DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

RCRA Corrective Action
Environmental Indicator (EI) RCRIS Code (CA750)
Migration of Contaminated Groundwater Under Control

Facility Name: **Hercules Incorporated Burlington Plant Site**
Facility Address: **Neck Road, Burlington Township, New Jersey 08016**
Facility EPA ID#: **NJD011136884**

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EIs developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Migration of Contaminated Groundwater Under Control" EI

A positive "Migration of Contaminated Groundwater Under Control" EI determination ("YE" status code) indicates that the migration of "contaminated" groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original "area of contaminated groundwater" (for all groundwater "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While final remedies remain the long-term objectives of the RCRA Corrective Action program, the EIs are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993 (GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated groundwater and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determination status codes should remain in the RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

Facility Information

The Hercules Burlington Plant is located on approximately 135 acres of land roughly 1.5 miles northeast of Burlington, New Jersey. The area surrounding the site is largely industrial, with some residential and undeveloped areas. A former petroleum bulk storage facility and barge unloading operation is located south of the site, along with property owned by U.S. Pipe Company. Northeast of the site, Liquid Carbonic Corporation operates a storage and transfer facility. A residential area is located east of the Hercules property, with approximately 20 houses situated along Neck Road, directly across the street

from the site. The site is bounded by the Delaware River along the entire western edge of the property. The facility is fenced, access is restricted, and security officers routinely patrol the property.

Hercules Incorporated (Hercules) has owned the Burlington Plant site since 1945, with manufacturing operations ongoing between 1946 and 1993, when the facility was permanently shut down. Prior to Hercules' ownership, the site was used as farmland. Principal products manufactured at the plant included hard and liquid resins made from processed pine tree rosins and used by the food and cosmetic industries as fragrances, additives, coatings, and adhesives. Other products manufactured at the Hercules site included raw materials used for manufacturing polyester fabrics, an agricultural herbicide, and a detergent ingredient. The site is divided into former process areas, materials handling and storage areas, support areas, and waste disposal areas. Wastewater from plant operations was managed in the lagoon system and an on-site wastewater treatment plant (WWTP). Effluent from the WWTP was discharged to the Delaware River via an outfall permitted under the New Jersey Pollutant Discharge Elimination System (NJPDES). Approximately 55 percent of the property remains undeveloped.

In May 1992, Hercules signed an Administrative Consent Order (ACO) with the New Jersey Department of Environmental Protection (NJDEP), requiring the facility to conduct all appropriate remedial investigation and feasibility study efforts, as well as any necessary remedial actions. In accordance with the ACO, several phases of investigation have been conducted at the site to date. The initial Remedial Investigation (RI) was completed in 1994, and subsequent phases of investigation (Phase II, Phase IIIA, Phase IIIB, and the Phase III Addendum) were completed in 1996 and 1997. Contamination has been found in soil and sediment at the site, largely within the uppermost foot of soil, although some pockets of deeper soil contamination also exist. In addition, three isolated areas of volatile organic compounds (VOCs) have been identified in the near-surface groundwater unit. Data obtained during the RI is being used to develop and implement remedial actions for soil, sediment, the former wastewater treatment lagoons, and groundwater beneath the site. Specific remedial actions were identified in the Remedial Action Selection Report (RASR) from 1998, and the follow-on Remedial Action Work Plan (RAWP) was conditionally approved in March 2001.

In a March 16, 1993 ACO Amendment, NJDEP indicated that completion of all requirements outlined in the 1992 ACO will also constitute satisfactory completion of applicable Industrial Site Recovery Act (ISRA) requirements. The Hercules Burlington Plant had been operating under interim status under the Resource Conservation and Recovery Act (RCRA), but all hazardous waste units (including a container storage area) have been clean closed and certified as posing no remaining environmental issues of concern.

1. Has **all** available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

   _X_ If yes - check here and continue with #2 below.

   ____ If no - re-evaluate existing data, or

   ____ If data are not available, skip to #8 and enter "IN" (more information needed) status code.

Summary of Areas of Concern (AOCs): During the phased RI effort, Hercules identified 101 AOCs at the Burlington Plant site including process areas, storage tanks, loading and unloading areas, materials storage areas, piping runs, transformers, and other various units. These areas of the site have been fully and appropriately investigated, and no further delineation is required. The 64 AOCs at which contamination was either not reported or found below applicable screening criteria have been closed with no further action. The remaining 37 AOCs have been retained for remedial action due to elevated contaminant concentrations in soil, sediment, and/or groundwater (Ref. 2). Groundwater remediation and monitoring will be required only for the four AOCs described below and shown on Attachment 1. AOC descriptions are excerpted from the RASR and consider all data currently available for shallow groundwater (Ref. 2).

AOC 6: This AOC encompasses methanol distillation equipment and four tanks (T-4950, T-4955, T-4960, and T-4961) associated with the former Methanol Recovery Unit. The unit was previously used to distill methanol for reuse, and the tanks contained methanol, glycol, and water. This AOC is located in the Liquid Resins Area at the center of the site. Samples collected in the AOC 6 area indicated only limited soil impacts above New Jersey Impact to Groundwater Soil Cleanup Criteria (NJ IGWSCC). Contaminated soil has been fully delineated and will be excavated as part of AOC remedial activities. Soil contamination does not appear to be a continuing source for groundwater contamination. Shallow groundwater in the vicinity of AOC 6 contains VOCs above applicable New Jersey Ground Water Quality Criteria (NJ GWQC). These impacts will be addressed via monitored natural attenuation and establishment of a Classification Exception Area (CEA) across the site.

