EPA/ROD/R05-94/254
1994

EPA Superfund
Record of Decision:

VAN DALE JUNKYARD
EPA ID: OHD980794606
OU 01
MARIETTA, OH
03/31/1994

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DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Van Dale Junkyard Site (also known as Vandale Junkyard Site)
Washington County, Ohio

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Vandale Junkyard site, in Washington County, Ohio. The Vandale Junkyard site is on the National Priorities List. This decision has been developed, and the remedy selected, in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, with the National Oil and Hazardous Substances Contingency Plan (NCP). This decision selecting a remedial action for the site is based on the Administrative Record for the site. The Administrative Record Index identifies items that comprise the Administrative Record, and is attached to this Record of Decision (ROD).

The State of Ohio concurs with the selected remedy. The letter of concurrence is attached to this ROD.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy at the Vandale Junkyard site will be a final site-wide remedy. The selected remedial action for the site addresses the principle threats posed by the site through treatment and containment of source materials. The major components of the selected remedial action include:

* Collection of materials estimated at 9,000 cubic yards of soils and 8,900 cubic yards of solid wastes (including drummed wastes) containing organic and inorganic contaminants.

* Segregation of solid wastes, including drummed wastes, from soils.

* Off-site disposal of drummed materials, sludges, and other wastes which contain substances, especially hazardous wastes, not suitable for on-site containment.

* Screening of solid waste materials for salvageable materials. Salvageable materials will be decontaminated on-site and taken off-site for salvage.

* Consolidation of soils and remaining solid wastes in designated areas on-site which contain contaminated soils, followed by construction of a RCRA Subtitle C hazardous waste cap.

* Bioremediation of organic contaminants in seep sediments.

* Institutional controls necessary to ensure the integrity of the remedial action. Site deed restrictions and fencing will be used to restrict site access as necessary to prevent the installation of drinking water wells and the disturbance of capped areas while cleanup levels are being achieved.

* Ground water and surface water/sediments monitoring program to confirm that the removal, treatment, and containment of source materials and the natural attenuation of residual contaminants results in the expeditious attainment of cleanup levels.

USE OF NATURAL ATTENUATION FOR GROUND WATER RESTORATION IN LIEU OF TREATMENT

U.S. Environmental Protection Agency (U.S. EPA) has determined that use of natural attenuation for ground water restoration will result in expeditious attainment of cleanup levels and that risks associated with the contaminated ground water will be minimized in the interim. Based upon monitoring data and geological information, U.S. EPA believes that cancer risks and other hazards to human health associated with contacting the ground water can be minimized by monitoring the ground water and restricting its use until the levels of contaminants in the water are below drinking water standards, background levels, and/or other health-based standards. U.S. EPA has determined that ground water at the Vandale Junkyard site does not pose a threat to off-site residential drinking water supplies and that restricting ground water use will prevent any contact with this water.

Natural attenuation is a viable remedy for contamination found in the ground water at the Vandale Junkyard site based on the specific hydrogeological conditions at the site. Ground water distribution and availability under the site varies greatly due to the presence of fractured bedrock. As a result, U.S. EPA believes that known ground water remediation technologies will not significantly expedite attainment of ground water cleanup levels over that anticipated to be attained through natural attenuation.

Contaminated soils and solid wastes which U.S. EPA believes are causing the ground water contamination will be removed and either treated and disposed off-site or contained on-site. Ground water contaminant levels will be closely monitored to ensure that there is progress toward, and expeditious attainment of, ground water cleanup levels. In the event that

progress toward or attainment of expeditious cleanup does not occur through natural attenuation, U.S. EPA has specified contingency measures to be considered in this ROD. These contingency measures include consideration of additional source removal, active remediation of the ground water, and engineering controls.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable and satisfies the statutory preference for remedies which employ treatment that reduces toxicity, mobility, or volume as a principal element. The majority of principal threat wastes identified at the site will be contained on-site in compliance with all ARARs. Principal threat wastes which are unsuitable for on-site containment will be treated and/or disposed off-site in compliance with all ARARs.

Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five (5) years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

3-31-94
Date

Michelle D Jordan
for Valdas V. Adamkus
Regional Administrator
U.S. EPA Region 5

DECISION SUMMARY
VANDALE JUNKYARD SITE
WASHINGTON COUNTY, OHIO

DECISION SUMMARY
VANDALE JUNKYARD SITE
WASHINGTON COUNTY, OHIO

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DECISION SUMMARY
VANDALE JUNKYARD SITE

I. SITE LOCATION AND DESCRIPTION

The Vandale Junkyard Site ("the site") is located in a rural area approximately 1.5 miles northeast of Marietta, Ohio on an unpaved access road off Marietta Township Road 83 in Washington County (see Figure 1). Marietta, which is situated along the Ohio River, has a population of approximately 16,000. Located in the rolling hills of the Appalachian Plateau Province in southeastern Ohio, the site occupies part of a natural ridge which runs east to west. Duck Creek, a small tributary to the Ohio River, is located less than one quarter of a mile to the west of the site. Surface water drainage from the site flows through two intermittent streams to Duck Creek.

The site encompasses 31 acres, approximately 10 acres of which occupies the top of the ridge and has been utilized as a junkyard (see Figure 2). The ridge is bordered on the north and east by steep, wooded ravines with depths approaching 200 feet in places. The remainder of the site consists of portions of the steeply sloped ravines. The Marietta Sanitation Corporation Landfill, a closed landfill, borders the site on the south. The active areas of the site are largely unvegetated and contain several barns and an occupied residential trailer, as well as a large quantity of junkyard materials. The wooded, sloped areas of the site contain variable quantities of discarded junkyard materials, debris, and the remnants of drums from industrial waste disposed at the site. A number of farm animals are currently raised on-site, including cows, pigs, chickens, and other fowl.

Agriculture and residential dwellings are the primary land uses in the area. Approximately 210 residences are located within a one-mile radius of the site, including four residences along the access road to the site and one residence on-site. The nearest residence along the access road is approximately 200 feet from the site boundary. Although a public water supply system is available in the area surrounding the site, 27 residences within a one-mile radius of the site are believed to utilize private residential wells as a drinking water source, including several in the vicinity of the site. There is no known usage of site ground water at present.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Vandale Junkyard has been a county licensed junkyard operation since the early 1960s, and may have been operated since some time in the 1940s. During its operation, it is known to have received a variety of materials for disposal and/or salvage, including general wastes such as scrap metal, appliances, furniture, automobiles, tires, and batteries. In addition, disposal records from various industrial facilities indicate that for a period during the late

1970s several thousand drums of industrial wastes were accepted at the site.

These drums contained such materials as waste industrial solvents, tar and iron cakes, sludges, paints, and inks. Although no records confirm the disposal of industrial wastes during other timeframes, there are indications that this may have occurred. Since drums were accepted for salvage, the contents were either emptied on to the ground or burned on the active parts of the junkyard. At some point a number of drums were also bulldozed over the north slope of the site and it is suspected that at least some of these drums were not emptied prior to this disposal.

Although investigations of hazardous substance disposal at the site began in 1980, when Ohio Environmental Protection Agency (Ohio EPA) personnel first visited the site, the site has a history of complaints to local authorities from nearby residents dating back to at least 1969. Most of the complaints appear to have been related to open-burning and accepting wastes which created nuisances, such as odors and rodents. Based on observations of drummed waste at the site in 1980, preliminary assessments of contamination at the site were conducted by the U.S. Environmental Protection Agency (U.S. EPA) and Ohio EPA (jointly referred to as the "Agencies") during the period 1980 to 1983, under the authority of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Although the Agencies continued to find drums during these visits, no records documenting the disposal of drummed waste after 1980 have been found.

The state of Ohio filed suit against the owner/operator of the facility in 1984, and a settlement was reached which assured access to the site for investigations and prohibited any further collection of solid or hazardous waste, as well as filling, grading, excavation, or burning activities. The owner/operator was allowed to continue junkyard operations permitted by Washington County, and the site remains a licensed junkyard. Since this time, concern from nearby residents has greatly decreased.

Based on the assessments of the release of hazardous substances at the site, the site was proposed for inclusion on U.S. EPA's National Priorities List (NPL) for Superfund sites in 1982, and was finalized on the NPL in June 1986. On July 7, 1987, U.S. EPA and Ohio EPA entered into an agreement, known as an Administrative Order on Consent, with five parties which were believed to have contributed wastes to the site (Potentially Responsible Parties or PRPs): American Cyanamid Company, BF Goodrich Company, Kardex Systems, Inc., UNISYS Corporation, and Washington County Disposal Company.

The agreement with the PRP group allowed them to conduct the investigation of ground water, soil, surface water, and sediment contamination which resulted from the release of hazardous substances at the site. This investigation was to be conducted in two stages, the Remedial Investigation (RI) and the Feasibility Study (FS). The purpose of the RI was to determine the nature and extent of on-site and off-site contamination with hazardous substances and estimate the risks posed by the site to human health and the environment. The purpose of the FS was to examine comprehensive cleanup options, called remedial

alternatives.

Phase I of the RI study was conducted by the PRP group under the oversight of the Agencies. Phase I activities began in September 1988 and included ground water monitoring well construction and sampling, soil sampling, surface water sampling, and sediment sampling.

The Agencies terminated the authority of the PRP group to conduct the RI/FS in August 1990, after a dispute about the work conducted by the group. U.S. EPA assumed responsibility for completion of the RI and the FS, with the cooperation of Ohio EPA. Phase II of the RI began in November 1990 and included additional monitoring well installation and sampling, as well as additional soil, surface water, and sediment sampling.

III. HIGHLIGHTS OF COMMUNITY RELATIONS ACTIVITIES

A public availability session was held in Marietta on October 6, 1988 to explain the Superfund process and the remedial investigation work which began in September 1988. An information repository was established at that time at the Washington County Public Library in Marietta.

The Final RI Report, which included the Baseline Risk Assessment, was released to the public in February 1992. A Fact Sheet summarizing the findings of the RI was distributed in June 1992 to approximately 100 members of the public who were on the site mailing list.

The Final FS Report and Proposed Plan were made available to the public in August 1992. A Fact Sheet summarizing the FS and Proposed Plan was distributed to members of the public on the site mailing list in August 1992.

In order to encourage public participation in the remedy selection process consistent with Section 117 of CERCLA, these documents and the remainder of the Administrative Record file for the site were made available for review by the public at the Washington County Public Library and the County Courthouse Commissioner's Office in Marietta, and at U.S. EPA Region 5 offices in Chicago, during the public comment period which extended from August 27, 1992 through November 13, 1992.

An announcement regarding the public comment period and the availability of the Administrative Record file was published in the Marietta Times newspaper on August 26, 1992. Following a written request from the public, a notice extending the public comment period until October 29, 1992 was published in the Marietta Times newspaper on September 9, 1992. After a second written request from the public, a notice extending the public comment period a final time through November 13, 1992 was published in the Marietta Times on October 29, 1992.

A public meeting was held in Marietta on September 10, 1992. At this meeting, attended by approximately thirty members of the public, representatives from U.S. EPA and Ohio EPA summarized the findings of the RI/FS, explained the Proposed Plan and remedy selection process, answered questions from the public, and accepted statements from members of the public. Comments, including formal statements from six community members, were recorded by a court reporter and a transcript of the meeting is included in the Administrative Record.

A total of 13 written submittals were received from the public during the public comment period. A corrected version of one submittal, containing four pages which were inadvertently excluded, was received several weeks after the close of the comment period.

