-054.

1.3 Problem Definition/Background:

☐ Description attached.

☒	Description in referenced reports:	Final Expanded Site Inspection (ESI) Report	September 29, 2009
		Title	**Date**

1.4 Project/Task Description:

☐ Description attached.

☒ Description in referenced reports:

	Final ESI Report	September 29, 2009
	Title	**Date**

Schedule: The field sampling event is scheduled to occur the week of June 27, 2011.

1.5 Quality Objectives and Criteria for Measurement Data:

Identification of the seven steps of the data quality objectives (DQO) process: DQOs were established for the Macon Naval Ordnance Plant (MNOP), currently Allied Industrial Park (AIP), to define the quantity and quality of the data to be collected to support the objectives of the QAPP. DQOs were developed using the seven-step process outlined in the following EPA guidance documents: "EPA Requirements for Quality Assurance Project Plans," EPA QA/R-5, March 2001; "Guidance for Quality Assurance Project Plans," EPA QA/G-5; and "Guidance on Systematic Planning Using the Data Quality Objectives Process," EPA QA/G-4, February 2006.

Step 1: **State the Problem**	**Stakeholders:** EPA, Georgia Department of Natural Resources (GADNR), U.S. Army Corps of Engineers (USACE), current owners and lessees of AIP properties, Macon-Bibb County Industrial Authority (MBCIA), City of Macon, local community **Site History/Conceptual Site Model:** The former MNOP (currently Allied Industrial Park) manufactured ordnance for the Navy in Macon, Bibb County, Georgia. Operational activities at MNOP began before World War II and ended around 1973 when it was sold to Allied Chemical Corporation. Ordnance manufactured at the MNOP included flares, small primers, detonators, and other triggering mechanisms. Several investigations have been conducted at the former MNOP by the USACE. Contaminants related to MNOP have been observed in Rocky Creek and its surrounding wetlands, which border the study area to the south. **Statement of Problem:** Sampling and laboratory analysis are required to determine the presence or absence of site-related contaminants in the on-site source (contaminated soil), drainage pathways, and the adjacent Rocky Creek and its surrounding wetlands.
Step 2: **Identify the Goals of the Study**	**Study Questions:** Are contaminants present on the property at concentrations exceeding comparison criteria? **Decision Statements:** Evaluate analytical data for environmental samples to determine whether contaminant concentrations are present above sample-specific minimum reporting limits, exceed comparison criteria and background concentrations, and whether observed releases have occurred.
Step 3: **Identify Information Inputs**	**Inputs:** A complete site history is contained in the Final ESI Report, September 29, 2009.
Step 4: **Define Study Boundaries**	**Spatial Boundary:** The MNOP is defined as a former naval ordnance manufacturing plant and downgradient drainage pathways. Site-related contaminants have been observed in Rocky Creek and its surrounding wetlands located along the southern boundary of the study area. **Temporal Boundaries:** Sampling activities are scheduled for the week of June 27, 2011. The temporal boundaries for sampling activities extend from when EPA initiates activities until EPA declares activities complete.

Step 5: **Develop the Analytical Approach**	**Analytical Methods:** The analytical parameter and associated laboratory analytical method that will be used for this project is EPA Test Methods for Evaluating Solid Waste, Physical/Chemical (SW-846) Method 7473. **Comparison Criteria:** Analytical data results will be compared to the comparison criteria provided in EPA Superfund Chemical Data Matrix (SCDM) benchmarks for Hazard Ranking System (HRS) scoring located a the following address: http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm **Decision Rules:** Analytical results will be compared with background concentrations for all media sampled and to the comparison criteria listed above. Constituent concentrations in samples that are greater than or equal to three times the background concentration or that are greater than or equal to the sample-specific and analyte-specific minimum reporting limit in the background sample are considered elevated. Constituent concentrations that are elevated, greater than or equal to the HRS benchmarks in the EPA SCDM, and meet the observed release criteria will be evaluated as actual contamination if detected in samples collected at HRS target locations, including wetlands and fisheries, as specified in the HRS rule for the surface water migration pathway.
Step 6: **Specify Performance or Acceptance Criteria**	Initial acceptance of the data will be determined by the EPA Region 4 Science and Ecosystem Support Division (SESD) Office of Quality Assurance through the data validation process. Any rejected data and the reasons for rejection will be summarized in the data validation report. Additionally, Tetra Tech will evaluate the data results using the HRS rule and guidance manual, and the EPA fact sheet on using qualified data. Sample concentrations will be reviewed to ensure that concentrations were detected above the sample and analyte-specific minimum reporting limits. See Table 2 of this QAPP.
Step 7: **Develop the Plan for Obtaining Data**	**Optimized Design:** In all, five surface soil, nine sediment, and three wetland samples are proposed for this event, not including duplicate and QA/QC samples. The types and number of environmental samples collected will be biased to identify source locations and to document observed releases of mercury to the surface water migration pathway. The samples to be collected and their proposed locations are summarized and described in Appendix B of this QAPP.

1.6 Special Training/Certification Requirements:

☒ OSHA 29 CFR 1910.120 ☐ Special Equipment/Instrument Operator (describe below): ☐ Other (describe below):

Special Requirements:

Training, including record retention, will be conducted in accordance with Section H.2 of EPA START III Contract No. EP-W-05-054 as well as the Tetra Tech START Program Level QAPP, May 2011 (Sections 1.5 and 1.6). Also, the Tetra Tech Director of Health and Safety maintains a database of personnel training located in the Tetra Tech Chicago, Illinois, corporate office.

1.7 Documentation and Records:

The most current version of this QAPP will be distributed to the entire distribution list presented in Section 1.1. The Tetra Tech site manager will be responsible for maintaining the most current revision of this QAPP and for distributing it to all personnel and parties involved in the field effort. Field records that may be generated include the following:

☒ Chains-of-Custody Forms
☐ Field Instrument Calibration Logs
☐ Field Monitoring and Screening Results
☐ Soil Borings and Well Logs
☒ Health and Safety Plan (HASP)
☒ Photographic log
☒ Site Logbook
☒ Site Maps and Drawings

Field documentation and records will be generated and maintained in accordance with the requirements presented in the EPA Region 4 SESD operating procedure, *Logbooks* (SESDPROC-010-R4), October 2010. This document can be found at the following web address: http://www.epa.gov/region4/sesd/fbqstp/index.html

Laboratory analytical data will be generated and maintained in accordance with the EPA SW-846 Method 7473 (mercury). The web address is: http://www.epa.gov/SW-846/sw846.htm. A 21-day turnaround time has been requested from the EPA Regional laboratory. The formal deliverables for EPA associated with this project are specified in the EPA technical direction document. A data validation report will be prepared to present laboratory analytical results. All project records under Tetra Tech's control will be maintained and retained in accordance with the requirements of EPA START III Contract No. EP-W-05-054.