AOC 50: This AOC designation applies to aboveground Tank T-7510-06, located along the southern edge of the property. This tank was previously used for chemical and petroleum storage. Between 1962 and 1968, the tank contained a solution of toluene and feedstocks for herbicide manufacturing operations. The tank was located on a concrete pad surrounded by an earthen containment dike. Toluene solution was released during a spill event in May 1968. The extent of the spill is unknown based on available file materials. After the spill in 1968, the tank was converted to fuel oil storage. The tank was removed from service and dismantled in 1992. While none of the soil samples collected at AOC 50 contained VOCs above NJ IGWSCC, shallow groundwater was found to be impacted by toluene. There does not appear to be any ongoing contaminant source in soil, and only an isolated area of groundwater has been impacted. Groundwater impacts in this location will be addressed via monitored natural attenuation and establishment of a CEA.

AOC 63: This AOC covers former underground storage tank (UST) E-1, located northwest of AOC 6 in the center of the site. The tank was used to store gasoline until its removal in 1991. The tank installation date is not provided in available file materials. It is unclear as to when the tank was

placed into service, but it is possible that the tank contained leaded gasoline before that product was phased out nationally. Soil surrounding the unit had an odor resembling weathered gasoline, suggesting at least one historical discharge had occurred in the vicinity of Tank E-1. Approximately 300 cubic yards of soil were subsequently removed as a remedial action to reduce contaminant concentrations below the most stringent NJ soil cleanup criteria. No significant ongoing source of contamination remains in soil in this area. Shallow groundwater has been impacted by gasoline-related VOCs above NJ GWQC. Lead and arsenic have also been reported above their respective NJ GWQC, but these impacts are not attributable to former operations at AOC 63 (as discussed below). Organic contamination in groundwater in this area will be addressed via monitored natural attenuation and establishment of the proposed CEA.

AOC 97: This AOC addresses elevated levels of lead and arsenic in shallow groundwater beneath the Hercules property. Both total and dissolved concentrations have exceeded applicable NJ GWQC, primarily on the western side of the site. No soil sources for lead or arsenic were identified during the RI, and nearly all reported lead and arsenic concentrations in soil were detected below the New Jersey Residential Direct Contact Soil Cleanup Criteria (NJ RDCSCC). For these reasons, elevated arsenic and lead in shallow groundwater are believed to be associated with natural background concentrations and/or historical use of the property for agricultural purposes. As such, the only further action planned for this AOC is monitoring.

References:

1. Phase II Remedial Investigation Report for the Hercules Burlington Plant (Revision 2). Prepared by Roux Associates, Inc. Dated February 29, 1996.
2. Remedial Action Selection Report. Prepared by Roux Associates, Inc. Dated November 20, 1998.
3. Remedial Action Work Plan. Prepared by Roux Associates, Inc. Dated February 11, 2000.
4. Letter from John Lucey and Neil Rivers, Roux Associates, Inc., to John Doyon, NJDEP, re: Geoprobe Sampling in AOCs 6, 50, and 63. Dated August 11, 2000.

2. Is **groundwater** known or reasonably suspected to be "**contaminated**"[1] above appropriately protective "levels" (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

   _X_ If yes - continue after identifying key contaminants, citing appropriate "levels," and referencing supporting documentation.

   ___ If no - skip to #8 and enter "YE" status code, after citing appropriate "levels," and referencing supporting documentation to demonstrate that groundwater is not "contaminated."

   ___ If unknown - skip to #8 and enter "IN" status code.

Rationale:

Local Hydrology and Groundwater Flow

Groundwater at the Hercules site occurs as a shallow water table aquifer in the Cape May Formation and as deeper aquifers in sand layers of the Raritan Formation. The water table generally occurs at a depth of 6 to 14 feet below the ground surface (bgs). Flow in the water table aquifer is toward the west, eventually discharging into the Delaware River. Based on slug tests and other RI data, hydraulic conductivity in the water table zone was estimated at approximately six feet per day. The shallow groundwater flow velocity was calculated as 0.05 feet per day (Ref. 7).

The uppermost portion of the Raritan Formation, directly beneath the Cape May Formation in the vicinity of the site, consists of a clay layer approximately 45-50 feet thick (Ref. 6). This unit acts as an aquitard, preventing direct hydraulic communication between the water table aquifer and deeper groundwater in the underlying sands of the Raritan Formation (Ref. 7). The clay layer is underlain by up to 75 feet of water-bearing coarse sand and gravel of the Raritan Formation. Groundwater movement in the Raritan Formation is influenced by pumping from high capacity supply wells in the region, but flow is generally to the south, away from the Delaware River. The aquifer receives recharge from the Delaware River regionally, but is isolated from the river immediately adjacent to the site by a confining clay layer. Bedrock of the Wissahickon Formation is encountered at approximately 120 to 170 feet bgs (Ref. 6).

A well search conducted during the Phase I RI effort indicated that no water supply wells are present in the shallow Cape May Formation, either sidegradient or downgradient of the site (Ref. 6). The Burlington County government has also indicated that shallow groundwater resources in this area will not be developed within the next 25 years (Ref. 7). Although groundwater is withdrawn from the Raritan Formation for municipal purposes within 0.75-mile of the site (Ref. 2), this aquifer shows no negative water quality impacts.