U.S. EPA's responses to comments received during the public comment period are contained in the Responsiveness Summary, which is part of this Record of Decision and may be found in Appendix A. As explained in the Responsiveness Summary, several of the written submittals from PRPs were lengthy and very detailed. Since these submittals typically did not contain itemized individual comments or questions, U.S. EPA summarized the significant comments, criticisms, and new information presented in these documents and responded to them as completely as possible.

This decision document presents the selected remedial action for the Vandale Junkyard Site, in Washington County, Ohio, chosen in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Contingency Plan (NCP). The decision for this site is based on the Administrative Record. The Administrative Record includes all items and documents such as work plans, data analyses, public comments, transcripts, and other relevant information provided by Section 113 of CERCLA. The Administrative Record Index is attached to this document as Appendix B. The provisions for public participation in remedy selection in Section 113(k)(2)(B)(i-v) and Section 117 of CERCLA have been satisfied.

IV. SCOPE AND ROLE OF RESPONSE ACTION

The response action at the Vandale Junkyard site will be a final site-wide remedial action to address contamination and potential contamination caused by waste disposed at the site. The remedial action will address the principal threats at the facility: contaminated soils and sediments, drummed wastes, and other solid wastes through excavation and treatment and/or containment to meet all Applicable or Relevant and Appropriate Requirements (ARARs). These contaminated materials have been identified in the RI as the primary risk to ground water, surface water, and surface water sediments. Consequently, actions to treat and/or contain contaminated soils and wastes and sediments, will, in addition to minimizing concerns associated with direct contact, minimize the potential for contaminants to infiltrate to the ground water or leach to the surface waters. Residual ground water and surface

water/ sediments contamination will be addressed through natural attenuation so that cleanup levels are achieved. If ground water and surface water/sediments cleanup levels are not expeditiously achieved through natural attenuation, then additional measures will be required.

When the remedial action is completed, no further remedial action at the site other than ground water and surface water monitoring and O&M activities are envisioned. The monitoring will be conducted to assure that the sources of ground water and surface water contamination have been sufficiently reduced and that residual ground water contamination is expeditiously eliminated through natural attenuation, so that clean up levels can be achieved. Since hazardous substances will remain above health based levels in the capped area of the site, five-year reviews of the remedial action will be necessary.

V. SUMMARY OF SITE CHARACTERISTICS

Field work for the remedial investigation was conducted in two phases. Phase I work began in September 1988, and Phase II work began in November 1990. The RI consisted of the installation of monitoring wells, sampling of monitoring and residential wells in the vicinity of the site, soils, surface waters, and surface water sediments. In addition, geophysical investigations were conducted in an effort to locate possible buried wastes.

The RI report details the findings of site investigations, characterizing the site resources and the nature and extent of hazardous substances (or contaminants) at the site. The Baseline Risk Assessment included in the RI used the findings of the site investigation to assess the current and possible future risks to public health, welfare, and the environment posed by site contaminants. The objective of the RI was not to remove all uncertainty regarding risks posed by the site, but rather to gather information sufficient to support an informed risk management decision regarding which remedy is the most appropriate.

Physical Site Characteristics

Before the start of junkyard activities, the topography of the site is believed to have been dominated by a narrow ridge running east to west along the present crest. Large areas of the site have been modified, however, and the hillside to the north of the access road has been flattened and widened to accommodate accumulated junkyard materials. Additionally, the hillside to the south of the site has been modified by operations at the Marietta Sanitation Corporation Landfill, which included the burying and layering of refuse and soil.

The soils overlying the site are composed primarily of clay and silt with lesser amounts of sand and organic matter. The dominant soils have a thin silty clay layer over a thick subsoil that contains shale mixed with clay and silt. The depth of unconsolidated materials (to bedrock) varies from none on the steeply sloped areas where bedrock is exposed, to approximately 20 feet. On the ridge top in the active area of the site, average soil depth is approximately ten feet. The soils in the active areas of the site are highly disturbed as a

result of modifications made to accommodate junkyard activities. Soils on the sloped areas are highly susceptible to slippage and a number of areas have large landslides.

Bedrock in the region is composed primarily of alternating beds of calcareous red claystones, siltstones, sandstones, and shales, with some thin beds of coal and limestone. Rock cores taken during well installation at the site typically found alternating beds of light gray siltstone to fine sandstone and reddish-brown to maroon claystone. These cores demonstrated that the bedrock is highly fractured, and led to the conclusion that the occurrence and migration of ground water is controlled primarily by the presence and orientation of these fractures.

Because the fractures do not occur uniformly throughout the stratigraphic section of rocks at and near the site, water likely occurs at various depths and in various quantities in nearly all strata but is found most commonly in the siltstone layers, which are separated by less permeable claystone layers. Lateral movement of ground water occurs along bedding planes and horizontal breaks, and vertical movement occurs through the fractures. Bedrock outcrops can be found along the north and east slopes of the site.

Sixteen monitoring wells were installed on and near the site during the RI. The total depth of these wells varies from 29 to 157 feet. Multiple water bearing zones were encountered at varying elevations during the installation of most of the wells. A readily defined water-bearing zone occupying a narrow range within the bedrock was identified in a number of on-site wells, but the presence of water bearing zones above and below this zone was highly variable. It appears that migration is primarily through interconnected fractures, and ground water movement in the upper bedrock is controlled primarily by topography with radial movement away from the crest of the site primarily towards the north, northwest, and northeast, discharging along the valley walls.

Figure 3 demonstrates the ground water flow directions in the readily defined water bearing zone. Area ground water flow is towards the southwest. There is no evidence of a defined water-bearing unit in the deeper water-bearing zones. The ground water yield from all wells installed during the investigation was typically very low. Individual water-bearing zones intercepted during the investigation were judged not sufficient to sustain a residential water supply well. However, residential wells in use near the site are known to penetrate a number of water-bearing zones, thereby providing sufficient water.

Surface water drainage from the site occurs through two intermittent tributaries to Duck Creek (see Figure 2). Duck Creek, which is a small tributary of the Ohio River, is approximately one-quarter of a mile to the west of the site. Tributary A, which is located at the bottom of the ravine on the northern part of the site, is relatively undisturbed and receives most of the runoff from the site. Tributary B, which drains the southerly portions of the site and part of the Marietta Sanitation Corporation Landfill, is highly modified from landfilling operations.

Approximately half-way between the edge of the north and northeast slopes and Tributary A

there is a “bench” where water draining from above accumulates and forms a series of small wetland areas designated as “seeps” (see Figure 4). These areas were designated as seeps because they may receive a portion of their water from ground water seepage, but most of the water is believed to be contributed by surface water runoff. Seeps A, B, C, and D and the “Marsh” are all areas along this bench where sufficient water accumulated to support sampling activities. All wetlands along the bench are estimated to comprise less than one acre in total area.

Nature and Extent of Contamination

The RI was designed to determine the nature and extent of contamination at the site through a sampling program for soils, ground water, surface waters, and sediments. The findings of the RI demonstrate the existence of widespread contamination in site soils, ground water, surface waters, and sediments with organic and inorganic substances. The organic contaminants are believed to be primarily associated with the industrial wastes disposed at the site, while the inorganic contaminants (metals) may be related to both the disposal of industrial wastes and the storage and salvage of junkyard materials on-site.

Records of wastes disposed at the site are incomplete, since the owner/operator was not able to supply detailed records. Information provided by industries which are believed to have contributed waste to the site indicates that a minimum of 2200 drums of industrial wastes were brought to the site. The limited information available on the types of contaminants which may have been contained in the wastes includes the following:

Volatile Organic Compounds (VOCs):	n-butanol
	2-butanone
	diethylene glycol monoethyl ether
	4-methyl-2-pentanone
	“mineral spirits”
	“naptha”
	“paint thinner”
	toluene
	trichloroethene
	1,1,1-trichloroethane
	“waste solvent”
	xylenes
Other Organic Compounds:	bis(2-ethylhexyl)phthalate
	other phthalates
	“organic ketones”
	“organic tars”
	“dyes”
	rubber

Inorganic Compounds:	chromium cyanide iron lead

It is very likely that other contaminants were contributed to the site from industrial wastes. In addition to the contaminants contributed by industrial waste disposal at the site, a number of inorganic and organic contaminants typically associated with the operation of a junkyard can reasonably be expected to have contributed to site contamination. These could include:

VOCs:	(from gasoline)	benzene ethylbenzene toluene xylene
	(from degreasing)	solvents
Other Organic Compounds:	(from cars)	greases oils plastics rubber
Inorganic Compounds:	(from cars and scrap metals)	chromium copper iron lead nickel zinc

Many of these contaminants are known to have toxic effects, both carcinogenic and noncarcinogenic, and the metals and VOCs are highly mobile.

For discussion purposes, Figure 2 indicates five potential contaminant source areas, designated as Areas 1 through 5 during the RI. Knowledge of past disposal activities at the site and the results of previous investigations were used to delineate these areas. The southern edge of Area 3 and all of Area 4 are believed to extend beyond the Vandale Junkyard property lines. It is important to note that the site is bordered directly on the south by the Marietta Sanitation Corporation Landfill, and that landfill material is believed to extend very close to the road which separates the sites in the vicinity of Area 3. Although the Vandale Junkyard site includes all areas where waste has come to be located, the presence of the landfill (which was closed in 1985) does complicate this determination. The Area of Contamination was defined by the site property boundary indicated on all figures. Samples collected beyond this boundary were intended to investigate the off-site transfer of

contaminants via surface or ground waters. Area 4 is the only exception to this, and waste disposal was not confirmed in this area (see below). As a distinct parcel of property with its own state-authorized waste disposal operations, the landfill was not treated as part of the site.

* Area 1 encompasses the area along the northern slope of the hillside. Drums containing various materials were apparently bulldozed into this area along with other debris.

* Area 2 includes the "burn" area, where drummed wastes were reported to have been burned or poured on to the ground, and a large pile of used appliances and other metal stored for salvage.

* Area 3 includes a recently revegetated area where junk automobiles were previously stored. This area may also have been used for storage and disposal of drummed wastes.

* Area 4 includes an area adjacent to the site and behind a nearby residence, where it was alleged that drummed wastes may have previously been disposed.

* Area 5 includes the northeast slope of the site where a large pile of discarded materials extends downslope from the active areas of the junkyard. These materials include cars, tires, scattered drums, glass, plastic sheeting, furniture upholstery, and a variety of other items.

A summary of the findings of the remedial investigation for each medium (soils, ground water, surface water, and sediments) follows. Please refer to the RI Report for details.

Soils

Soils at and adjacent to the site were sampled at various depths and found to contain a wide range of contaminants. Sampling locations were selected based on what is known about disposal practices at the site and on observations of drum fragments and other indicators. Table 1 indicates the major organic contaminants found and the range in concentrations. Table 2 provides information on inorganic contaminants and comparisons to site-specific and published background levels.

Area 1 (see Figure 2) soils contain the highest concentrations of VOCs and semivolatile organic compounds (SVOCs) detected at the site. Chlorinated VOCs, including tetrachloroethene and trichloroethene, and unchlorinated VOCs typically associated with gasoline, including benzene, ethylbenzene, toluene, and xylenes (or BTEX compounds) were found at relatively high levels. Phthalates were the SVOCs found at very high levels. A number of metals were also found to exceed background levels.

Area 2 generally contains the highest concentrations of metals, and the second highest levels

of VOCs. This area also contains elevated levels of polycyclic aromatic hydrocarbons (PAHs), a group of SVOCs. In addition, since this area was where chlorinated VOCs were suspected to have been burned, the soils were sampled for dioxins and furans. These potential combustion products of chlorinated VOCs were found at low levels in all samples. Area 3 contains the highest levels of PAHs, significantly elevated levels of metals, and the only detections of pesticides on site. Area 4, which is adjacent to the site boundary, contains low levels of VOCs and slightly elevated levels of metals. Significant indications of site-related contamination were not found, leading U.S. EPA to conclude that direct disposal of waste from the site did not occur in this area. Area 5 contains elevated levels of both SVOCs and metals.