2.0 DATA GENERATION AND ACQUISITION

2.1 Sampling Process Design:

Appendix B of this QAPP presents details on the types and numbers of samples to be collected, sample locations, sample matrices, and laboratory analytical methods. The rationale for this sampling process design is based on the DQO process discussed in Section 1.5 of this QAPP. Samples submitted to the EPA Regional laboratory will be analyzed for mercury.

2.2 Sample Methods Requirements:

Matrix	Sampling Method	EPA and Tetra Tech Standard Operating Procedures and Guidance
Soil and Sediment	Refer to Table B-1 of Appendix B of this QAPP for more details, including requested laboratory analyses and methods. Soil and sediment samples will be collected from 0 to 6 inches below ground surface using stainless steel spoons and aluminum pans.	Refer to the EPA Region 4, SESD SOPs for *Soil Sampling* (SESDPROC-300-R1), November 2007; and *Sediment Sampling* (SESDPROC-200-R2), September 2010. Available at the following web address: http://www.epa.gov/region4/sesd/fbqstp/index.html. Also refer to Section 2.2, page 20 of the Tetra Tech START Program Level QAPP, May 2011. A list of applicable SWPs is included in the HASP, which will be available on site.

Other Sample Method Requirements: The Tetra Tech site manager, in coordination with the EPA RPM, will be responsible for identifying failures in sampling and field measurement systems, overseeing any corrective actions, ensuring that the corrective actions are documented in site logbooks and other appropriate records, and assessing the effectiveness of corrective actions. Field decontamination will be conducted in accordance with the procedures provided in the EPA Region 4, SESD OP *Field Equipment Cleaning and Decontamination* (SESDPROC-205-R1), November 2007, available at the following web address: http://www.epa.gov/region4/sesd/fbqstp/index.html. Field supplies required for this sampling event includes disposable Nitrile gloves, sample jars, sample packaging materials such as coolers and vermiculite or suitable packing material, and personal protective equipment (PPE) identified in the HASP. Also see Table 3 of this QAPP for a list of equipment and supplies.

2.3 Sample Handling and Custody Requirements:

Sample handling and chain-of-custody record keeping will be conducted in accordance with EPA Region 4, SESD OP *Packing, Marking, Labeling, and Shipping of Environmental and Waste Samples* (SESDPROC-209-R2), April 2011, available at the following web address: http://www.epa.gov/region4/sesd/fbqstp/index.html. Once collected, all samples will be placed on ice and kept in a custody-sealed cooler in a secure location. The Tetra Tech site manager will ensure that custody of samples is maintained until they are shipped to the laboratory. Chain-of-custody records will be used to document the samples collected and delivered to the laboratory. Samples will be processed using SCRIBE. Also refer to Section 2.3, page 29 of the Tetra Tech START Program Level QAPP, May 2011.

2.4 Analytical Method Requirements:

The analytical parameter and associated laboratory analytical method that will be used for this project is EPA SW-846 Method 7473, mercury analysis (also presented in Table 2 of this QAPP).

Data validation of the analytical data package will be conducted by the Office of Quality Assurance. Data validation will be conducted in accordance with the EPA SW-846 Method 7473 for mercury analysis; the EPA Region 4 Analytical Support Branch (ASB) Laboratory Operations and Quality Assurance Manual (LOQAM), January 2011; and Section 2.5.2, page 36 of the Tetra Tech START Program Level QAPP, May 2011. Laboratory instruments required for sample analyses are contained in the EPA SW-846 Method.

Modifications to data validation criteria will be provided by EPA. The individual responsible for ensuring the success of the analyses is Jenny Scifres, EPA SESD, Chief of the Inorganic Chemistry Section.

A 21-day turnaround time was requested for the laboratory to submit results to the EPA SESD, Office of Quality Assurance. Tetra Tech anticipates the final validated data packages will be received from SESD within 42 days. Within 14 days after the package is received, Tetra Tech will conduct a cursory review of the data packages against the chain-of-custody records to ensure that results for all samples are received. The data packages will also be reviewed to determine whether any data are rejected and whether any data qualifiers assigned during the validation process affects the usability of the data as defined in Section 1.5 of this QAPP. Once the cursory review is completed, Tetra Tech will notify the RPM of problems encountered, if any.

2.5 Quality Control Requirements:

QC requirements for field monitoring are provided in the EPA Region 4, SESD SOP Field Measurement Uncertainty (SESDPROC-014-R0), February 2008, and QC requirements for field sampling are provided in the EPA Region 4 SESD OP Field Sampling Quality Control (SESDPROC-011-R3), October 2010. Both are available at the following web address: http://www.epa.gov/region4/sesd/fbqstp/index.html. Also refer to Section 2.5.1, page 35 of the Tetra Tech START Program Level QAPP, May 2011.

Quality control requirements for analytical methods are presented in the associated EPA SW-846 Method; and the EPA Region 4 ASB LOQAM, January 2011; as well as in Section 2.5.2, page 36 of the Tetra Tech START Program Level QAPP, May 2011.

Laboratory and quality control samples will include one matrix spike and matrix spike duplicate (MS/MSD) from sample sets collected at a frequency of one MS/MSD set for every 20 samples per medium collected. Field quality control samples will include field duplicate samples collected at a frequency of one field duplicate sample for every 20 samples per medium collected. All quality control samples will be submitted for analysis of parameters listed in Table 2 and in Table B-2 (Appendix B) of this QAPP.

2.6 Instrument/Equipment Testing, Inspection, and Maintenance Requirements:

For instrument testing, inspection, and maintenance requirements for field monitoring, refer to the EPA Region 4, SESD OP Equipment Inventory and Management (SESDPROC-108-R3), April 2009, available at the following web address: http://www.epa.gov/region4/sesd/fbqstp/index.html. Also refer to the manufacturer's operating manual for further instructions on field instrument testing, inspection, and maintenance as well as to Section 2.6, page 41 of the Tetra Tech START Program Level QAPP, May 2011. Table 3 of this QAPP contains a list of field instruments that will be used during this sampling event.

Laboratory instrument testing, inspection, and maintenance requirements are contained in the EPA SW-846 Method, as well as in the associated manufacturer's operating manuals.

2.7 Instrument Calibration and Frequency:

For instrument calibration and frequency requirements for field monitoring, refer to the EPA Region 4, SESD OP Equipment Inventory and Management (SESDPROC-108-R3), April 2009, available at the following web address: http://www.epa.gov/region4/sesd/fbqstp/index.html. Also refer to the manufacturer's operating manual for further instructions on calibration as well as to Section 2.7.1, page 43 of the Tetra Tech START Program Level QAPP, May 2011.