Groundwater Quality Concerns

[1] "Contamination" and "contaminated" describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate "levels" (appropriate for the protection of the groundwater resource and its beneficial uses).

During the phased RI effort, samples of both shallow and deep groundwater were collected at various locations across the Hercules site. Analytical results from these samples were compared to the NJ GWQC for Class II-A potable groundwater to identify and determine the severity of site-related impacts. Based on the resultant data, Hercules has determined that, while the deep aquifer has not been significantly impacted, shallow groundwater contains both organic and inorganic constituents of concern (COCs).

Several VOCs were reported above NJ GWQC in the shallow aquifer. Table 1 below presents a summary of organic exceedences from May 1996 (the most recent data for which source area data are available).

Table 1 - Organic Exceedences, May 1996 Sampling Event (µg/L)

AOC	Well	Constituent	NJ GWQC	May 1996 Concentration
6	MW-14	Benzene	1	11
		Toluene	1,000	9,600
		Vinyl Chloride	5	28
50	MW-10	Toluene	1,000	7,100
63	MW-8	Benzene	1	57
		Toluene	1,000	1,200
		Xylenes	1,000	1,400
	MW-13	Benzene	1	3

Source: Ref. 6, Table 2.

These organic impacts are highly localized in the vicinity of AOCs 6, 50, and 63 (Ref. 7). A limited groundwater investigation conducted in the spring of 2000 delineated the downgradient edge of contamination in each source area (Ref. 10). Seven temporary well points were installed and sampled at various distances stepping out from AOCs 6, 50, and 63. Attachment 1 shows the approximate extent of the three VOC impact areas, as determined during the supplemental investigation.

Shallow groundwater at the Hercules site has also been found to contain arsenic and lead above their NJ GWQC of 8 and 10 µg/L, respectively. Samples were collected and analyzed for these constituents as part of the Phase III investigation in May 1996 (arsenic) and October 1997 (lead). As summarized on Plate 4 of the RASR (Ref. 6), arsenic was detected in shallow groundwater up to 33 µg/L (total) and 17 µg/L (dissolved). Lead was reported up to 52 µg/L (total) and 13 µg/L (dissolved). These inorganic exceedences occur predominantly and fairly ubiquitously across the western portion of the site, as shown in Attachment 2 for total metals concentrations. The distribution of exceedences for dissolved metals closely follows that for total metals as shown.

Whereas likely VOC source areas have been easily identified and documented, establishing a source for metals impacts has been difficult. Hercules processes did not involve the use of arsenic- or lead-containing raw materials, by-products, or final products (Refs. 3, 6). No soil sources for the lead or arsenic were identified during the RI; as stated previously, nearly all of the detected arsenic and lead concentrations in soil were below NJDEP's most stringent soil cleanup criteria for unrestricted future uses. Based on these findings, elevated levels of lead and arsenic do not appear to be attributable to

Hercules operations on the property. Furthermore, in nearly all of the samples, lead was reported above NJ GWQC in unfiltered groundwater and below NJ GWQC in filtered groundwater; similar results were reported for arsenic.

Rather than being site-related impacts, these impacts are believed to be associated with natural background conditions and/or historical agricultural uses of the property. The fact that unfiltered samples contained significantly higher lead and arsenic concentrations than the filtered samples suggests that the metals are naturally occurring in sediments of the aquifer (Ref. 5). Additionally, lead- and arsenic-based pesticides were commonly used on old agricultural sites (Ref. 9). NJDEP and EPA have concurred with this conclusion (Ref. 11), and no remedial actions are required to address the two inorganic COCs (Ref. 7). Nevertheless, to detect any possible changes in concentration over time that might necessitate reevaluation of these COCs, arsenic and lead will be included in the ongoing monitoring program for this site, as discussed in the response to Question 7.

References:

1. Administrative Consent Order. Issued by NJDEP. Dated April 10, 1982.
2. Site Inspection Report for Hercules Inc. Prepared by USEPA. Dated August 29, 1989.
3. Phase II RI Report. Prepared by Roux Associates. Dated February 29, 1996.
4. Letter from John Doyon, NJDEP, to Joe Keller, Hercules, re: Hercules Phase III RI Report. Dated April 30, 1997.
5. Draft Phase III RI Report. Prepared by Roux Associates, Inc. Dated January 15, 1997.
6. Remedial Action Selection Report. Prepared by Roux Associates, Inc. Dated November 20, 1998.
7. Remedial Action Work Plan. Prepared by Roux Associates, Inc. Dated February 11, 2000.
8. Letter from John Doyon, NJDEP, to Joseph Keller, Hercules, re: Remedial Action Work Plan Response to Comments. Dated June 29, 2000.
9. Letter from Michael Gonsher and John Lucey, Roux Associates, to John Doyon, NJDEP, re: CEA Determination. Dated June 30, 2000.
10. Letter from John Lucey and Neil Rivers, Roux Associates, Inc., to John Doyon, NJDEP, re: Geoprobe Sampling in AOCs 6, 50, and 63. Dated August 11, 2000.
11. Personal communication with Elizabeth Butler, USEPA, re: Status Update on the Hercules Incorporated Burlington Plant Site. Dated October 4, 2001.

3. Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within "existing area of contaminated groundwater"[2] as defined by the monitoring locations designated at the time of this determination)?

    _X_ If yes - continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier data) and rationale why contaminated groundwater is expected to remain within the (horizontal or vertical) dimensions of the "existing area of groundwater contamination"[2].

    ___ If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the "existing area of groundwater contamination"[2]) - skip to #8 and enter "NO" status code, after providing an explanation.

    ____ If unknown - skip to #8 and enter "IN" status code.

Rationale:

Groundwater contaminant migration has been stabilized and will be appropriately monitored at the Hercules Burlington Plant. The approved approach for addressing shallow groundwater contamination at the Hercules site focuses on monitored natural attenuation and establishment of appropriate institutional controls (Ref. 4). Several considerations were taken into account while making this positive stabilization determination, including:

- The limited extent of VOC contamination in groundwater beneath the site
- Observed contaminant concentration reductions which have been attributed to natural attenuation and development of a contingency plan for addressing VOCs in groundwater in case a more aggressive remedial response becomes necessary
- The relatively low concentrations of VOCs currently reported in source area wells and modeling results which show VOC concentrations dropping below NJ GWQC before leaving the Hercules property
- Establishment of institutional controls, and an associated groundwater monitoring program, for the Hercules Burlington Plant property.

The discussions below expand on each of these considerations and the means by which each contributes to contaminant stabilization in groundwater at the Hercules property.

Limited Extent of Groundwater Impacts

As stated in the response to Question 2, VOC impact areas beneath the Hercules site have been defined and are highly localized. As shown on Attachment 1, the three impact areas are completely contained within site boundaries, and none of the site perimeter wells exhibited VOC contamination above NJ GWQC (Ref. 5). Horizontal movement of groundwater has been estimated at only 0.05 feet per day, with even the closest downgradient property boundary approximately 225 feet and more than 12 years

[2] "existing area of contaminated groundwater" is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of "contamination" that can and will be sampled/tested in the future to physically verify that all "contaminated" groundwater remains within this area, and that the further migration of "contaminated" groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

away (Ref. 1). Vertical migration of contaminants into the deeper groundwater unit is minimized by the presence of an aquitard between the two water-bearing units. Furthermore, based on a review of groundwater and surface water interaction in the vicinity of the site, as well as other hydrogeologic detail submitted with the Revised RAWP, NJDEP has determined that it is unlikely that a downward head exists that would cause dissolved contaminants to move deeper into the Raritan Formation (Ref. 7). Based on these considerations, COCs in shallow groundwater are not expected to migrate significantly beyond the existing area of contamination.

Observed Contaminant Concentration Reductions

Even though certain VOCs remain above NJ GWQC, contaminant concentrations in shallow groundwater have notably decreased since the RI began in July 1993. Table 2 below presents a comparison of VOC concentrations over time in source area wells at AOCs 50 and 63. (No wells were available for sampling at AOC 6 prior to the May 1996 sampling event.)

Table 2 - Comparison of VOC Concentration Over Time in Source Area Wells (µg/L)

AOC	Well	Constituent	NJ GWQC	July 1993 Concentration	May 1996 Concentration
50	MW-10	Toluene	1,000	26,000	7,100
63	MW-8	Benzene	1	810	57
		Toluene	1,000	4,800	1,200
		Xylenes	1,000	5,700	1,400
	MW-13	Benzene	1	200 *	3

Source: Ref. 1, Table 2.

* This concentration was measured in December 1994, shortly after well installation.

As shown in Table 2, contaminant concentrations in several wells dropped by an order of magnitude between 1993 and 1996. All VOC concentrations measured in 1996 (including those at AOC 6) were within an order of magnitude of the applicable NJ GWQC (Ref. 4). Data from AOC 63 indicate falling VOC concentrations both within the immediate source area (at MW-8) and downgradient (at MW-13).

Because the site-specific organic COCs are highly amenable to biodegradation processes, these decreases have been attributed to natural attenuation (Ref. 4). Hercules will rely on monitored natural attenuation for remediation of organics in shallow groundwater, and VOC concentrations should continue to decline. Nevertheless, a contingent remedy of enhanced in-situ bioremediation has also been developed in case a more aggressive remedial response is necessary for VOCs in shallow groundwater. This option would be implemented if ongoing monitoring indicates increasing contaminant concentrations, more rapid plume migration than anticipated, newly identified receptors of contamination above NJ GWQC, or other unexpected conditions.

Contaminant Degradation Modeling Results

As part of the groundwater remedy selection and implementation process, Hercules has developed projections for the amount of time required for COCs in groundwater to naturally degrade to concentrations at or below their respective NJ GWQC. To obtain comparable and conservative

estimates, the rates of degradation were assessed using three different methods (the method described in NJDEP's *Final Guidance on Designation of CEAs* dated November 1998, a graphical projection method, and Bioscreen modeling). All calculations incorporated the highest contaminant concentrations from May 1996, and known or estimated site-specific hydrogeological parameters. Time frames required for each volatile COC to attenuate to NJ GWQC are shown in Table 3 below.