Figures 5 through 8 provide detailed information on soil sampling results. It is clear that soil contamination is highly variable and widespread (both vertically and horizontally) over the portions of the site affected by site operations. Significant soil contamination related to site activities was not confirmed off-site.

Ground Water

Ground water was sampled at a number of wells on and near the site. A total of 13 wells were installed and sampled and 4 nearby residential wells were also sampled. Four shallow wells (S-3, S-4, S-5, and S-6) and one deep well (D-3) were installed on-site. The remaining wells are adjacent to the site. Figures 9 and 10 provide detailed results of ground water sampling. Table 3 presents highlights of the results of this sampling. The highest levels of organic contaminants were found in ground water in Areas 1 and 2 on-site, where soil contamination is also highest. As indicated in Table 4, the three wells in these areas, S-4, S-5, and S-6, all had multiple contaminants in excess of U.S. EPA's Maximum Contaminant Levels (MCLs) for drinking water.

Table 4 also indicates that nearly all wells had MCL exceedances for inorganics, but the on-site wells generally had the greater number. The off-site wells which are directly adjacent to the southern edge of the site may be influenced by both the Marietta Sanitation Corporation Landfill and the site. However, sampling results from wells located on the south and west perimeters of the Marietta Sanitation Corporation Landfill do not indicate that the site is influencing off-site ground water at present. In addition, ground water was not typically encountered in off-site wells in the zones which were found to contain ground water on-site.

Ground water sampling results indicate that contamination is widespread and highly variable, reflecting the distribution of contaminants over the surface of the site, and extending both slightly east (beneath a residential property) and south of the site property line (beneath the Marietta Sanitation Corporation Landfill property).

Surface Water

Surface waters and seeps which drain the site were sampled in a number of areas upstream

and downstream of site influence. Organic contaminants were detected in only one stream sample which drains Area 3 and at low levels in all seeps. No Ohio Water Quality Standards (WQS) or U.S. EPA Ambient Water Quality Criteria (AWQC) were exceeded for organic contaminants. Inorganic contaminants were found to exceed WQS and AWQC at a number of locations, and this information is summarized in Table 5.

The exceedances in Tributary A and the seeps are believed to be directly attributable to surface water runoff and ground water transport of contaminants at the site. It does appear that the influence of the site on Duck Creek via Tributary A is limited, at least at the flow conditions monitored during the RI. No correlations were found between contaminants in Tributary A and those in Duck Creek downstream of their confluence. The exceedances in Tributary B, which tended to be highest, are believed to primarily reflect the effects of leachate from the Marietta Sanitation Corporation Landfill. Leachate seeps from the landfill have been observed discharging directly into Tributary B and this stream is believed to receive the majority of its base flow directly from leachate from the landfill.

Figures 11 and 12 provide more detailed results of surface water sampling.

Sediments

Surface water sediments were also sampled at all locations where surface water samples were collected, including the seeps. Tributary A and most seep samples reflected some influence from the site, with SVOCs and metals being the most common and highest in concentration. Tributary B contained elevated levels of metals and organics, again probably reflecting more influence from the landfill than the site.

Figures 13 and 14 provide more detailed results of sediment sampling.

Contaminant Persistence

The persistence of a contaminant refers to the amount of time a chemical compound resides in the environment before its chemical structure is altered, as well as the residence time of the compound in a particular environmental medium. Persistence is particularly critical when a substantial period of time has elapsed since waste disposal occurred. The VOCs at the site, primarily chlorinated solvents but also some unchlorinated solvents, are generally characterized by rapid volatilization, low adsorption to soil and sediment, and varying degrees of solubility and biodegradability.

The low adsorption properties of most VOCs at the site indicate that these contaminants would be expected to leach relatively unimpeded through soils and into ground water and surface waters. The RI did demonstrate that while surficial levels of VOCs in soils were not consistently high, many VOCs were distributed at varying concentrations throughout the site and the various media. Biodegradation of chlorinated VOCs is likely occurring at slow rates, while unchlorinated VOCs are likely biodegrading at a higher rate.

Phthalates and other SVOCs at the site tend to have moderate to high soil adsorption, low volatility, and a high potential for biodegradation. These contaminants would be expected to reside preferentially in soils and sediments and not leach readily into ground water and surface waters. For example, bis(2-ethylhexyl) phthalate, which was found to be widespread and at very high concentrations in some soil samples, was found at low levels in only two ground water and two surface water samples. Alternatively, the more mobile VOCs which were often at lower levels and less well distributed in soils were often well distributed and at higher levels in ground water samples. The RI also confirmed that surface water runoff containing sediment particles effectively transported SVOCs around the site.

Metals tend to be the most persistent of all contaminants, although they may change form quite readily in the environment. The abundant supply of exposed scrap metal and drums provides a constant source of some metals, and surface water runoff serves to transport dissolved metals and those attached to soil particles very readily around the site.

Contaminant Migration

The principle routes of contaminant migration at the site are likely by overland flow from precipitation, downward infiltration through unsaturated soils and bedrock, lateral and vertical migration in ground water in unconsolidated soils and within saturated fractures, joints, and bedding planes of bedrock, and airborne transport of volatile contaminants by volatilization and finer soil particles containing adsorbed contaminants. Figure 15 provides a conceptual view of contaminant transport at the site. It appears that while all pathways are important, the least significant of these is volatilization to the atmosphere.

Summary

The RI demonstrated that the distribution of contaminants at the site is widespread, as evidenced by the distribution of organic contaminants across the various media in Table 6. In addition, what is known about disposal activities and contaminant transport mechanisms appears to correlate with the observed distribution of contaminants. For example, the highest levels of organic contaminants in soils were found below the “burn area” where drums were allegedly emptied for salvaging and also in areas over the north slope where drums were apparently bulldozed prior to being emptied (see Areas 1 and 2 in Figure 2).

Similarly, the highest levels of inorganic contaminants in soils were generally found in the active areas of the junkyard where metals have been disposed and stored over several decades (see Area 2 in Figure 2). Analogously, the ground water monitoring wells with the highest levels of organic contaminants are located over the north slope where soils levels are highest in organics, and the wells with the highest levels of inorganic contaminants are located closer to the active portions of the junkyard. Table 7 presents a summary of apparent correlations between elevated ground water and soil contaminants.

While the sampling conducted during the RI allows us to delineate contaminant source areas

in a general fashion, the RI did not attempt to determine with precision the areas and volumes which will require remediation. It is important to note that exposure of waste materials to weathering processes continues at the site, which can result in the movement of contaminants beyond and within the source areas identified in the RI. In addition, the site soils have been heavily disturbed over time through bulldozing, burning, and recontouring.

A very intensive sampling network would be necessary to fully characterize the lateral and vertical heterogeneity of soil contaminants. The RI does allow us to generally identify the boundaries for contaminant source area removal, but further delineation of contaminant hot spots within these source areas will be necessary during remedial design and remedial action. This delineation will include collection of soil samples for analysis and the use of field screening techniques.

VI. SUMMARY OF SITE RISKS

As part of the RI/FS, U.S. EPA prepared a Baseline Risk Assessment for the site. This risk assessment was developed to characterize, in the absence of remedial action, the current and potential threats to human health and the environment that may be posed by the site through different exposure pathways, such as ingestion and dermal contact. The risk assessment involves identifying contaminants which are judged to represent the major potential health risks at the site, and assessing the toxicity, or degree of hazard, posed by substances found at the site, and the routes by which humans and the environmental receptors (plants and animals) could come into contact with these substances. The process is summarized below, and the Baseline Risk Assessment in the RI report may be consulted for further information. Figure 16 provides a conceptual model of contaminant sources, transfer, and receptors at the site.

Identification of Contaminants of Concern

Based on frequency of detection, concentration relative to background, and toxicity, the list of contaminants found in the various media at the site was screened to 23 Contaminants of Concern. These contaminants have been used to evaluate toxicity, exposure pathways, and potential health risks for receptors at and near the site. The contaminants are listed on Table 8 and include ten metals, five VOCs, and eight SVOCs. Although the toxicity screening aspects of this procedure were oriented specifically to identifying human health threats, this same list of contaminants was deemed suitable for use in assessing ecological threats.

Exposure Assessment

Exposure assessment is the process of identifying potential pathways for contaminants to reach human or ecological receptors and estimating contaminant uptake by these receptors. The NCP requires that the Baseline Risk Assessment consider Reasonable Maximum Exposure scenarios for both current land use and for potential future uses.

Current land use at the site includes operation of the junkyard business, a residential trailer occupied by an adult male (with an off-site drinking water supply), and the rearing of domesticated animals for food, including cows, pigs, and fowl. The site continues to be actively used by workers and residents on a daily basis. It is also important to note that there is no current use of on-site ground water and that no nearby residential wells in use at this time appear to have been affected.

The future use scenario assumed by U.S. EPA for the site is full residential use. The basis for this assumption is that the site is only 1.5 miles from the city of Marietta, and the vicinity is dominated by residential use. This scenario includes the construction of houses with drinking water wells. U.S. EPA does not consider this to be a remote hypothetical threat, particularly since the occupied mobile home was placed on-site in 1990, during the site investigation.

Human Health

For the current use scenario, potentially exposed populations are adults, adolescents, and children who live in the immediate vicinity of the site, work in contaminated site areas, and/or visit or trespass onto the site for the purposes of domestic animal care, hunting, and recreation. These receptors may come into direct contact with contaminants in shallow soils, surface water, sediments, and air during these activities. For the future use scenario, potentially exposed populations are adults, adolescents, and children who reside on-site in newly constructed housing. These receptors will have free access to all parts of the site and may come into contact with contaminants in shallow to deep soils, surface water, sediments, and ground water.

Specific exposure pathways examined in these scenarios are:

- incidental ingestion of contaminated soil;
- dermal (skin) contact with contaminated soil;
- inhalation of contaminants in ambient air;
- dermal contact with contaminated surface water and sediment
- ingestion, dermal contact, and vapor inhalation of contaminants in ground water.

Chronic daily intakes of contaminants of concern were calculated for all receptors and exposure pathways using U.S. EPA guidance. Please refer to the Baseline Risk Assessment for details on this process.

Ecological

With the widespread contamination of the various media at the site, ecological receptors may be exposed to contaminants from a number of routes. Terrestrial plants may be exposed to contaminants in soils by root uptake and airborne contaminants from deposition. Terrestrial

animals may be exposed to dermal uptake of soil and water contaminants; ingestion of contaminated plants, soil, animals, and water; and inhalation of airborne VOCs and contaminated dust. Aquatic plants and animals may be exposed to contaminants in the water and sediment, and aquatic animals may be exposed to contaminants in ingested plants, soil, animals, and water. Exposure to contaminants through most of these routes could increase with a future residential use scenario since there would be extensive disturbance of soils and waste materials.

The primary on-site locations where ecological resources may encounter contaminants include:

- all terrestrial locations south and west of Tributary A;
- Tributary A; and
- seeps south and west of Tributary A.

Secondary areas where ecological resources may encounter contaminants include:

- terrestrial locations north and east of Tributary A, via airborne movement of contaminants;
- terrestrial and aquatic locations downwind from the site, via airborne movement of contaminants;
- Duck Creek via drainage of Tributary A into the creek; and
- Tributary B.