Instrument calibration and frequency requirements for EPA analytical methods are presented in the EPA SW-846 Method; the EPA Region 4 ASB LOQAM, January 2011; and in the associated manufacturer's operating manuals, as well as in Section 2.7.2, page 43 of the Tetra Tech START Program Level QAPP, May 2011.

2.8 Inspection/Acceptance Requirements for Supplies and Consumables:

Supplies and consumables required for this sampling event will be inspected and accepted by the Tetra Tech site manager or designated field team member and include disposable nitrile gloves, sample jars, sample packaging materials, and PPE identified in the HASP. All sample containers will meet EPA criteria for cleaning procedures for low-level chemical analysis. Sample containers will have certifications provided by the manufacturer in accordance with pre-cleaning criteria established by EPA. See Section 2.8, page 45 of the Tetra Tech START Program Level QAPP, May 2011. See Table 3 in this QAPP for a complete list of supplies and consumables.

2.9 Non-Direct Measurement Requirements:

Information pertaining to the site (including photographs, maps, and so forth) has been compiled from file information obtained from EPA. This data and information are presented in the final ESI report, dated September 29, 2009. The extent to which this data and information, if any, are used to achieve the objectives of this project will be determined by Tetra Tech in cooperation with the EPA RPM. Any justifications and qualifications required for the use of this data and information will be provided in the reports generated for this project. Refer to Section 2.9, page 45 of the Tetra Tech START Program Level QAPP, May 2011. Historical information, including target data obtained from internet websites, will be reviewed and cross referenced with information obtained from EPA and GAEPD for accuracy prior to inclusion in the investigation reports.

2.10 Data Management:

All reference materials generated during this investigation and included in the final report will be submitted to the RPM in PDF on CD, and a SCRIBE database will be created for the analytical data results. The SCRIBE database will be submitted to the RPM with the final report. All field-generated data will be managed as part of the permanent field record for the project. All laboratory analytical data will be managed in accordance with the requirements of the EPA SW-846 Method; as well as the EPA Region 4 policy and applicable federal regulations. Finally, all field-generated data and other records generated or obtained during this project will be managed according to the requirements of EPA START III Contract No. EP-W-05-054, as well as to Section 2.10, page 46 of the Tetra Tech START Program Level QAPP, May 2011.

3.0 ASSESSMENT AND OVERSIGHT

3.1 Assessment and Response Actions:

Field and laboratory audits will not be conducted for this project. All deliverables that Tetra Tech contributes to in whole or in part, including the final report, will be subjected to the corporate three-tiered review process, which includes a technical review, an editorial review, and a quality control review, with each reviewer signing off on a quality control review sheet when any issues or revisions have been addressed. These reviews will be performed by qualified individuals in accordance with the requirements of EPA START III Contract No. EP-W-05-054 and with Section 3.1, page 47 of the Tetra Tech START Program Level QAPP, May 2011.

3.2 Corrective Action:

The Tetra Tech site manager, in coordination with the EPA RPM, will be responsible for identifying failures in sampling and field measurement systems, overseeing any corrective actions, ensuring that the corrective actions are documented in site logbooks and other appropriate records, and assessing the effectiveness of corrective actions. Corrective action requirements for EPA analytical methods are presented in the EPA SW-846 Method; and Section 3.1.2, page 49 of the Tetra Tech START Program Level QAPP, May 2011.

3.3 Reports to Management:

All formal deliverables to EPA associated with this project will be prepared, reviewed, and distributed in accordance with the requirements of the EPA START III Contract No. EP-W-05-054, Section 3.2, page 51 of the Tetra Tech START Program Level QAPP, May 2011, and under the supervision of the Tetra Tech QA manager, Jessica Vickers or appropriate designee.

4.0 DATA VALIDATION AND USABILITY

4.1 Data Review, Verification, and Validation Requirements:

All field-generated data and records (such as global positioning system coordinates of sample locations and field logbook notes) will be reviewed for completeness and accuracy by the Tetra Tech site manager and appropriate designees. Field data and records will be reviewed at the end of each day so that corrective actions, if necessary, can be made prior to demobilizing from the site.

Data validation of the analytical data packages will be conducted by the Office of Quality Assurance. Data validation will be conducted in accordance with the EPA SW-846 Method 7473 for mercury analysis; the EPA Region 4 ASB LOQAM, January 2011; and Section 2.5.2, page 36 of the Tetra Tech START Program Level QAPP, May 2011. Laboratory instruments required for sample analyses are contained in the EPA SW-846 Method.

Modifications to data validation criteria will be provided by EPA. The individual responsible for ensuring the success of the analyses is Jenny Scifres, EPA SESD, Chief of the Inorganic Chemistry Section.

4.2 Verification and Validation Methods:

All field-generated data will be maintained in the project file and included (as appropriate) in project deliverables in final form after all reviews and associated corrective actions. The laboratory analytical data will be validated in accordance with EPA policy, by the EPA Region 4 SESD, Office of Quality Assurance. The analytical data validation methods are provided in the ASB LOQAM, January 2011; and Section 4.1, page 53 of the Tetra Tech START Program Level QAPP, May 2011. The validated analytical data packages will contain a summary of all data qualifier flags and their explanations. Also see Section 4.2, page 54 of the Tetra Tech START Program Level QAPP, May 2011.

4.3 Reconciliation of the Data to the Project-Specific DQOs:

The Tetra Tech site manager, in cooperation with the EPA RPM and Tetra Tech QA Manager, will be responsible for reconciling the data and other project results with the requirements specified in this QAPP and by the data users and decision makers. Ultimate acceptance of the data is at the discretion of the EPA RPM. Depending on the nature of how specific data quality indicators do not meet the project's requirements, the data may be discarded and resampling and reanalysis of the subject samples may be required. Resampling, reanalysis, or other out-of-scope actions identified to address data quality deficiencies and data gaps will require approval by the EPA RPM, EPA Project Officer, and EPA Contracting Officer.

All final data packages will be reviewed to determine whether the site-specific DQOs, as defined in Section 1.5 of this QAPP, are met based on the following guidance documents:

- EPA, HRS, 40 Code of Federal Regulations Part 300, Appendix A, 55 Federal Register 51532. December 1990.
- EPA, Hazard Ranking System Guidance Manual, Publication 9345.1-07, EPA 540-R-92-026. November 1992.
- EPA, Using Qualified Data to Document an Observed Release and Observed Contamination. November 1996.