Table 3 - Time Frames Required for Volatile COCs to Attenuate to NJ GWQC (µg/L)

COC	May 1996 Conc	NJ GWQC	Degradation Time (Years)		
			CEA Guidance Method	Graphical Projection	Bioscreen Modeling
Benzene	57	1	4.0	4.3	**4.5**
Toluene	9,600	1,000	**5.0**	NA	**5.0**
Xylene	1,400	1,000	0.7	0.5	**0.8**
Vinyl Chloride	28	5	**10.0**	NA	7.0

Source: Ref. 3, Table 2.
Longest degradation time in bold
* Projections marked with NA could not be completed due to the low number of positive detections for that constituent.

As shown in Table 3, all of the volatile COCs will be naturally degraded to or below NJ GWQC within a maximum of 10 years, considering all three estimates.

Using the CEA Guidance estimation method and Bioscreen modeling, Hercules also projected the distances contaminants will travel from the source areas before falling below NJ GWQC. This evaluation considered a number of site-specific parameters such as hydraulic conductivity, effective porosity, seepage velocity, and organic carbon partition coefficients. The estimated maximum travel distances range from less than 5 feet for xylenes to 139 feet for vinyl chloride (Ref. 3). The plume map in Attachment 1 shows that even the closest downgradient property boundary is located at a distance of 225 feet from the source area wells. Therefore, contamination in shallow groundwater is not expected to leave the Hercules property at concentrations exceeding NJ GWQC.

Institutional Controls

The approved shallow groundwater remedy for the Hercules Burlington Plant site also calls for establishment of a groundwater CEA and Well Restriction Area (WRA). These institutional controls will prohibit development of shallow groundwater resources in the immediate area, and eliminate a potential route of exposure to the site-specific COCs (i.e., benzene, toluene, xylenes, vinyl chloride, lead, and arsenic). Administrative action continues, and the restrictions have yet to be formalized. Nevertheless, complete details on the CEA and WRA were included with and approved as part of the RAWP (Ref. 8).

With regard to VOC contaminants, the CEA and WRA will remain in effect for at least 10 years -- the time frame projected for all such constituents to drop to or below NJ GWQC (Ref. 3). The CEA and WRA durations are indeterminate for lead and arsenic impacts. Although the metals impacts are not believed to be related to the site, Hercules has included these COCs as part of the CEA and WRA restrictions and monitoring program to facilitate NJDEP approval of the plan. Ongoing metals monitoring will provide additional groundwater data and should definitively confirm that such impacts are associated with background and/or historic agricultural land uses.

The restrictions will address the entire property area, rather than just the impacted areas of groundwater, to account for widespread lead and arsenic detections in groundwater across the western portion of the site. The controls will not extend off site, however, because VOC contamination above NJ GWQC is not projected to cross site boundaries. NJDEP and USEPA have agreed with Hercules' finding that lead and arsenic are not related to the site (Ref. 9), therefore, assessment of potential migration of those COCs into downgradient locations is not warranted and has not been completed.

References:

1. Remedial Action Selection Report. Prepared by Roux Associates, Inc. Dated November 20, 1998.
2. Letter from John Doyon, NJDEP, to Joseph Keller, Hercules, re: RASR Approval. Dated February 25, 1999.
3. Letter from Michael Gonshor and John Lucey, Roux Associates, to John Doyon, NJDEP, re: CEA Determination. Dated May 7, 1999. Presented as Appendix D to Reference 4.
4. Remedial Action Work Plan. Prepared by Roux Associates, Inc. Dated February 11, 2000.
5. Letter from John Doyon, NJDEP, to Joseph Keller, Hercules, re: RAWP. Dated May 2, 2000.
6. Letter from John Lucey and Neil Rivers, Roux Associates, Inc., to John Doyon, NJDEP, re: Geoprobe Sampling in AOCs 6, 50, and 63. Dated August 11, 2000.
7. Memorandum from George Nicholas, NJDEP, to John Doyon, NJDEP, re: Revised RAWP. Dated September 12, 2000.
8. Letter from John Doyon, NJDEP, to Joseph Keller, Hercules, re: RAWP Revisions and Approval. Dated March 2, 2001.
9. Personal communication with Elizabeth Butler, USEPA, re: Status Update on the Hercules Incorporated Burlington Plant Site. Dated October 4, 2001.

4. Does "contaminated" groundwater **discharge** into **surface water** bodies?

___ If yes - continue after identifying potentially affected surface water bodies.

_X_ If no - skip to #7 (and enter a "YE" status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater "contamination"does not enter surface water bodies.

____ If unknown - skip to #8 and enter "IN" status code.

Rationale:

The Delaware River is located west of the Hercules property, just across River Road from the Burlington Plant site. The river is the only surface water body in the site vicinity (Ref. 1).

Shallow groundwater flows westward and discharges into the Delaware River in the vicinity of the site. However, as shown on Attachment 1, the closest area of VOC-impacted groundwater beneath the Hercules property was located approximately 300 feet upgradient of the river in 1996. Therefore, groundwater presently discharging into the Delaware River is not contaminated. Furthermore, as discussed in the response to Question 3, it appears that VOC contamination will have dropped below all applicable NJ GWQC before reaching the site boundary, and presumably still further before reaching the Delaware River. Based on this analysis, it appears unlikely that VOC-impacted groundwater will be discharged to surface water in the future. Samples collected during the 1998 Preliminary Ecological Evaluation confirmed that the river was not impacted by site-specific VOC contaminants, and NJDEP concurred with a No Further Action determination for this medium (Ref. 4).

An analysis of lead and arsenic discharges to the Delaware River has not been completed and is not warranted, as the presence of these constituents is not attributed to former Hercules operations.