Toxicity Assessment

The purpose of toxicity assessment is to estimate the likelihood and severity of adverse effects, both carcinogenic (cancer-causing) and non-carcinogenic, from exposure to contaminants. Based on toxicological studies of the contaminants of concern, several are classified as carcinogens. Cancer classifications represent weight-of-evidence judgements of the likelihood that a chemical is a human or animal carcinogen. Carcinogens found in ground water include:

Group A Known Human Carcinogens:	Arsenic Vinyl chloride
Group B1 Probable Human Carcinogen:	Cadmium
Group B2 Probable Human Carcinogen:	Bis(2-ethylhexyl) phthalate
Group C Possible Human Carcinogen:	1,1-Dichloroethene

Carcinogens found in soils include:

Group A Known Human Carcinogens:	Arsenic Nickel Vinyl chloride
Group B1 Probable Human Carcinogen:	Cadmium
Group B2 Probable Human Carcinogen:	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Bis(2-ethylhexyl)phthalate Indeno(1,2,3-cd)pyrene Lead
Group C Possible Human Carcinogen:	1,1-Dichloroethene

U.S. EPA has also developed carcinogenic and non-carcinogenic toxicity factors to reflect the relative risks (i.e. potency) associated with contaminants. These contaminant specific factors, along with other factors such as the uptake estimated for each contaminant of concern at the site, are utilized to develop the risk characterization for the site presented below.

U.S. EPA's preferred toxicity value for evaluating carcinogenic effects is the Cancer Slope Factor (CSF). U.S. EPA's preferred toxicity value for evaluating non-carcinogenic effects is the Reference Dose (RfD). Both CSFs and RfDs have been derived from human epidemiological studies and animal bioassay studies. The CSF or RfD value for each contaminant includes a margin of safety to reflect, among other things, the inherent uncertainties in extrapolating from studies.

CSFs are statistical values developed by U.S. EPA to conservatively reflect (i.e. show the "upper-bound" estimate of) potential cancer risks resulting from a specified exposure to a contaminant. In particular, CSFs represent the 95% upper confidence limit on the slope of the dose response relationship at low doses for a carcinogen. The larger the CSF value, the more potent is the carcinogen; i.e., a smaller dose of a high CSF value contaminant is sufficient to increase the risk of cancer. CSF values can range from about 0.0001 to 100,000 in units of lifetime risk per unit dose (mg/kg-day). CSFs are multiplied by the estimated uptake of a potential carcinogen to provide an "upper-bound" estimate of the excess lifetime cancer risk associated with exposure at that uptake level. This approach makes underestimation of the actual cancer risk highly unlikely.

RfDs are estimates of lifetime daily exposure levels which are believed to result in no adverse health effects. Estimated uptakes of contaminants at a site can then be compared to

the RfDs in order to assess the potential for noncarcinogenic effects.

Risk Characterization

Risk characterization combines the exposure assessment results with the toxicity assessment results to estimate health risks from contaminants at the site. Human health risks at Superfund sites are assessed with respect to the separate carcinogenic and noncarcinogenic effects of substances found at the sites under the current and future exposure scenarios.

Carcinogenic risks from various exposure pathways are assumed to be additive and are presented in terms of the degree of increased risk over the average or background level in humans. For the general population, the background risk of developing some form of cancer in one's lifetime is one chance in three. The NCP specifies that acceptable carcinogenic risks are those that may result in less than one additional cancer case in 10,000 ($1x10^{-4}$) to 1,000,000 ($1x10^{-6}$) people over a lifetime (70 years) after exposure to the site. An excess lifetime cancer risk of 1 in 1 million indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to carcinogen(s) over a 70-year lifetime under the specific exposure conditions at a site. The NCP specifies that $1x10^{-6}$ is the point of departure for the development of remedial goals.

Noncarcinogenic risks to humans, or hazards, are evaluated with respect to a hazard quotient (HQ), which is the ratio of the level of exposure for a particular contaminant at the site to the RfD for that contaminant. If the HQ for an individual or group from exposure to a contaminant exceeds 1, noncarcinogenic health effects may result from exposure to that contaminant. By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the hazard index (HI) can be generated. If the HI exceeds 1, noncarcinogenic health effects may result from exposure to that medium or to all site media.

Human health hazards associated with the presence of lead are assessed differently than for other noncarcinogens. A model developed by U.S. EPA was used to estimate possible blood lead levels for children exposed to the site for the existing and future scenarios.

Since the site is currently being used to raise various types of domestic animals, the Baseline Risk Assessment also attempted to examine the potential for human health effects from consumption of meat from these animals. Meat from the domestic animals at the site was not analyzed for the presence of contaminants; this analysis was done using a model.

Defining the potential risks to ecological receptors at the site was approached through comparison of sampling results to available criteria and standards for aquatic exposure and to known toxicity thresholds for terrestrial wildlife. In addition, an ecological survey was performed on the site and this included a qualitative assessment for toxic effects.

Human Health Risk Summary

The Baseline Risk Assessment concluded that the contaminants which contributed most to elevated site risks for human health include: the VOCs 1,1-dichloroethene, tetrachloroethene, and vinyl chloride; the SVOCs bis(2-ethylhexyl)phthalate and polycyclic aromatic hydrocarbons (PAHs); and the metals antimony, arsenic, barium, cadmium, and lead.

The risk assessment also concluded that approximately 95% of the excess risk to human health associated with the site is due to potential use of ground water, with the remaining 5% associated with contact with site soils. The contaminants which contribute most to excess risks and hazards in ground water include antimony; arsenic; barium; bis(2-ethylhexyl) phthalate; cadmium; 1,1-dichloroethene; nickel; tetrachloroethene; vanadium; and vinyl chloride. The contaminants which contribute most to excess risks and hazards in soils include antimony, arsenic, bis(2-ethylhexyl)phthalate, lead, and PAHs.

The risk assessment indicates that for the current use scenario at the site, lifetime risks could reach 3 additional cases of cancer in 1000 exposed adults and 4 additional cases of cancer in 10,000 exposed adolescents. These results exceed the acceptable risk range of 1 in 10,000 ($1x10^{-4}$) to 1 in 1,000,000 ($1x10^{-6}$) exposed individuals. For the future residential use scenario, lifetime risks could reach 2 additional cases of cancer in 100 exposed adults, 3 additional cases of cancer in 100 exposed adolescents, and 4 additional cases of cancer in 100 exposed children. These results all exceed the acceptable risk range.

The risk assessment indicates that total site hazard indices for current use scenario were 2.7 for adults, 3.4 for adolescents, and 1.9 for children, all of which exceed the acceptable level of 1. It also indicates that for the future use scenario, the total site hazard indices were 27 for adults, 43 for adolescents, and 28 for children, all well in excess of the acceptable level.

The model used to estimate health effects from exposure to lead indicates that child blood lead levels could be unacceptably high for both the current and future use scenarios. The model looks at the potential for lead uptake from diet, ambient air, drinking water, and soil. Exposure to lead in site soils is estimated to be the primary cause of elevated blood levels.

Results utilizing cows to represent domesticated animal meat consumption indicated that for the contaminants found at the site, only the PAHs and some VOCs would be expected to occur in vegetation at levels of concern for bioaccumulation in grazing animals. These contaminants could cause health effects in consumers if they are accumulated to high enough levels in the meat derived from these animals. These contaminants are rapidly metabolized in animals, however, and are not known to accumulate to any great degree in animal tissue. Therefore, no unacceptable risks are believed to exist from this exposure route.

Environmental Risks

Evaluation of the potential toxic effects of site contaminants on terrestrial, wetland, and

aquatic communities at the site is complex. Generally, visible indications of contamination are present, and sampling results confirm widespread contamination at the site. Nevertheless, only isolated signs of environmental distress from the contaminants were observed during the investigation. In addition, despite the extensive habitat degradation at the site due to disposal activities, diverse terrestrial and aquatic habitats were observed over the north slope. Tissue samples were not collected to identify actual uptake of contaminants by ecological receptors.

Evaluation of site contaminant levels against known toxicity thresholds for animals indicates that no toxic effects are identifiable. The site contaminant levels did not exceed the chemical-specific concentrations associated with acute or chronic toxic effects in wild or laboratory animals. However, absolute conclusions regarding the potential effects of site contaminants cannot be made due to uncertainties about the estimates of toxicity and exposure for animals. Toxicity thresholds for plants were not identified so a similar comparison could not be made. In addition, exceedances of surface water quality criteria and standards indicate that more subtle adverse effects on aquatic life may be occurring, particularly in the surface water and sediments in the seeps located on the north slope of the site.

Based on information supplied by the State of Ohio and surveys conducted during the investigation, no endangered or threatened species are known to occur on the site.

Conclusion

In summary, releases of hazardous substances from the site, if not addressed, may present an imminent and substantial endangerment to public health, welfare, and the environment. Please refer to the Baseline Risk Assessment in the RI report for a complete discussion of these results.

VII. REMEDIAL ACTION APPROACH

The Feasibility Study built upon the findings of the RI by identifying, screening, and evaluating remedial action alternatives for addressing the contaminants contributing to unacceptable risks at the site. The primary remediation approach developed during the FS emphasizes a combination of removing and treating or containing contaminated soils, solid waste, and sediments to specified cleanup levels, thereby eliminating and/or minimizing their contribution of hazardous substances to the ground water and surface waters/sediments.

U.S. EPA anticipates that once the sources of contaminants to the ground water and surface waters/sediments are reduced sufficiently, ground water and surface waters/sediments will expeditiously achieve their cleanup levels through natural attenuation. However, if contaminant concentrations in ground water, surface waters, or sediments are not diminishing sufficiently to achieve cleanup levels in a reasonable timeframe through source removal and

containment, additional work may be required. A reasonable timeframe for assessing cleanup is not being specified at this time. Information to be obtained during remedial design and remedial action will affect this determination.

Regular monitoring will indicate if progress in achieving the cleanup level is occurring. Although additional work options are provided in this Record of Decision, criteria for making a determination that progress toward cleanup levels is not occurring at a reasonable rate is difficult to make in advance. However, delineation of an acceptable rate of natural ground water attenuation capable of measuring whether reasonable progress being made towards attaining ground water cleanup levels will be conducted during remedial design, based in part on additional ground water information to be collected. The effectiveness of the selected ground water remedy will be evaluated at the required five-year review. If it is determined at the five-year review that the rate of acceptable natural ground water attenuation is not being achieved, then additional work may be required. U.S. EPA anticipates that no additional work will be necessary, and will conduct regular reviews of the effectiveness of the remedy.

CERCLA provides a preference for remedial actions which achieve protection of human health and the environment through treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous substances, pollutants, or contaminants. The preamble to the NCP states that treatment is the preferred alternative for the remediation of hazardous substances. The preamble also states that solutions will most often involve a combination of methods of protection, including remedial measures such as treatment and engineering controls, and other activities such as institutional controls.

Principle threat wastes are those source materials considered to be highly toxic or highly mobile and that cannot be reliably contained or would present a significant risk to human health or the environment if exposure occurs. They include liquids, highly mobile materials such as solvents, and materials having high levels of toxic substances. Principle threat wastes at the Vandale Junkyard site consist of possible buried drums, drum fragments, sludges, and related industrial wastes containing VOCs, semivolatile organic compounds, and metals as well as soils closely associated with (and significantly contaminated by) these materials.

It is important to note that the widespread and diverse contaminant distribution at the site, when combined with the diverse physical characteristics of the site, resulted in major constraints on the development of a straightforward remediation approach. In particular, two factors were critical in directing remedy development: the presence of large quantities of “junkyard” wastes in association with the industrial wastes, and the steeply sloped and unstable nature of the area where much of the waste has come to be located.