The data packages will also be reviewed to determine whether any data are rejected and whether any data qualifiers assigned during the validation process affects the usability of the data as defined in Section 1.5 of this QAPP. Estimated, or "J" flagged, data will be evaluated in accordance with *Using Qualified Data to Document an Observed Release and Observed Contamination* fact sheet, November 1996. This evaluation will be conducted to ensure that estimated results used to establish observed releases and areas of observed contamination meet the HRS definition of elevated concentrations. Data that are rejected will be identified in the analytical data packages received from the EPA SESD Office of Quality Assurance. Reconciliation of the data to the project-specific DQOs will be conducted in accordance with EPA HRS rule and guidance manual. Also see Section 4.3, page 56 of the Tetra Tech START Program Level QAPP, May 2011.

TABLE 1: SAMPLE SUMMARY

Site Name:	Macon Naval Ordnance Plant	**City, County:** Macon, Bibb County	**State:** Georgia

ENVIRONMENTAL SAMPLES							
No. of Samples	**Matrix**	**Location**	**Purpose**	**Depth or other Descriptor**	**Sampling Method**	**Requested Analyses**	**Analytical Methods**
ALL MATRICES							
Refer to Appendices A and B of this QAPP for proposed field sampling locations. Final sampling locations will be based on observations in the field.							
QUALITY CONTROL SAMPLES							
Refer to Table B-2 in Appendix B and Section 2.5 of this QAPP.							

TABLE 2: PERFORMANCE OR ACCEPTANCE CRITERIA

Site Name:	Macon Naval Ordnance Plant	**City, County:** Macon, Bibb County	**State:** Georgia

ALL MATRICES

Analysis	Analytical Method
Mercury	7473

Data Quality Measurements

Accuracy	Refer to EPA Region 4, SESD SOP for *Soil Sampling* (SESDPROC-300-R1), November 2007; SESD SOP for *Sediment Sampling* (SESDPROC-200-R2), September 2010; the SW-846 Method above; and the data validation SOPs discussed in Sections 4.1 and 4.2 of this QAPP.
Precision	Refer to EPA Region 4, SESD SOP for *Soil Sampling* (SESDPROC-300-R1), November 2007; SESD SOP for *Sediment Sampling* (SESDPROC-200-R2), September 2010; the SW-846 Method above; and the data validation SOPs discussed in Sections 4.1 and 4.2 of this QAPP.
Representativeness	5 surface soil, 9 sediment, and 3 wetland samples will be collected from the MNOP property, drainage pathway, and wetland areas to provide a representative quantity of samples for the investigation. Refer to Figure 2 in Appendix A of this QAPP for the proposed sampling locations.
Completeness	Supplemental sampling is being conducted to confirm the presence of low concentrations of Mercury detected during the ESI and to fill a data gap, and will be used for NPL evaluation. Background samples will be collected for comparison to determine whether contaminant concentrations are elevated (see Section 1.5, Step 5 of this QAPP for the definition of elevated).
Comparability	In accordance with the HRS Guidance Manual, sample comparability should be achieved once all field and laboratory work are conducted using the same procedures for the respective sample matrices.

TABLE 3: EQUIPMENT AND SUPPLIES

Site Name:	Macon Naval Ordnance Plant	**City, County:** Macon, Bibb County	**State:** Georgia

Field Instruments	Sample Containers	Sampling Equipment and Supplies	Sample Processing Supplies	Decontamination Supplies	Miscellaneous Supplies
GeoXT Trimble unit	4-oz jars	stainless steel spoons	plastic baggies		digital camera
Trimble antenna		Aluminum pans	vermiculite		permanent markers
Trimble range pole		Nitrile gloves	coolers		logbooks
Trimble clamp cradle		Visqueen	custody seals		garbage bags
		Waders	laptop		vehicle power converter
			printer		first aid kit
			paper		
			labels		
			FedEx labels		
			duct tape		
			strapping tape		
			paper towels		
			2-oz jars		

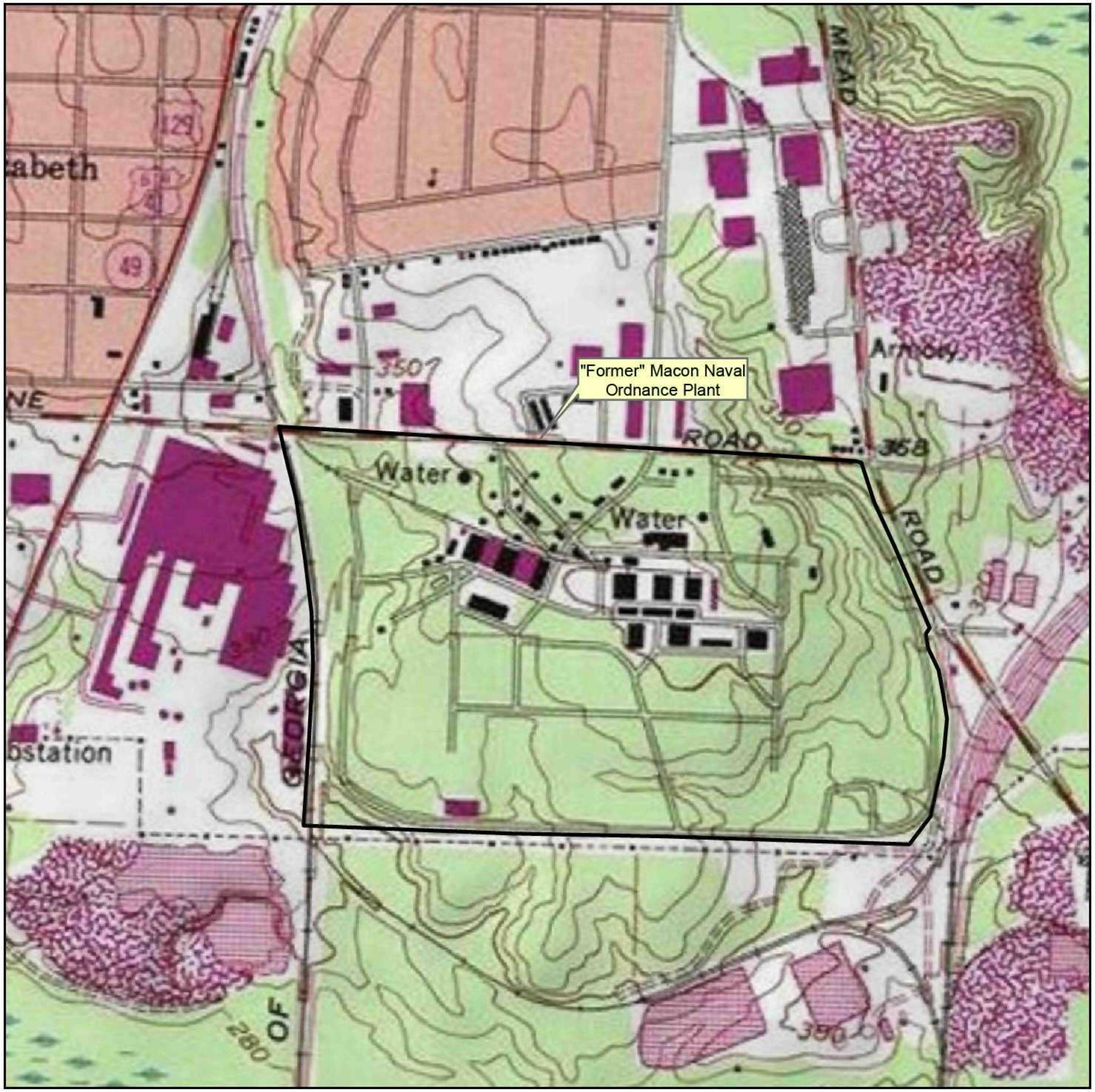
Notes:

oz = Ounce

APPENDIX A

FIGURES

(Two Pages)



LEGEND

▭ Property Boundary

MAP SOURCE:
USGS, MACON WEST, GA
TOPOGRAPHIC QUADRANGLE, 1981
PROPERTY BOUNDARY SOURCE:
MACON-BIBB COUNTY BOARD OF TAX
ASSESSORS

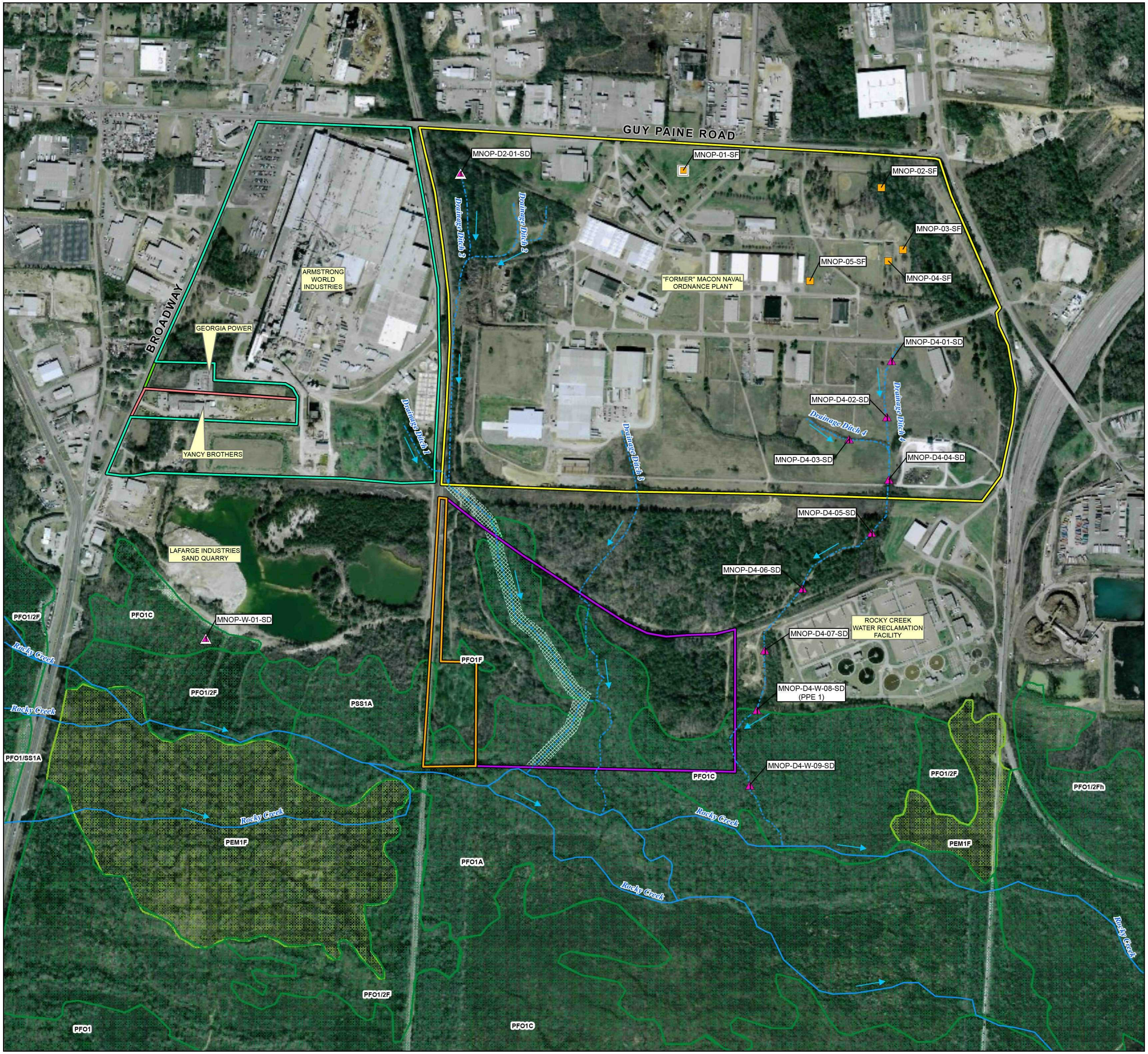
United States Environmental Protection Agency

MACON NAVAL
ORDNANCE PLANT
MACON,
BIBB COUNTY,
GEORGIA
TDD No.TTEMI-05-003-0127

FIGURE 1
PROPERTY LOCATION

TETRA TECH

Path: C:\GIS_Workspace\TTEMI-05-003-0127_Macon_Naval_Ordnance_Plant\Figures\GIS\MXDs\Site Location Maps\FMNOP SITE LOC MAP 6-20-11.mxd Date Saved: 6/20/2011 10:25:18 AM User: dale.vonbusch