References:

1. Site Inspection Report for Hercules Inc. Prepared by USEPA. Dated August 29, 1989.
2. Phase II RI Report. Prepared by Roux Associates. Dated February 29, 1996.
3. Preliminary Ecological Evaluation Report Addendum. Prepared by Roux Associates. Dated March 27, 1998.
4. Letter from John Doyon, NJDEP, to Joseph Keller, Hercules, re: PEE Addendum. Dated July 20, 1998.

5. Is the **discharge** of "contaminated" groundwater into surface water likely to be **"insignificant"** (i.e., the maximum concentration[3] of each contaminant discharging into surface water is less than 10 times their appropriate groundwater "level," and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or ecosystems at these concentrations)?

____ If yes - skip to #7 (and enter "YE" status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration[3] of key contaminants discharged above their groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgement/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or ecosystem.

____ If no - (the discharge of "contaminated" groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration[3] of each contaminant discharged above its groundwater "level," the value of the appropriate "level(s)," and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations[3] greater than 100 times their appropriate groundwater "levels," the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.

____ If unknown - enter "IN" status code in #8.

Rationale:

Question not applicable. See response to Question #4.

[3] As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

6. Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or ecosystems that should not be allowed to continue until a final remedy decision can be made and implemented[4])?

____ If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and ecosystems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment[5], appropriate to the potential for impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialist, including an ecologist) adequately protective of receiving surface water, sediments, and ecosystems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.

____ If no - (the discharge of "contaminated" groundwater cannot be shown to be "**currently acceptable**") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or ecosystem.

____ If unknown - skip to 8 and enter "IN" status code.

Rationale:

Question not applicable. See response to Question #4.

[4] Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies.

[5] The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the surface waters, sediments or eco-systems.

7. Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

__X__ If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."

____ If no - enter "NO" status code in #8.

____ If unknown - enter "IN" status code in #8.

Rationale:

To ensure that COC concentrations continue to decline as expected, and to detect any changes in hydrogeological conditions, Hercules will implement a monitoring program for shallow groundwater at the Burlington Plant site.

Based on data obtained during the temporary well investigation in Spring 2000, Hercules has established a monitoring well network on site which meets the Technical Requirements for Site Remediation (N.J.A.C. 7:26E) via monitored natural attenuation. Permanent plume fringe monitoring wells were installed at the downgradient edge of the three VOC impact areas. Sentinel well monitoring locations were also established based on the temporary well results and available slug test data. The selected plume fringe and sentinel wells for each AOC are noted in Table 4 below. The location of each is shown on Attachment 1.

Table 4 - Plume Fringe Wells and Sentinel Wells

AOC	Plume Fringe Well	Sentinel Well
6	MW-15	MW-16
50	MW-12	MW-17
63	MW-13	MW-18

The sentinel wells were installed at a maximum distance of 91 feet downgradient of the plume fringes, corresponding to approximately five years of travel time under current site conditions (Ref. 3). The sentinel wells are also located at least 55 feet upgradient of the Delaware River, roughly three years of travel time, to ensure adequate protection of surface water. The well network was approved by NJDEP in May 2001 (Ref. 6).

The long-term monitoring program planned for the Hercules site was outlined in the approved RAWP from February 2000 (Ref. 2). The program involves the collection of shallow groundwater samples from select background, source area, and downgradient wells over a period of eight quarters. In addition to the plume fringe and sentinel wells identified above, samples will also be collected from wells MW-2, MW-7,

MW-8, MW-10, MW-11, and MW-14. Samples will be analyzed for VOCs, arsenic, lead, and additional parameters (such as dissolved oxygen, ferrous and ferric iron, sulfate and sulfite, nitrate and nitrite, and chloride) which would indicate whether or not geochemical conditions remain favorable for natural attenuation (Ref. 2).

The groundwater monitoring program was approved as part of the RAWP, and was scheduled to begin in the second quarter of 2001 (Ref. 4). Nevertheless, the focus of remedial activity has shifted toward soil concerns, and the groundwater remedy has yet to be implemented by Hercules (Ref. 7). The revised date for initiation of quarterly groundwater monitoring has yet to be determined.

References:

1. Remedial Action Selection Report. Prepared by Roux Associates, Inc. Dated November 20, 1998.
2. Remedial Action Work Plan. Prepared by Roux Associates, Inc. Dated February 11, 2000.
3. Letter from John Lucey and Neil Rivers, Roux Associates, Inc., to John Doyon, NJDEP, re: Geoprobe Sampling in AOCs 6, 50, and 63. Dated August 11, 2000.
4. Revised Remedial Action Work Plan. Prepared by Roux Associates, Inc. Dated November 29,2000.
5. Letter from John Doyon, NJDEP, to Joseph Keller, Hercules, re: RAWP Revisions and Approval. Dated March 2, 2001.
6. Letter from John Doyon, NJDEP, to Joseph Keller, Hercules, re: Geoprobe Sampling in AOCs 6, 50, and 63. Dated May 29, 2001.
7. Personal communication with Elizabeth Butler, USEPA, re: Status Update on the Hercules Incorporated Burlington Plant Site. Dated October 4, 2001.

8. Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

_X_ YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the Hercules Incorporated Burlington Plant site, EPA ID #NJD011136884, located on Neck Road, Burlington Township, New Jersey. Specifically, this determination indicates that the migration of "contaminated" groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the "existing area of contaminated groundwater." This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

____ NO - Unacceptable migration of contaminated groundwater is observed or expected.

____ IN - More information is needed to make a determination.

Completed by: _____ Date:_____
Michele Benchouk
Engineering Consultant
Booz Allen Hamilton

Reviewed by: _____ Date:_____
Pat Shanley
Geologist
Booz Allen Hamilton

Also reviewed by: _____ Date:_____
Elizabeth Butler, RPM
RCRA Programs Branch
USEPA Region 2

_____ Date:_____
Barry Tornick, Section Chief
RCRA Programs Branch
USEPA Region 2

Approved by: Original signed by: _____ Date: January 18, 2002
Raymond Basso, Chief
RCRA Programs Branch
USEPA Region 2

Locations where references may be found:

References reviewed to prepare this EI determination are identified after each response. Reference materials are available at the USEPA Region 2, RCRA Records Center, located at 290 Broadway, 15th Floor, New York, New York, and the New Jersey Department of Environmental Protection Office located at 401 East State Street, Records Center, 6th Floor, Trenton, New Jersey.

Contact telephone and e-mail numbers: Elizabeth Butler, USEPA RPM
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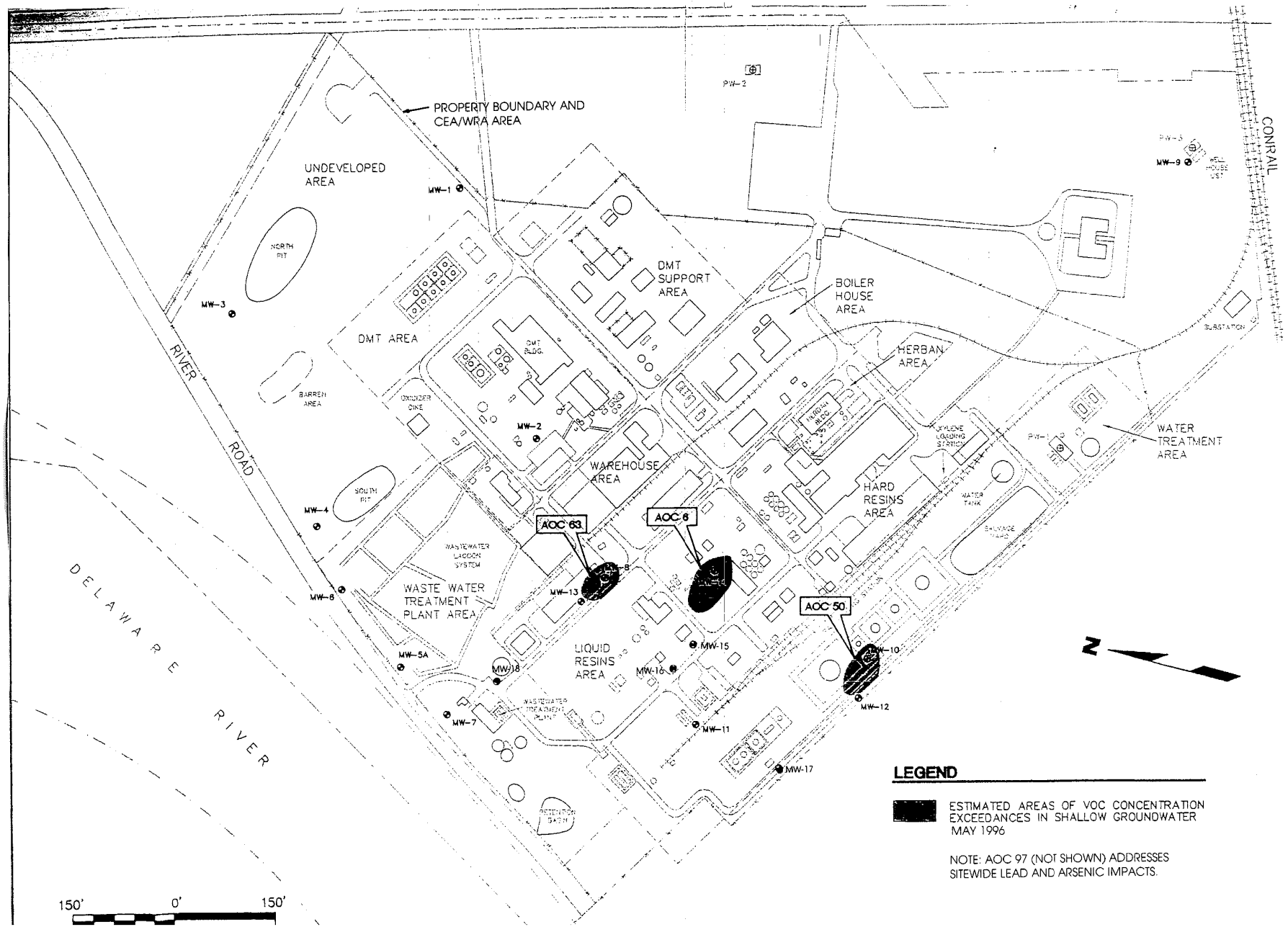
Attachments

The following attachments have been provided to support this EI determination.