Soils

Soil sampling during the RI confirmed widespread contamination with organic and inorganic

substances. This contamination results in elevated risks/hazards to human health and in potentially harmful effects to the environment. Soils at the site are not only a direct contact hazard but also a source area for ground water and surface water contamination at the site. The cleanup requirements for soils at the site are to excavate, then treat and/or dispose off-site or consolidate and contain on-site, principle threat wastes in soils to acceptable levels for direct contact exposures and to reduce leaching of contaminants so that ground water, surface water, and sediment cleanup levels are achieved.

Since the Agencies do not have chemical-specific cleanup requirements (Applicable or Relevant and Appropriate Requirements, or ARARs) for soil, site-specific cleanup levels were developed based on risk-based criteria, U.S. EPA guidance, and water quality ARARs. Water quality ARARs are used because remedial action objectives for soils must also be protective of ground water, surface waters, and sediments. The soil cleanup levels were selected based on a comparison between background levels in the vicinity of the site, soil concentrations which are protective of ground water, risk-based standards for soils generated from the results of the risk assessment, and analytical detection limits. Cleanup levels for soils are listed on Table 9. These cleanup levels will be used to determine which soils require remediation, and these cleanup levels will be attained in all areas of the site that remain uncapped. Some modifications to these cleanup levels may be made by U.S. EPA during remedial design based on additional site-specific information (e.g., site-specific leachability tests), provided that cumulative total site risk remains less than $1x10^{-6}$ and cumulative total site hazard does not exceed 1.

Through a combination of removal, treatment, and containment of contamination in the soils, the selected remedy will effectively address the principle threats and satisfy CERCLA's preference for treatment. Soil volumes which may require consolidation and containment or excavation and treatment for the various alternatives were developed based on a comparison of RI sampling results to the cleanup levels and on knowledge of site history and waste deposits. The actual soil volumes requiring excavation and treatment or containment may be greater or less than the volume estimated based on the sampling to be conducted during remedial design.

Solid Waste

Solid waste materials at the site, including possible buried drummed waste and junkyard materials, have been identified as source materials for soil, ground water, surface water, and sediment contamination. The cleanup requirements for solid wastes at the site are to remove and treat principle threat wastes (drummed and other wastes) and other source materials to reduce leaching of contaminants, so that soil, ground water, surface water, and sediment cleanup levels can be achieved.

The RI/FS concluded that a listed hazardous waste under the Resources Conservation and Recovery Act (RCRA), waste code K086, ink formulation wash water, was disposed at the site. Although other listed hazardous wastes may have been disposed at the site, available

information on wastes disposed is not specific enough to be conclusive. However, it is likely that many or all of the organic solvent VOCs found at the site may also be derived from other listed RCRA wastes. Although it appears that disposal of listed wastes (including K086) may have ended prior to the effective date of RCRA, any materials excavated for the purpose of off-site disposal would require compliance with RCRA ARARs. Cleanup requirements for the K086 and other potential RCRA wastes are addressed in the Evaluation of Alternatives section of this plan.

Ground Water

Ground water sampling has confirmed widespread contamination with organic and inorganic substances and exceedances of Maximum Contaminant Levels (MCLs) promulgated under the Safe Drinking Water Act. This contamination is believed to be the result of leaching from site soils and solid wastes. The fractured bedrock geology at the site prevents the development of a homogeneous aquifer, instead allowing only marginally interconnected zones of ground water. These zones of ground water, while they may be sufficient to support the low pumping rate of a domestic water supply well, do not yield water at a rate sufficient to support pumping for remediation. These hydrogeologic characteristics would limit the effectiveness of an active ground water remediation system. As a result, U.S. EPA believes that there is no currently available ground water remediation system which would effectively prevent migration of contaminated ground water away from the site or significantly expedite the cleanup of existing ground water contamination over the cleanup anticipated to occur with natural attenuation.

Source removal and containment of contaminants in site soils will be utilized to eliminate or minimize, to the extent technically feasible, additional leaching of the contaminants from the soils to the ground water. U.S. EPA anticipates that once the sources of ground water contaminants are eliminated or reduced, ground water cleanup levels will be expeditiously achieved through natural attenuation.

Cleanup levels were developed for ground water by comparing site background levels; MCLs and Maximum Contaminant Level Goals (greater than zero), both of which are ARARs for ground water; risk/hazard based levels generated from the results of the risk assessment for the site; and analytical detection limits. Cleanup levels are listed in Table 9.

Surface Water

Contamination of surface waters at the site with organic and inorganic substances reflects the influence of contaminated soils, solid wastes, and sediments. Surface water quality standards and criteria ARARs, consisting of Ohio EPA's Water Quality Standards and U.S. EPA's Ambient Water Quality Criteria, were exceeded in the seeps for numerous inorganic substances. The seeps are directly downgradient of some of the most highly contaminated soils at the site and it is believed that the exceedances are related to runoff from these areas. By remediating soils, sediments, and other wastes and attaining all cleanup levels for the

protection of ground water, the migration of these contaminants to surface waters will be eliminated or minimized. It is anticipated that the ARAR-based cleanup levels in Tables 10 and 11 will then be expeditiously attained in the seeps through natural attenuation once source removal measures are completed.

Some surface water ARARs were also exceeded in Tributary B, which is located adjacent to the site. The RI concluded that it is very unlikely that the site is contributing significantly to this problem. Rather, it appears that the Marietta Sanitation Corporation Landfill, which Tributary B partially drains, is causing these exceedances. Attainment of cleanup levels for the protection of ground water and soils will further decrease the possible transport of contaminants from the site to Tributary B, but it appears unlikely that surface water quality criteria will be attained in Tributary B unless the contributions from the Marietta Sanitation Corporation Landfill diminish.

Sediments

Seep sediments were found to contain levels of contaminants which could lead to surface water quality criteria or standards exceedances. Since there are no chemical-specific ARARs for sediments, the cleanup requirement for these sediments is to reduce contaminants to levels necessary to attain all water quality ARARs. This will be accomplished through source removal, natural attenuation, and active remediation of organic contaminants in the sediments as necessary. The sediment cleanup levels were derived to ensure that water quality ARARs are attained, and are listed in Tables 10 and 11.

VIII. DESCRIPTION OF ALTERNATIVES

The Feasibility Study developed and examined six alternatives for remedial action, including a "No Action" alternative. This section summarizes the alternatives examined in detail in the FS. For more information on the development of the alternatives please refer to the FS report. All of the alternatives described in this section, except for the No Action alternative, include the following common elements:

Institutional Controls
Institutional controls will be utilized to restrict future access to areas or resources (such as ground water) where cleanup levels have not yet been fully attained and to ensure that the effectiveness of the remedy is maintained. These controls will consist of fencing and other measures necessary to restrict access to the site, deed restrictions to ensure that capped areas are not disturbed or built upon and contaminated ground water is not utilized for drinking water during cleanup, and the prevention of future waste disposal.

Ground Water and Surface Waters/Sediment Monitoring
Ground water and surface waters/sediments will be periodically sampled to assess

progress toward attainment of all cleanup levels. This sampling will consist of the collection of samples from locations established during site remediation on a quarterly basis.

In addition, it is important to note again that all action alternatives rely on source control and natural attenuation of contaminants for remediation of ground water and surface waters/sediments. This is because, based on existing knowledge of site conditions and available technologies, active remediation of these resources, with the exception of organic contaminants in seep sediments, is not expected to significantly expedite achieving cleanup levels in the resources or effectively prevent further migration of contaminants at the site. As described in depth in Section X of this document, progress towards achieving these cleanup levels will be assessed periodically, and additional remedial measures will be implemented if source control and natural attenuation is not effective.

Alternative 1: No Action

CERCLA requires that a "No Action" alternative be considered as a basis upon which to compare other alternatives. Under this alternative, no remedial action would take place and the site would remain in its present condition. All contamination would remain in site soils, ground water, surface water, and sediments. Solid waste materials would remain on-site. This alternative would not comply with State or Federal ARARs and would not adequately protect human health or the environment. There is no cost for this alternative.

Alternative 2: On-Site Consolidation and Capping of Contaminated Soils and Solid Waste; Off-Site Treatment and Disposal of Contaminated Solid Waste (Including Drummed Wastes); On-Site Bioremediation of Seep Sediments

Under this alternative, an estimated 9,000 cubic yards of soils which exceed the cleanup levels and 3,600 cubic yards of unsalvageable solid wastes on the north slope of the site would be collected and consolidated with 500 cubic yards of unsalvageable solid wastes in the active areas of the site. No treatment of the soils would be performed. The consolidated materials would be placed over active areas where soils exceed cleanup levels, compacted to the maximum extent practicable, and capped with a RCRA Subtitle C hazardous waste cap. No soils would be excavated in the active areas of the site.

Any drummed or other wastes (including soils) encountered during excavation which are not suitable for on-site disposal or may be RCRA listed or characteristic wastes would be taken off-site for treatment and disposal. All non-hazardous solid wastes (i.e. junkyard materials, empty drums) would be screened for salvageable items. Materials found salvageable (estimated at 900 cubic yards for the north slope and 3000 cubic yards for the active areas) would be decontaminated as necessary and taken off-site for salvage. Sediments in the seeps on the north slope which exceed cleanup levels for organic contaminants would be bioremediated in place. Finally, as described above, necessary institutional controls would be implemented and monitoring conducted. The FS report provides a complete breakdown

of cost estimates for this alternative.

Months to Implement Action: 10-12 months
Estimated Capital Cost: $3,709,650
Estimated 30 Year Operation and Maintenance (O&M) Cost: $855,230
Estimated Present Net Worth Cost (30 years): $4,564,880

Alternative 3A: On-Site Treatment of Contaminated Soils and Contaminated Solid Waste (Including Drummed Wastes) by Incineration and/or Stabilization/Solidification (as Necessary); On-Site Placement and Capping of Treated Materials; On-Site Bioremediation of Seep Sediments

Under this alternative, an estimated 9,000 cubic yards of soils on the north slope of the site and an estimated 24,600 cubic yards of soils in the active areas of the site which exceed cleanup levels would be excavated. All excavated soils would then be screened for the presence of organic contaminants, inorganic contaminants, or both. Soils with organic contaminants above cleanup levels, estimated at 17,600 cubic yards, would be incinerated. Residuals from incineration would be stabilized/solidified as necessary to meet ARARs and placed on-site under a cap meeting the requirements of Ohio EPA for a solid waste landfill (OAC 3745-27-11) . Soils containing only inorganic contaminants above cleanup levels, estimated at 16,000 cubic yards, would be stabilized and solidified as necessary to meet ARARs, and the residuals placed on-site under the solid waste cap. Any RCRA restricted soils and debris would be delisted after treatment so that residuals could be disposed as a solid waste.

Any drummed wastes encountered during excavation would be incinerated and residuals stabilized/solidified as necessary. RCRA restricted residuals would be delisted and disposed as a solid waste. Other solid wastes such as junkyard materials and empty drums would be screened for salvageable items. Salvageable materials (estimated at 900 cubic yards for the north slope and 3000 cubic yards for the active areas) would be decontaminated as necessary and taken off-site for salvage. Unsalvageable materials would be consolidated with treated soils and placed under the solid waste cap. Finally, sediments on the north slope of the site would be bioremediated in place, institutional controls implemented, and monitoring conducted. The FS report provides a complete breakdown of cost estimates for this alternative.

Months to Implement Action: 18-24 months
Estimated Capital Cost: $26,763,740
Estimated 30 Year Operation and Maintenance (O&M) Cost: 855,230
Estimated Present Net Worth Cost (30 years): $27,618,970

Alternative 3B: On-Site Treatment of Contaminated Soils and Contaminated Solid Waste (Including Drummed Wastes) by Incineration and/or Stabilization/Solidification (as Necessary); Off-Site Land Disposal of Treated Materials; On-Site Bioremediation of

Seep Sediments

All activities under this alternative would be the same as those described for Alternative 3A except that all treated materials and non-hazardous solid wastes would be taken off-site for disposal. No wastes would remain on-site for capping. The FS report provides a complete breakdown of cost estimates for this alternative.