Legend

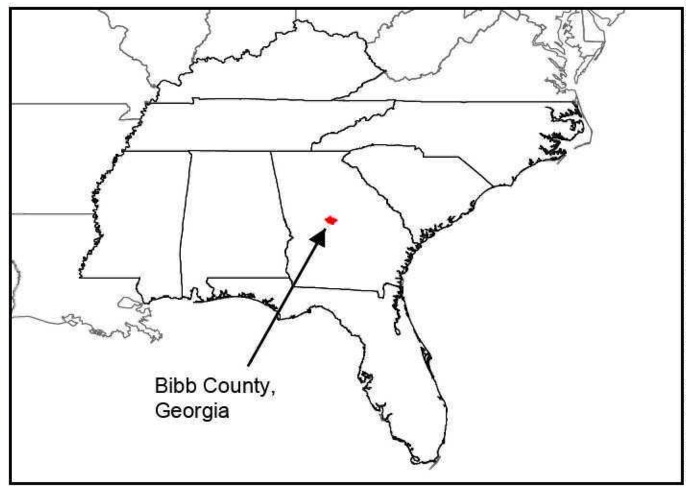
- ▲ Sediment Sample
- ■ Surface Soil Sample
- ▲ Background Sediment Sample
- ■ Background Surface Soil Sample
- — Creek
- - - Drainage Ditch
- ☐ "Former" Macon Naval Ordnance Plant
- ☐ Armstrong World Industries
- ☐ Armstrong World Industries Remote Landfill Property
- ☐ Former Macon Naval Ordnance Landfill Property
- ☐ Georgia Power
- ☐ Yancy Brothers
- ▨ Drainage Easement

AERIAL PHOTOGRAPH SOURCE:
ESRI I3 Imagery Prime, 2009
PROPERTY BOUNDARY SOURCE:
Macon-Bibb County Board of Tax Assessors
WETLAND AREAS SOURCE:
U.S. Fish and Wildlife Service National
Wetlands Inventory

NOTES:
D - Drainage Ditch
MNOP - Macon Naval Ordnance Plant
PEM - Palustrine Emergent Wetland
PFO - Palustrine Forested Wetland
PPE - Probable Point of Entry
PSS - Palustrine Scrub/Shrub Wetland
RC - Rocky Creek
SD - Sediment Sample
SF - Surface Soil Sample
W - Wetland

0 250 500 1,000 Feet
1:6,000

N



United States
Environmental Protection Agency

MACON NAVAL ORDNANCE PLANT
MACON,
BIBB COUNTY,
GEORGIA
TDD No. TTEMI-05-003-0127

FIGURE 2
PROPOSED SUPPLEMENTAL
SAMPLING LOCATIONS

TETRA TECH

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APPENDIX B

TABLES

(Three Pages)

TABLE B-1
MACON NAVAL ORDNANCE PLANT
SOIL AND SEDIMENT SAMPLING LOCATIONS AND RATIONALE

Station ID	Sample ID	Depth (in bgs)	Sample Type	Sample Location	Rationale
MNOP01	MNOP-01-SF	0 to 6	Grab Soil	North-central portion of MNOP	Background surface soil sample for comparison to source soil sample results.
MNOP02	MNOP-02-SF	0 to 6	Grab Soil	Northeastern portion of MNOP	Determine presence or absence of mercury in soil.
MNOP03	MNOP-03-SF	0 to 6	Grab Soil	Near Building 109	Determine presence or absence of mercury in soil.
MNOP04	MNOP-04-SF	0 to 6	Grab Soil	Near Building 109	Determine presence or absence of mercury in soil.
MNOP05	MNOP-05-SF	0 to 6	Grab Soil	Near Building 105E	Determine presence or absence of mercury in soil.
MNOPD201	MNOP-D2-01-SD	0 to 6	Grab Sediment	Drainage Ditch 2, northwestern portion of MNOP	Background drainage ditch sample for comparison to Drainage Ditch 4 sample results.
MNOPD401	MNOP-D4-01-SD	0 to 6	Grab Sediment	Drainage Ditch 4, on MNOP property	Determine presence or absence of mercury in sediment.
MNOPD402	MNOP-D4-02-SD	0 to 6	Grab Sediment	Drainage Ditch 4, on MNOP property	Determine presence or absence of mercury in sediment.
MNOPD403	MNOP-D4-03-SD	0 to 6	Grab Sediment	Drainage Ditch 4, on MNOP property	Determine presence or absence of mercury in sediment.
MNOPD404	MNOP-D4-04-SD	0 to 6	Grab Sediment	Drainage Ditch 4, on MNOP property	Determine presence or absence of mercury in sediment.
MNOPD405	MNOP-D4-05-SD	0 to 6	Grab Sediment	Drainage Ditch 4, north of RCWRF	Determine presence or absence of mercury in sediment.
MNOPD406	MNOP-D4-06-SD	0 to 6	Grab Sediment	Drainage Ditch 4, NW of RCWRF	Determine presence or absence of mercury in sediment.
MNOPD407	MNOP-D4-07-SD	0 to 6	Grab Sediment	Drainage Ditch 4, west of RCWRF	Determine presence or absence of mercury in sediment.
MNOPW01	MNOP-W-01-SD	0 to 6	Grab Sediment	South of Lafarge Industries Sand Quarry	Background wetland sample for comparison to downstream wetland sample results.
MNOPD408	MNOP-D4-W-08-SD	0 to 6	Grab Sediment	Drainage Ditch 4, at PPE 1	Determine presence or absence of mercury in sediment.
MNOPD409	MNOP-D4-W-09-SD	0 to 6	Grab Sediment	Drainage Ditch 4, in wetland	Determine presence or absence of mercury in sediment.

Notes:

bgs	Below ground surface
D	Drainage ditch
ID	Identification
in	Inches
MNOP	Macon Naval Ordnance Plant
NW	Northwest
PPE	Probable point of entry
RCWRF	Rocky Creek Water Reclamation Facility
SF	Surface soil sample
SD	Sediment
W	Wetland

TABLE B-2
MACON NAVAL ORDNANCE PLANT
QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Sample ID	Sample Type	Rationale
MNOP-01-SF	MS/MSD	QA/QC sample to provide information about the effect of each sample matrix on the sample preparation procedures and measurement methodology. One MS/MSD sample will be designated for every 20 soil/sediment samples collected.
MNOP-D4-07-SD-DUP	Field duplicate	Ensure both field and laboratory precision. One duplicate sample will be collected for every 20 soil/sediment samples collected.

Notes:

D	Drainage ditch
DUP	Duplicate
ID	Identification
MNOP	Macon Naval Ordnance Plant
MS/MSD	Matrix spike/matrix spike duplicate
QA	Quality assurance
QC	Quality control
SD	Sediment sample
SF	Surface soil sample

TABLE B-3
MACON NAVAL ORDNANCE PLANT
ANALYTICAL METHODS, REQUIRED SAMPLE CONTAINERS, AND PRESERVATIVES

ANALYTICAL PARAMETER	PARAMETER: TO BE NOTED ON CHAIN-OF-CUSTODY RECORDS	MATRIX	ANALYTICAL METHOD[1]	NUMBER[2] AND TYPE OF SAMPLE CONTAINER	PRESERVATION METHOD	SAMPLE HOLDING TIME
SOIL AND SEDIMENT SAMPLES						
Mercury	Hg	Soil and Sediment	7473	One 4-ounce glass jar with Teflon-lined lid	Cool to 4 °C	28 days

Notes:

[1] EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), which can be viewed at the following website: http://www.epa.gov/SW-846/sw846.htm.