- Attachment 1 - Groundwater AOC and Well Location Map
- Attachment 2 - Shallow Wells Exceeding NJ GWQC for Arsenic and/or Lead
- Attachment 3 - Summary of Media Impacts Table

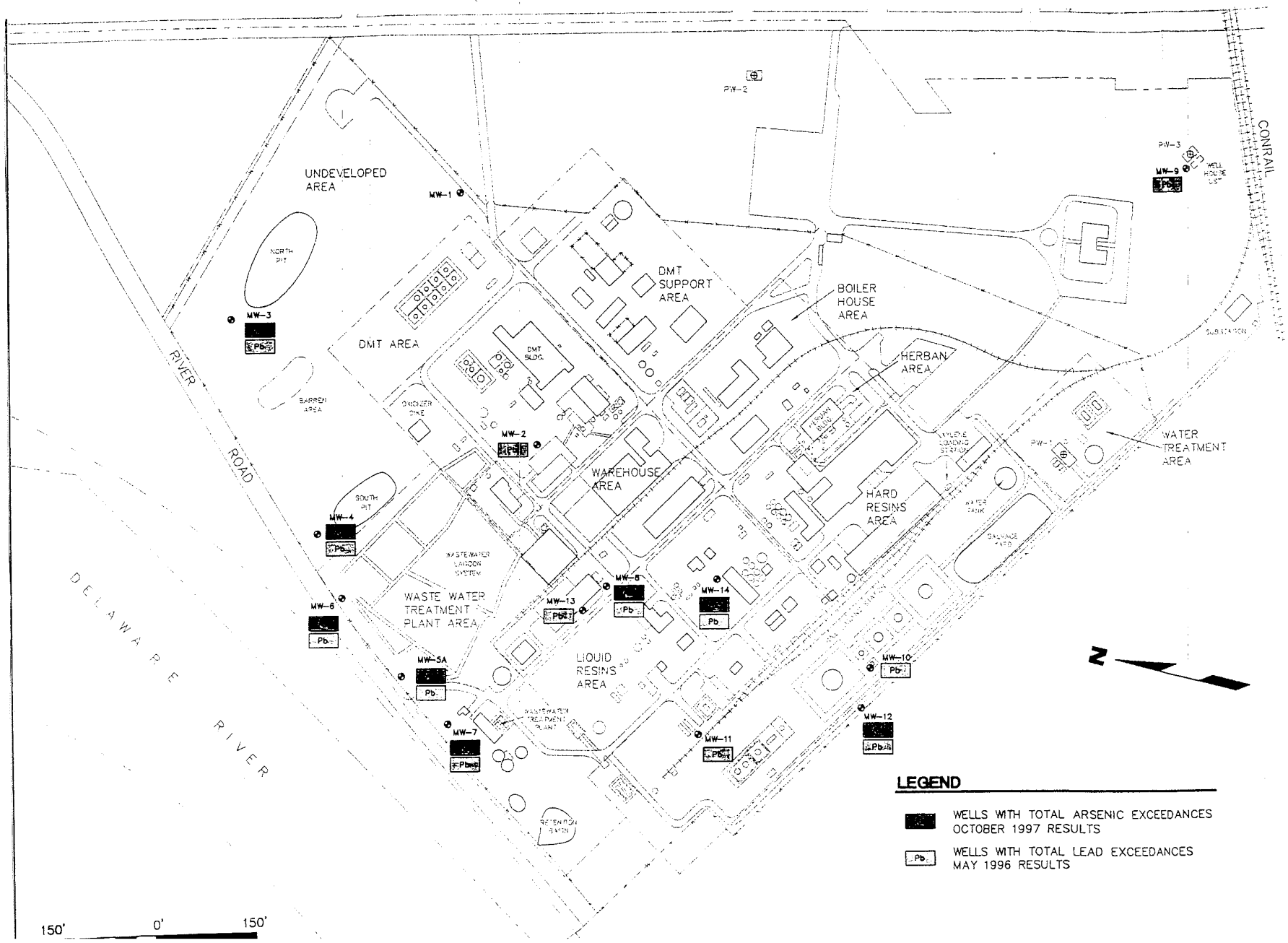
Attachment 1 -Groundwater AOC and Well Location Map

(Source: RASR, November 20, 1998. Plate 4.)



Attachment 2 - Shallow Wells Exceeding NJ GWQC for Total Arsenic and/or Lead

(Source: RASR, November 20, 1998. Plate 4.)



Attachment 3 - Summary of Media Impacts Table

Hercules Incorporated Burlington Plant Site

	GW	AIR (Indoors)	SURF SOIL	SURF WATER	SED	SUB SURF SOIL	AIR (Outdoors)	CORRECTIVE ACTION MEASURE	KEY CONTAMINANTS
Shallow Groundwater	Yes	NA	NA	NA	NA	NA	NA	▸ Implementation of monitored natural attenuation program to address VOC impacts to shallow groundwater at AOCs 6, 50, and 63; ongoing degradation, but no new monitoring completed to date ▸ Determination that lead and arsenic in shallow groundwater are attributed to natural background conditions and/or former use of the land for agricultural purposes; requires no active remediation by Hercules ▸ Ongoing shallow groundwater monitoring program approved for eight quarters of sampling; not yet implemented ▸ Groundwater CEA and WRA proposed for the entire site; not yet implemented	▸ Benzene ▸ Toluene ▸ Vinyl Chloride ▸ Xylenes ▸ Arsenic ▸ Lead