Months to Implement Action: 18-24 months
Estimated Capital Cost: $29,627,900
Estimated 30 Year Operation and Maintenance (O&M) Cost: $645,350
Estimated Present Net Worth Cost (30 years): $30,273,250

Alternative 4A: On-Site Treatment of Contaminated Soils by Low Temperature Thermal Desorption and/or Stabilization/Solidification (as Necessary); On-Site Placement and Capping of Treated Soils; Off-Site Treatment and Disposal of Contaminated Solid Waste (Including Drummed Wastes); On-Site Bioremediation of Seep Sediments

Under this alternative, the estimated 9,000 cubic yards of soils on the north slope of the site and 24,600 cubic yards in the active areas of the site which exceed cleanup levels would be excavated. All excavated soils would then be screened for the presence of organic and inorganic contaminants. Soils with organic contaminants above cleanup levels would be treated with a low temperature thermal desorption unit. Treated materials would be stabilized/ solidified as necessary, with residuals placed on-site under a cap meeting the requirements of Ohio EPA for a solid waste landfill (OAC 3745-27-11). Soils containing only inorganic contaminants above cleanup levels would be stabilized and solidified as necessary, and the residuals placed on-site under the solid waste cap. Any RCRA restricted soils and debris would be delisted after treatment so that residuals could be disposed as a solid waste.

Any drummed wastes encountered during excavation would be taken off-site for treatment and disposal. RCRA restricted residuals would be delisted and disposed as a solid waste. Other solid wastes such as junkyard materials and empty drums would be screened for salvageable items. Salvageable materials (estimated at 900 cubic yards for the north slope and 3000 cubic yards for the active areas) would be decontaminated as necessary and taken off-site for salvage. Unsalvageable materials would be consolidated with treated soils and placed under the RCRA Subtitle C cap. Finally, as described above, sediments on the north slope of the site would be bioremediated in place, institutional controls implemented, and monitoring conducted. The FS report provides a complete breakdown of cost estimates for this alternative.

Months to Implement Action: 18-24 months
Estimated Capital Cost: $14,514,490
Estimated 30 Year Operation and Maintenance (O&M) Cost: $855,230

Estimated Present Net Worth Cost (30 years): $15,369,720

Alternative 4B: On-Site Treatment of Contaminated Soils by Low Temperature Thermal Desorption and/or Stabilization/Solidification (as Necessary); Off-Site Disposal of Treated Soils; Off-Site Treatment and Disposal of Contaminated Solid Waste (Including Drummed Wastes); On-Site Bioremediation of Seep Sediments

All activities under this alternative would be the same as those described for Alternative 4A except that all treated materials and unsalvageable solid wastes would be taken off-site for disposal. No wastes would remain on-site for capping. The FS report provides a complete breakdown of cost estimates for this alternative.

Months to Implement Action: 18-24 months
Estimated Capital Cost: $17,305,930
Estimated 30 Year Operation and Maintenance (O&M) Cost: $645,350
Estimated Present Net Worth Cost (30 years): $17,951,280

IX. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Each of the alternatives was evaluated using the nine criteria described below. These criteria are specified in the NCP at 40 CFR 300.430(e)(9)(iii).

Threshold Criteria:

1. Overall Protection of Human Health and the Environment:
   Addresses whether a remedy provides adequate protection and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs):
   Addresses whether a remedy will meet all requirements of other federal and state environmental laws and regulations or provides grounds for invoking a waiver.

Primary Balancing Criteria:

3. Long-Term Effectiveness and Permanence:
   Refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met.

4. Reduction of Toxicity, Mobility, or Volume Through Treatment:
   Assesses the degree to which a remedy utilizes treatment to address the principle threats at the site.

5. Short-Term Effectiveness:
   Addresses the potential adverse effects that implementation of a remedy may have on human health and the environment, i.e. during construction and before cleanup levels are achieved.

6. Implementability:
   Addresses the technical and administrative feasibility of a remedy, including the availability of services and materials.

7. Cost:
   Includes the estimated capital and operation and maintenance costs for a remedy, also expressed in net present worth costs.

Modifying Criteria:

8. State Acceptance:
   Indicates whether the State of Ohio supports the alternative.

9. Community Acceptance:
   Addresses the acceptability of the alternative to the local community based on comments received during the public comment period.

The following discussion summarizes the compliance of the alternatives with the nine criteria. For a more detailed discussion of this evaluation, please refer to the Feasibility Study.

1. Overall Protection of Human Health and the Environment

All alternatives under consideration except Alternative 1 (the No Action alternative) are expected to be protective of human health and the environment in the long term. Alternatives which utilize treatment are preferred and provide a greater degree of protection for human health and the environment in the long-term.

Alternative 2, which provides for removal and off-site treatment of drummed materials, sludges, and other wastes (including soils) not suitable for containment but does not provide on-site treatment of soil source materials, allows for a greater potential of future leaching and migration of contaminants from the untreated soils. This potential is mitigated by the use of a RCRA Subtitle C multilayer cap, which may reduce infiltration of surface water significantly over the solid waste cap proposed for Alternatives 3A and 4A with on-site content of treated materials.

Alternatives 3A and 4A may provide a higher level of overall protection than Alternative 2 by providing both treatment of soil source materials and on-site containment of the residuals with a solid waste cap. Alternatives 3B and 4B would provide the highest level of overall

protection at the site by treating the source materials and disposing of the residuals off-site. However, since the treated residuals from Alternatives 3B and 4B would be disposed at an off-site facility within a reasonable distance of the site, the overall impacts on human health and the environment might be similar to those for Alternatives 3A and 4A.

2. Compliance with ARARs

CERCLA requires that remedial actions meet legally applicable or relevant and appropriate requirements of other environmental laws. "Applicable requirements" means those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. These laws include, but are not limited to the following: the Toxic Substances Control Act, the Safe Drinking Water Act, the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act, and any state environmental law that has more stringent requirements than the corresponding Federal law.

"Relevant and appropriate" requirements are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under Federal or State law that, while not legally "applicable" to a hazardous substance, pollutant, contaminant, remedial action or circumstance at a site, address problems or situations sufficiently similar to those encountered at the site so that their use is well suited to that site. A requirement that is judged to be relevant and appropriate must be complied with to the same degree as if it were applicable. However, there is more discretion in this determination; it is possible for only part of a requirement to be considered relevant and appropriate, the rest being dismissed if judged not to be relevant and appropriate in a given case.

In addition to legally binding laws and regulations, many Federal and State environmental and public health programs also develop criteria, advisories, guidance and proposed standards that are not legally binding, but that may provide useful information or recommended procedures. These "To Be Considered" (TBC) materials are not potential ARARs but are evaluated along with ARARs, as part of the risk assessment conducted for each CERCLA site, to set protective cleanup level targets. Chemical-specific values such as health advisories and reference doses are used in the absence of ARARs or where ARARs are not sufficiently protective to develop cleanup goals. Other TBC materials such as guidance and policy documents developed to implement regulations may be considered and used as appropriate where necessary to ensure protectiveness.

Potential Federal and State ARARs for this site are listed in Appendices C and D. ARARs are addressed in three categories: chemical-specific, action-specific, and location-specific.

Chemical-Specific ARARs: Usually health or risk-based numerical values which establish the acceptable amount or concentration of a chemical that may be found in or discharged to

the ambient environment. All alternatives except Alternative 1 (the No Action alternative) are anticipated to comply with air, ground water, and surface water chemical-specific ARARs. There are no chemical-specific ARARs for soils. Significant federal chemical-specific ARARs are summarized below.

Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) has established maximum contaminant levels (MCLs) allowable in regulated public water supplies. The MCLs are relevant and appropriate for determining ground water clean-up requirements at the site since the ground water serves as an actual or potential source of drinking water. Maximum Contaminant Level Goals (MCLGs) are non-regulatory health-based goals established under SDWA, and non-zero MCLGs may also be relevant and appropriate under some circumstances. Ground water cleanup levels specified for Alternatives 2 through 4B were developed to assure compliance with MCLs and with MCLGs as appropriate. These alternatives also provide for a monitoring component to assure detection of compounds with SDWA MCLs and MCLGs (as appropriate).

Clean Air Act

The Clean Air Act sets maximum contaminant concentrations for airborne releases. Depending on the alternative, these requirements may be applicable or relevant and appropriate to the remedial action. Alternatives 2 through 4B provide for monitoring to evaluate air releases during all soils removal, handling, and treatment processes. This monitoring and any necessary control devices will be used to assure compliance with these requirements.

Clean Water Act

The Clean Water Act (CWA) is administered by Ohio EPA and establishes surface water quality standards. These standards and U.S. EPA's Ambient Water Quality Criteria serve as ARARs for surface waters at the site.

Action-Specific ARARs: Usually technology or activity-based requirements or limitations on actions taken with respect to hazardous wastes. All action alternatives are expected to comply with action-specific ARARs. Significant action-specific ARARs are highlighted below.

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) requirements for treatment, storage, or disposal of hazardous wastes apply to a site under the following circumstances:

1) if the site contains RCRA listed or characteristic hazardous waste that was treated or disposed of after the effective date of the RCRA regulations under consideration as potential ARARs for the site, or

2) if the CERCLA activity at the site constitutes current treatment, storage, or

disposal of RCRA hazardous waste.

In cases where it is not known whether RCRA hazardous wastes were disposed at the site after the effective date of this law, RCRA requirements may not be applicable, but may be relevant and appropriate if the CERCLA action involves treatment, storage, or disposal of wastes similar or identical to RCRA hazardous waste.

40 CFR Part 264 lists requirements for Hazardous Waste Management units under RCRA, and specifies that hazardous waste management units may be closed in either of two ways: a RCRA compliant cover system or “clean” closure corrective action. The Site was not regulated under RCRA, and hazardous waste disposal after the effective date of RCRA has not been confirmed. However, certain wastes disposed at the site were later listed as RCRA wastes and others may be characteristic RCRA wastes. Therefore, parts of 40 CFR Part 264 are ARARs for remedial alternatives at the Site.

The Hazardous and Solid Waste Amendments (HSWA) to RCRA include provisions restricting land disposal of RCRA hazardous wastes. The purpose of the RCRA Land Disposal Restrictions (LDRs) at 40 CFR Part 268 is to minimize the potential of future risk to human health and the environment by requiring treatment of hazardous wastes prior to land disposal. As available records indicate that prior to the effective date of RCRA a waste was disposed at the site which would have been a RCRA listed waste if disposed after the effective date of RCRA, LDRs are relevant and appropriate. Consequently, all action alternatives (2, 3A, 3B, 4A, and 4B) must comply with LDRs for this waste. This listed waste, K086, is an ink formulation wash water which is listed due to potentially high levels of lead and chromium.

No drums of K086 or other identifiable listed wastes have been found at the site, but there is a reasonable possibility that drums of such wastes will be found during remediation. U.S. EPA also recognizes that soils and debris which contain constituents found in K086 waste must be considered restricted soil wastes under RCRA. RCRA characteristic wastes and/or soils may also be encountered.

RCRA LDR compliance would require treatment to Best Demonstrated Available Technology (BDAT) for any drummed waste subject to LDRs and placement of residuals under a RCRA Subtitle C cap. Alternatives 3A and 3B would meet BDAT for drummed K086 waste by incinerating the waste on-site, whereas under Alternatives 4A and 4B this waste will be taken off-site for treatment and disposal.