[2] For soil and sediment samples designated for MS/MSD analysis, double sample volume is required.

°C Degrees Celsius

Reference No. 11
Macon Naval Ordnance Plant
EPA ID No. GAD003302676

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 4 Science and Ecosystem Support Division
980 College Station Road, Athens, Georgia 30605-2700
D.A.R.T. Id: 11-0536
Project: 11-0536, Former Macon Naval Ordnance Landfill - Reported by Jenny Scifres

August 1, 2011

4SESD-ASB

MEMORANDUM

SUBJECT: FINAL Analytical Report
Project: 11-0536, Former Macon Naval Ordnance Landfill
Superfund Remedial

FROM: Jenny Scifres
ASB Inorganic Chemistry Section Chief

THRU: Gary Bennett, Chief
Analytical Support Branch

TO: Donna Seadler

Attached are the final results for the analytical groups listed below. These analyses were performed in accordance with the Analytical Support Branch's (ASB) Laboratory Operations and Quality Assurance Manual (ASB LOQAM) found at www.epa.gov/region4/sesd/asbsop. Any unique project data quality objectives specified in writing by the data requestor have also been incorporated into the data unless otherwise noted in the Report Narrative. Chemistry data have been verified based on the ASB LOQAM specifications and may have been qualified if the applicable quality control criteria were not met. For a listing of specific data qualifiers and explanations, please refer to the Data Qualifier Definitions included in this report. The reported results are accurate within the limits of the method(s) and are representative only of the samples as received by the laboratory.

Analyses Included in this report:	Method Used:
Total Metals (TMTL)	
Total Mercury	EPA 245.5

Sample Disposal Policy

Because of the laboratory's limited space for long term sample storage, our policy is to dispose of samples on a periodic schedule. Please note that within 60 days of this memo, the original samples and all sample extracts and/or sample digestates will be disposed of in accordance with applicable regulations. The 60-day sample disposal policy does not apply to criminal samples which are held until the laboratory is notified by the criminal investigators that case development and litigation are complete.

These samples may be held in the laboratory's custody for a longer period of time if you have a special project need. If you wish for the laboratory to hold samples beyond the 60-day period, please contact our Sample Control Coordinator, Debbie Colquitt, by e-mail at Colquitt.Debbie@epa.gov, and provide a reason for holding samples beyond 60 days

cc: Nardina Turner

SAMPLES INCLUDED IN THIS REPORT

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID	Laboratory ID	Matrix	Date Collected	Date Received
MNOP-01-SF	E112801-01	Surface Soil	6/29/11 12:40	7/1/11 9:50
MNOP-02-SF	E112801-02	Surface Soil	6/30/11 08:30	7/1/11 9:50
MNOP-03-SF	E112801-03	Surface Soil	6/30/11 08:15	7/1/11 9:50
MNOP-04-SF	E112801-04	Surface Soil	6/30/11 08:20	7/1/11 9:50
MNOP-05-SF	E112801-05	Surface Soil	6/29/11 12:20	7/1/11 9:50
MNOP-05-SF-DUP	E112801-06	Surface Soil	6/29/11 12:25	7/1/11 9:50
MNOP-D2-01-SD	E112801-07	Sediment	6/29/11 13:15	7/1/11 9:50
MNOP-D4-01-SD	E112801-08	Sediment	6/30/11 13:05	7/1/11 9:50
MNOP-D4-02-SD	E112801-09	Sediment	6/30/11 12:55	7/1/11 9:50
MNOP-D4-02-SD-DUP	E112801-10	Sediment	6/30/11 12:57	7/1/11 9:50
MNOP-D4-03-SD	E112801-11	Sediment	6/30/11 12:40	7/1/11 9:50
MNOP-D4-04-SD	E112801-12	Sediment	6/30/11 12:25	7/1/11 9:50
MNOP-D4-05-SD	E112801-13	Sediment	6/30/11 12:10	7/1/11 9:50
MNOP-D4-06-SD	E112801-14	Sediment	6/30/11 11:50	7/1/11 9:50
MNOP-D4-07-SD	E112801-15	Sediment	6/30/11 11:15	7/1/11 9:50
MNOP-D4-W-08-SD	E112801-16	Sediment	6/30/11 10:45	7/1/11 9:50
MNOP-D4-W-09-SD	E112801-17	Sediment	6/30/11 10:00	7/1/11 9:50
MNOP-W-01-SD	E112801-18	Sediment	6/29/11 17:40	7/1/11 9:50

DATA QUALIFIER DEFINITIONS

U	The analyte was not detected at or above the reporting limit.
J	The identification of the analyte is acceptable; the reported value is an estimate.
QR-1	MRL verification recovery less than lower control limits.

ACRONYMS AND ABBREVIATIONS

CAS	Chemical Abstracts Service Note: Analytes with no known CAS identifiers have been assigned codes beginning with "E", the EPA ID as assigned by the EPA Substance Registry System (www.epa.gov/srs), or beginning with "R4-", a unique identifier assigned by the EPA Region 4 laboratory.
MDL	Method Detection Limit - The minimum concentration of a substance (an analyte) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero.
MRL	Minimum Reporting Limit - Analyte concentration that corresponds to the lowest demonstrated level of acceptable quantitation. The MRL is sample-specific and accounts for preparation weights and volumes, dilutions, and moisture content of soil/sediments.
TIC	Tentatively Identified Compound - An analyte identified based on a match with the instrument software's mass spectral library. A calibration standard has not been analyzed to confirm the compound's identification or the estimated concentration reported.