Two alternatives to BDAT treatment requirements are available for on-site disposal of RCRA restricted soils and debris after treatment: a Treatability Variance under 40 CFR 268.44 requiring placement of residuals under a RCRA Subtitle C cap, or delisting residuals under 40 CFR 260.20 and .22 and placement of residuals under a solid waste cap. Soil and debris Treatability Variances are intended to address situations where a CERCLA waste differs significantly from the waste used to set the LDR treatment standard such that the LDR

standard cannot be met or the BDAT used to set the standard is inappropriate for the waste. This Variance would result in the use of stabilization/solidification to attain U.S. EPA's alternate treatment levels. An alternative way to comply with LDRs for soils, and preferred route for Alternatives 3A, 3B, 4A, and 4B, is to treat any soils to site cleanup levels and then "delist" the residuals so that they can be disposed as a solid waste. Under these alternatives, the residuals would be shown to be nonhazardous wastes and thus no longer subject to RCRA Subtitle C hazardous waste regulations. The treated soil residuals would then be managed in accordance with Ohio EPA solid waste disposal requirements.

As described in the Proposed Plan, K086 waste is listed primarily due to the presence of lead and chromium. Delineation of RCRA restricted soils associated with K086 wastes will be complicated by the presence of lead and chromium from junkyard materials, especially automobile batteries and chromed parts. The approach developed in the Proposed Plan to delineate these soils is the following: soils which are excavated over and surrounding areas where drummed waste disposal appears to be the predominant influence over soil contamination and which exhibit levels of chromium or lead above cleanup levels will be considered RCRA restricted soils. The north slope and burn areas of the site are the likely candidate areas for this approach.

However, it is important to note that BDAT treatment standards for K086 address a whole range of contaminants which may be found in this waste and are distributed widely in site soils, many of which are contaminants of concern for remediation. This includes bis(2-ethylhexyl)phthalate; butylbenzylphthalate; methyl ethyl ketone; methyl isobutyl ketone; toluene; 1,1,1-trichloroethane; trichloroethene; and xylenes. Delineation of these RCRA restricted soil wastes from other contaminated soils may be very difficult. Furthermore, it is likely that most soils contaminated with organic solvent VOCs are derived from RCRA listed wastes for which sufficient documentation is not available.

Alternative 2, which provides for no on-site treatment of soils, would comply with LDRs by consolidation of soils which can be identified as having contacted K086 waste within the Area of Contamination (the site) followed by capping with the RCRA Subtitle C multilayer cap. It is important to note that although RCRA regulations do not prohibit the on-site consolidation and capping of drummed K086 waste or other identifiable LDR restricted wastes encountered, Alternative 2 does provide for the off-site disposal of any such wastes in compliance with all RCRA ARARs.

State of Ohio action-specific ARARs, as listed in Appendix E, are similar to the federal ARARs described above.

Comprehensive Environmental Response, Compensation and Liability Act

The CERCLA Off-Site Rule, 40 CFR 300.440, would be followed under all action alternatives to ensure that any wastes sent off-site are directed to a CERCLA "off-site compliant" and RCRA permitted and compliant facility.

Location-Specific ARARs: Restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations. The primary location-specific ARARs which could apply to actions at the site relate to wetlands and floodplains for surface waters, and EPA anticipates that all aspects of all action alternatives will comply with these ARARs.

TBCs:

The U.S. EPA Office of Groundwater has published Groundwater Classification Guidelines (GWCGs) which enable classification of all groundwater as Class I, II, or III, based on its use, value, and vulnerability. The ground water beneath the site would be classified as a Class II aquifer (current or potential source of drinking water). A Class II aquifer should be protected from contamination which might render the aquifer unusable or unacceptable as a source of drinking water. Therefore, contamination and degradation of the groundwater is unacceptable and should not be allowed to occur. The GWCGs are TBC for the site.

The U.S. EPA Environmental Criteria and Assessment Office has prepared the Integrated Risk Information System (IRIS) to provide health based and regulatory information on specific chemicals. IRIS provides chemical specific information which is utilized by U.S. EPA in risk calculations and development of health based cleanup goals and is a TBC. The RI and FS utilized IRIS values where appropriate. As presented in all action alternatives, the elimination of the direct contact threat by excavation and treatment or containment of contaminated materials would comply with the health based cleanup goals developed utilizing the IRIS database.

3. Long-Term Effectiveness and Permanence

Alternative 1 would not be effective over the short or long-term. Alternative 2, which provides for the off-site disposal of drummed wastes and other unsuitable wastes and relies on containment for contaminated soils, is expected to provide a high degree of reliable protection of human health and the environment over time. Alternatives which employ treatment and containment or removal of soils, in addition to the removal of drummed wastes and other solid wastes (3A, 3B, 4A, and 4B) are considered to provide a greater degree of reliable protection of human health and the environment over time. Alternatives 3B and 4B provide the greatest long-term effectiveness and permanence at the site since treated materials are disposed off-site.

4. Reduction of Contaminant Mobility, Toxicity, and Volume Through Treatment

Alternative 1 provides no treatment, so there is no reduction in contaminant toxicity, mobility, or volume (TMV) through treatment. Alternative 2 provides for a significant reduction in TMV through off-site treatment and disposal of drummed and other wastes which are unsuitable for on-site containment, as well as bioremediation of seep sediments. Alternatives which employ treatment and containment or removal of soils, drummed wastes,

and other solid wastes (3A, 3B, 4A, and 4B) will provide a greater reduction in TMV. Each treatment alternative would achieve essentially similar performance goals and standards. Treatment of the soils and other wastes will destroy most of the organic contaminants and will incorporate the inorganic contaminants in a matrix which greatly reduces their mobility and toxicity.

5. Short-Term Effectiveness

Alternatives 2, 3A, 3B, 4A, and 4B all require substantial soil excavation at the site. As a result, all will increase short-term exposure of human and environmental receptors to contaminants which are released through vaporization, surface water runoff, or fugitive dust emission. The excavation necessary on the north slope of the site for these alternatives will also have significant impacts on the plant and animal communities in this area. Measures necessary to minimize these impacts during site remediation and restoration activities are incorporated into these alternatives.

Alternative 2, which requires less excavation and does not require treatment of excavated soils, has a lesser potential for short-term effects than the other action alternatives since it can be completed in a shorter time frame and there will be no air emissions from treatment units.

Alternatives 3A, 3B, 4A, and 4B all require on-site treatment units which will have air emissions. However, engineering controls and the site safety plan requirements (including air monitoring) to be implemented during excavation and treatment activities will ensure that contaminant emissions meet ARARS, thus ensuring the safety of on-site workers and nearby residents. Alternatives 3B and 4B will also greatly increase truck traffic along the route used for transport of treated materials and may present exposure risks along the route if a spill or other release of these materials occurs.

6. Implementability

All action alternatives are expected to be technically feasible and administratively implementable. Alternative 2 would be the easiest and fastest to implement due to the need for less excavation, the lack of treatment for soils, and fewer administrative difficulties. Alternatives 3A, 3B, 4A, and 4B would all require either Delisting or a Treatability Variance for RCRA restricted soils and debris and as a result would be slightly more complex to administer. Alternatives 4A and 4B would also require the performance of treatability tests to confirm their anticipated technical feasibility. Alternatives 3B and 4B would be most complex to administer due to the need to dispose of treated materials off-site.

7. Cost

The No Action alternative would not entail any cost at the present time, but may result in the need for very costly remediation in the future. Alternative 3B is estimated to be the most

expensive alternative, followed by (from most to least expensive) Alternatives 3A, 4B, 4A, and 2. It is important to note that the estimated cost for Alternative 2 is only 30% of the cost of the least costly remedy which employs soil treatment, 4A. Cost estimates for Alternatives 3B, 3A, 4B, and 4A exceed the cost estimate for Alternative 2 by factors of 6.7, 6.1 , 4, and 3.5 (respectively).

8. State Acceptance

The State of Ohio supports the selected remedy discussed below.

9. Community Acceptance

Community acceptance of the alternatives was evaluated based on the comments received during the public comment period. The primary concern expressed by community members, especially nearby residents, was that the excavation and treatment of contaminated materials could pose a greater risk to their health than leaving the contaminants in place. As the Responsiveness Summary explains, U.S. EPA remains convinced that no action at the site would allow contaminants to continue to migrate off-site. In addition, site characteristics prevented the development of a containment remedy which does not require significant collection and consolidation of contaminated materials. The use of long-term or permanent institutional controls to limit exposure to contaminants via ground water consumption and direct contact with soils does not provide reliable protection of human health and the environment over time and is therefore not acceptable. Finally, U.S. EPA believes that the action alternatives can be implemented without significantly increasing the short-term risks or hazards for nearby residents from contaminant releases associated with soil excavation and treatment. Alternative 2, which minimizes the disturbance of wastes at the site and does not include on-site treatment while providing the necessary protection of human health and the environment, is the action alternative most closely aligned with the expressed community concerns.

Comments submitted by various PRPs found fault with many aspects of the RI, FS, and Proposed Plan. These comments are addressed in considerable detail in the Responsiveness Summary. Sections X and XI of this Record of Decision explain the modifications incorporated into the selected remedy to address concerns expressed in these comments. U.S. EPA maintains that the RI/FS and Proposed Plan were completed in accordance with CERCLA/SARA, the NCP, and Agency guidance available when the studies were completed, and that many of the comments resulted from misinterpretation of these documents and the investigation.

X. THE SELECTED REMEDY

U.S. EPA selects Alternative 2 for the remediation of the Vandale Junkyard site. The objectives of this remedial action are to achieve a total site risk of $1x10^{-6}$ or less for

carcinogens, a total site hazard index of 1 or less for noncarcinogens, and to meet all ARARs. U.S. EPA believes that this remedy meets the threshold criteria and provides the best balance of trade-offs among the alternatives with respect to the criteria used to evaluate remedies. Based on available information, U.S. EPA also believes that this remedy will protect human health and the environment by removing, treating, or containing all significant threats at the site, and thereby reducing human health risks and hazards, and environmental hazards, to acceptable levels.

This remedy will also comply with ARARs, will be cost-effective, and will utilize permanent solutions and alternative treatment technologies (such as bioremediation of sediments) to the maximum extent practicable. The selected remedy does satisfy the preference for treatment as a principle element.

The components of this remedial action are:

* Collection and consolidation of materials estimated at 9,000 cubic yards of soils and 8,900 cubic yards of solid wastes (including drummed wastes) containing organic and inorganic contaminants.

* Segregation of solid wastes, including drummed wastes, from soils.

* Off-site disposal of drummed materials, sludges, and other wastes which contain substances, especially hazardous wastes, not suitable for on-site containment.

* Screening of solid waste materials for salvageable materials. Salvageable materials will be decontaminated on-site and taken off-site for salvage.

* Consolidation of soils and non-salvageable solid wastes in areas on-site which exceed soils cleanup levels, followed by the construction of a cap meeting requirements for a RCRA Subtitle C hazardous waste landfill.

* In-place bioremediation of sediments in the seeps on the north slope which exceed cleanup levels for organic contaminants.

* Institutional controls necessary to ensure the integrity of the remedial action. Deed restrictions and fencing will be used to restrict site access as necessary to prevent the installation of drinking water wells in contaminated ground water and the disturbance of capped areas while cleanup levels are being achieved.

* Ground water and surface water/sediments monitoring program to confirm that the removal, treatment, and containment of source materials and the natural attenuation of residual contaminants allows the expeditious attainment of cleanup levels.

* Other Operation and Maintenance (O&M) requirements, including cap mowing, inspection, and repair.