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-01-SF

Station ID: MNOP01

Lab ID: E112801-01

Matrix: Surface Soil

Date Collected: 6/29/11 12:40

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.073	J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 20:25	EPA 245.5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 4 Science and Ecosystem Support Division
980 College Station Road, Athens, Georgia 30605-2700
D.A.R.T. Id: 11-0536
Project: 11-0536, Former Macon Naval Ordnance Landfill - Reported by Jenny Scifres

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-02-SF
Station ID: MNOP02

Lab ID: E112801-02
Matrix: Surface Soil

Date Collected: 6/30/11 8:30

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.050	U, J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 20:38	EPA 245.5

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-03-SF

Station ID: MNOP03

Lab ID: E112801-03

Matrix: Surface Soil

Date Collected: 6/30/11 8:15

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.072	J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 20:42	EPA 245.5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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980 College Station Road, Athens, Georgia 30605-2700
D.A.R.T. Id: 11-0536
Project: 11-0536, Former Macon Naval Ordnance Landfill - Reported by Jenny Scifres

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-04-SF

Station ID: MNOP04

Lab ID: E112801-04

Matrix: Surface Soil

Date Collected: 6/30/11 8:20

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.40		mg/kg dry	0.050	7/12/11 16:38	7/14/11 20:47	EPA 245.5

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-05-SF
Lab ID: E112801-05
Station ID: MNOP05
Matrix: Surface Soil

Date Collected: 6/29/11 12:20

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.058	J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 20:51	EPA 245.5

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-05-SF-DUP **Lab ID:** E112801-06

Station ID: MNOP05 **Matrix:** Surface Soil

Date Collected: 6/29/11 12:25

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.070	J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 20:55	EPA 245.5

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-D2-01-SD

Lab ID: E112801-07

Station ID: MNOPD201

Matrix: Sediment

Date Collected: 6/29/11 13:15

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.085	J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 21:00	EPA 245.5

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-D4-01-SD

Lab ID: E112801-08

Station ID: MNOPD401

Matrix: Sediment

Date Collected: 6/30/11 13:05

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.050	U, J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 21:04	EPA 245.5

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-D4-02-SD **Lab ID:** E112801-09

Station ID: MNOPD402 **Matrix:** Sediment

Date Collected: 6/30/11 12:55

CAS Number	*Analyte*	*Results*	*Qualifiers*	*Units*	*MRL*	*Prepared*	*Analyzed*	*Method*
7439-97-6	Mercury	0.051	J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 21:09	EPA 245.5

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 4 Science and Ecosystem Support Division
980 College Station Road, Athens, Georgia 30605-2700
D.A.R.T. Id: 11-0536
Project: 11-0536, Former Macon Naval Ordnance Landfill - Reported by Jenny Scifres

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-D4-02-SD-DUP
Lab ID: E112801-10
Station ID: MNOPD402
Matrix: Sediment

Date Collected: 6/30/11 12:57

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.050	U, J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 21:22	EPA 245.5

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-D4-03-SD **Lab ID:** E112801-11

Station ID: MNOPD403 **Matrix:** Sediment

Date Collected: 6/30/11 12:40

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.050	U, J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 21:26	EPA 245.5

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-D4-04-SD

Lab ID: E112801-12

Station ID: MNOPD404

Matrix: Sediment

Date Collected: 6/30/11 12:25

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.083	J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 21:39	EPA 245.5

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-D4-05-SD

Lab ID: E112801-13

Station ID: MNOPD405

Matrix: Sediment

Date Collected: 6/30/11 12:10

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.050	U, J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 21:44	EPA 245.5

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Project: 11-0536, Former Macon Naval Ordnance Landfill - Reported by Jenny Scifres

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-D4-06-SD **Lab ID:** E112801-14

Station ID: MNOPD406 **Matrix:** Sediment

Date Collected: 6/30/11 11:50

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.050	U, J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 21:48	EPA 245.5

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-D4-07-SD **Lab ID:** E112801-15

Station ID: MNOPD407 **Matrix:** Sediment

Date Collected: 6/30/11 11:15

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.46		mg/kg dry	0.050	7/12/11 16:38	7/14/11 21:52	EPA 245.5

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Project: 11-0536, Former Macon Naval Ordnance Landfill - Reported by Jenny Scifres

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-D4-W-08-SD

Station ID: MNOPD408

Lab ID: E112801-16

Matrix: Sediment

Date Collected: 6/30/11 10:45

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.19	J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 21:57	EPA 245.5

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Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-D4-W-09-SD
Lab ID: E112801-17
Station ID: MNOPD409
Matrix: Sediment

Date Collected: 6/30/11 10:00

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	1.1		mg/kg dry	0.050	7/12/11 16:38	7/14/11 22:01	EPA 245.5

Total Metals

Project: 11-0536, Former Macon Naval Ordnance Landfill

Sample ID: MNOP-W-01-SD

Lab ID: E112801-18

Station ID: MNOPW01

Matrix: Sediment

Date Collected: 6/29/11 17:40

CAS Number	Analyte	Results	Qualifiers	Units	MRL	Prepared	Analyzed	Method
7439-97-6	Mercury	0.16	J, QR-1	mg/kg dry	0.050	7/12/11 16:38	7/14/11 22:05	EPA 245.5

Total Metals (TMTL) - Quality Control

US-EPA, Region 4, SESD

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1107087 - M 245.5 Hg Soil-Waste										
Blank (1107087-BLK1)				Prepared: 07/12/11 Analyzed: 07/14/11						
EPA 245.5										
Mercury	U	0.050	mg/kg dry							U
Blank (1107087-BLK2)				Prepared: 07/12/11 Analyzed: 07/14/11						
EPA 245.5										
Mercury	U	0.050	mg/kg dry							U
Blank (1107087-BLK3)				Prepared: 07/12/11 Analyzed: 07/14/11						
EPA 245.5										
Mercury	U	0.050	mg/kg dry							U
LCS (1107087-BS1)				Prepared: 07/12/11 Analyzed: 07/14/11						
EPA 245.5										
Mercury	0.83642	0.050	mg/kg dry	0.90000		92.9	85-115			
Matrix Spike (1107087-MS1)		**Source: E112801-01**		Prepared: 07/12/11 Analyzed: 07/14/11						
EPA 245.5										
Mercury	0.42096	0.050	mg/kg dry	0.36258	0.072668	96.1	85-115			
Matrix Spike (1107087-MS2)		**Source: E112801-11**		Prepared: 07/12/11 Analyzed: 07/14/11						
EPA 245.5										
Mercury	0.41128	0.050	mg/kg dry	0.39432	0.031422	96.3	85-115			
Matrix Spike Dup (1107087-MSD1)		**Source: E112801-01**		Prepared: 07/12/11 Analyzed: 07/14/11						
EPA 245.5										
Mercury	0.41147	0.050	mg/kg dry	0.36284	0.072668	93.4	85-115	2.84	20	
Matrix Spike Dup (1107087-MSD2)		**Source: E112801-11**		Prepared: 07/12/11 Analyzed: 07/14/11						
EPA 245.5										
Mercury	0.42111	0.050	mg/kg dry	0.39246	0.031422	99.3	85-115	3.03	20	
MRL Verification (1107087-PS1)				Prepared: 07/12/11 Analyzed: 07/14/11						
EPA 245.5										
Mercury	0.033500	0.050	mg/kg dry	0.050000		67.0	70-130			U, MRL-3, QR-1

Notes and Definitions for QC Samples

U	The analyte was not detected at or above the reporting limit.
MRL-3	MRL verification for Soil matrix
QR-1	MRL verification recovery less than lower control limits.