Soil Collection and Consolidation:

Figure 17 provides the anticipated area for collection of soils which exceed cleanup levels. Sampling during remedial design and screening during remedial action will be necessary to confirm all areas where soils exceed cleanup levels. Cleanup levels are specified in Table 9. U.S. EPA believes it has conservatively estimated the volume of soils requiring collection for consolidation in the active areas of the site. Final soil volumes to be collected may be reduced significantly, but could also increase, based on this sampling.

Drummed Waste Disposal:

Off-site treatment and disposal will be necessary for drummed materials, sludges, and soils which are not suitable for containment under the cap. The following materials will be unsuitable for consolidation and containment:

- drums containing liquid industrial wastes, especially those which may be RCRA characteristic or listed wastes;
- drums or drum fragments containing solid industrial wastes, especially organic wastes such as solvents and tars and including any which may be RCRA characteristic or listed wastes;
- identifiable industrial sludges, especially those highly organic in composition, such as solvents and tars, and including those which may be RCRA characteristic or listed wastes; and
- soils visibly contaminated with industrial wastes, especially organic wastes such as solvents and tars and particularly those located near fragments of drums which may have contained RCRA characteristic or listed wastes.

These materials will be taken off-site and receive the level of treatment necessary to comply with all state and federal requirements prior to disposal at an approved facility.

Solid Waste:

Materials which are anticipated to be salvageable will consist primarily of scrap metal, household appliances, automobile parts and batteries, and empty drums. Salvage of these materials will recycle the metals and reduce the volume of waste requiring disposal as solid waste on-site. Decontamination by steam cleaning or other means may be necessary for materials to be taken off-site for salvage. Drums that contain or may have contained hazardous waste must be properly emptied per RCRA and Ohio EPA requirements (see OAC 3745-51-07) before they may be considered non-hazardous.

Capping:

Figure 17 shows the locations for consolidation of all materials to be capped on-site. Figure 18 provides a cross-section view of the cap to be required. Soils and other materials, including unsalvageable solid wastes, will be placed in two areas comprising approximately 3 acres on-site and capped with a RCRA Subtitle C multilayer cap.

U.S. EPA's recommended design for a cap and cover system which complies with RCRA Subtitle C requirements is a multilayer system consisting of, from bottom to top (or equivalent as approved by U.S. EPA):

> A low hydraulic conductivity geomembrane/soil layer consisting of 2 feet of compacted natural or amended soil with a hydraulic conductivity of $1x10^{-7}$centimeters per second or less overlain by a geomembrane layer with a minimum thickness of 20 mils (0.5 millimeters);
>
> A drainage layer consisting of at least 1 foot of material (typically sand) with a minimum hydraulic conductivity of $1x10^{-2}$centimeters per second, overlain by filter fabric to prevent clogging by fines; and
>
> A vegetation/soil layer consisting of at least 2 feet of soil, sloped at 3 to 5 percent, covered with vegetation to protect the drainage and lower levels from penetration and frost.

Sediments:

In-place bioremediation of seep sediments will be accomplished by adding nutrients and providing supplemental oxygen as necessary to speed the degradation of organic contaminants, while minimizing physical disturbance of the seeps. Bioremediation would be initiated after source removal activities are completed and is anticipated to require a maximum of five years.

Institutional Controls:

Deed restrictions will be used to prevent installation of drinking water wells and disturbance of capped areas until cleanup levels have been achieved. Fencing and other measures will be used to restrict site access until cleanup levels are achieved and as necessary to maintain the long-term reliability of the remedy.

Ground Water Monitoring:

A goal of this remedial action is to restore the ground water to its beneficial use, which at this site is to serve as a potential drinking water supply. Based on the information obtained during the RI and the analysis of all remedial alternatives, U.S. EPA believes that the

selected remedy will be able to achieve this goal. Ground water contamination may be especially persistent in the immediate area of the contaminant sources, where concentrations are relatively high. The ability to achieve the cleanup levels specified in Table 9 at all points throughout the site cannot be determined until all source removal activities are completed and ground water contaminant levels are monitored over time. Monitoring for ground water contaminants of concern will be conducted on a quarterly basis at a minimum of six locations for a thirty year period. This will include compliance with RCRA requirements, including at least 1 upgradient and 3 downgradient wells for the capped area in addition to other RCRA ground water monitoring requirements.

If the selected remedy fails to demonstrate expeditious progress toward meeting the specified remediation levels at any or all of the monitoring points, after the period of time established by U.S. EPA during remedial design, the contingency measures described in this section may replace the selected remedy and remediation levels for these areas. Such contingency measures will at a minimum include consideration of additional source removal activities, ground water extraction and treatment, and institutional controls. These measures are considered to protect human health and the environment, and may be technically practicable under the appropriate circumstances.

If it is determined, on the basis of the preceding criteria, that ground water in certain portions of the site is not being expeditiously restored to beneficial use, consideration will be given to the installation of a ground water extraction and treatment system where feasible. This system will be operated as long as progress is being made towards attainment of the specified cleanup levels. If even a limited application of such a system to speed the attainment of cleanup levels is found to be technically infeasible, or if after a reasonable amount of time even this activity fails to attain cleanup levels, then the following measures involving long-term management may occur, for a yet to be determined period of time:

> Engineering controls such as physical barriers or long-term gradient control provided by low level pumping, will be implemented as containment measures;
>
> Chemical-specific ARARs will be waived for the cleanup of those portions of the site based on the technical impracticability of achieving further contaminant reduction;
>
> Monitoring of specified wells will continue; and
>
> Remediation technologies for ground water restoration will be re-evaluated periodically.

The decision to invoke any or all of these measures may be made at any time, including a periodic review of the remedial action which will occur at five year intervals in accordance with CERCLA Section 121(c).

Surface Water and Sediment Monitoring:

The surface water and sediment monitoring program will be used to confirm that the removal of source materials and the natural attenuation of residual contaminants allows the attainment of cleanup levels, which are the more stringent of U.S. EPA's Ambient Water Quality Criteria or Ohio EPA's Water Quality Standards listed in Tables 10 and 11. Surface waters will be monitored quarterly for contaminants of concern until cleanup levels are attained. Six locations for surface water monitoring will be selected during remedial design. Sediments will also be monitored for contaminants of concern until cleanup levels are attained. Eight locations for sediment monitoring will be selected during remedial design and two locations will be monitored each quarter on a rotating basis so that each location is monitored annually. Sediments in seeps where active bioremediation is implemented will be monitored at least quarterly during active bioremediation. Sediment cleanup levels are the more stringent of the calculated sediment criteria presented in Tables 10 and 11. These criteria were developed to assure compliance with U.S. EPA's Ambient Water Quality Criteria and Ohio EPA's Water Quality Standards.

Detailed Cost Estimate:

Table 12 provides a breakdown of the cost estimate for Alternative 2. Operation and maintenance costs were estimated for a thirty year period. A discount rate of 5% percent before taxes and after inflation over a thirty year period was used for present worth calculations of capital and operating costs. This estimate is intended to represent -30% to +50% of the overall implementation costs for the selected remedy. The cap maintenance cost estimates described in Table 12 may be adjusted during remedial design to reflect the cost of one major cap repair in the event of cap failure during the O&M period.

XI. DOCUMENTATION OF SIGNIFICANT CHANGES

Section 117(b) of CERCLA requires that the final remedial action plan be accompanied by a discussion of any significant changes in the Proposed Plan. The Proposed Plan issued by U.S. EPA identified Alternative 4A as the preferred alternative for site remediation. In selecting a remedy for the Vandale Junkyard site, U.S. EPA has chosen Alternative 2 over Alternative 4A based on public comment and further consideration of the alternatives. In selecting Alternative 2 over Alternative 4A, U.S. EPA has carefully reviewed the balancing and modifying criteria as they relate to the identified action alternatives, all of which were developed to be protective of human health and the environment.

The Responsiveness Summary attached as Appendix A provides the comments received during the public comment period on the Proposed Plan and U.S. EPA's responses to the comments. These comments covered a broad range of issues relating to remedy selection, but a major focus of the comments from PRPs was the need for and type of soil treatment to be employed. The primary concern expressed by community members, especially nearby

residents, was that the excavation and treatment of contaminated materials could pose a greater risk to their health than leaving the contaminants in place.

As the Responsiveness Summary explains, U.S. EPA remains convinced that no action at the site would allow contaminants to continue to migrate off-site. In addition, site characteristics prevented the development of a containment remedy which does not require significant excavation and consolidation of contaminated soils. The use of long-term or permanent institutional controls to limit exposure to contaminants via ground water consumption and direct contact with soils does not provide reliable protection of human health and the environment over time and is therefore not acceptable. Finally, U.S. EPA believes that the selected remedy can be implemented without significantly increasing the short-term risks or hazards for nearby residents from contaminant releases associated with soil excavation and treatment. Alternative 2, which minimizes the disturbance of wastes at the site and does not include on-site treatment while providing the necessary protection of human health and the environment, is the action alternative most closely aligned with the expressed community concerns.

Soil Treatment vs. Containment

Treatment of soils at the site, while desirable and preferred under CERCLA, is difficult and expensive due to the nature of the site soils and the extensive contamination with organic and inorganic contaminants. Much of the site contamination is anticipated to be at relatively low levels -- above the cleanup levels but below levels at which treatment is cost-effective. In addition, the need for separate treatment technologies for organic and inorganic contaminants in soils significantly increases costs. Finally, the treatment for inorganic contaminated soils is only capable of immobilizing the contaminants, which necessitates long-term containment of the treated soils. Cap maintenance and related activities are significant costs which must be borne regardless of the degree of treatment provided to the contained materials.

Cleanup Levels

U.S. EPA is also making an adjustment to the method for determining cleanup levels for soils and water. The cleanup levels listed in Table 9 were developed to assure that after remediation the cumulative total site risk for carcinogens would not exceed $1x10^{-6}$ and that the cumulative total site hazard index for noncarcinogens would not exceed 1. Since there are a large number of contaminants of concern at the site, this resulted in very low calculated cleanup levels for individual contaminants. In order to promote flexibility in assessing remediation needs, particularly for soils excavation, the selected remedy provides that individual contaminant cleanup levels may be adjusted by U.S. EPA provided that the total site risk remains less than $1x10^{-6}$ and total site hazard does not exceed 1.

In addition, soil cleanup levels for the protection of ground water were calculated on a theoretical basis using an equilibrium partitioning methodology, and with no allowance for dilution and attenuation of contaminants as they migrate through soils or ground water. This

method is a conservative approach that may overestimate the actual transfer of contaminants from soils to ground water. The selected remedy provides the flexibility to conduct leachability tests on site soils to determine soil cleanup levels needed to assure compliance with ground water cleanup levels during remedial design. Site-specific leachability tests must be reliable and accurate and utilize a methodology approved by U.S. EPA before conducting such tests.

Finally, the cleanup level for vinyl chloride in ground water has been lowered to reflect the more sensitive detection limit readily available. This new cleanup level, 0.5 ug/liter, was achieved in the residential well samples collected at the site and is low enough to assure compliance with the U.S. EPA Maximum Contaminant Level drinking water standard for vinyl chloride.

Conclusion

Alternative 2, as described in Section X of this ROD, is the U.S. EPA final remedial action plan for the Vandale Junkyard site. Alternative 2 was presented in the Proposed Plan, and the selection of Alternative 2 could have been reasonably anticipated based upon the RI/FS, Proposed Plan, and the other contents of the Administrative Record for the site, particularly since this selection was responsive to public comments.

XII. STATUTORY DETERMINATIONS

CERCLA Section 121(b)(1) (Cleanup Standards) states that, "remedial actions in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants is a principle element, are to be preferred over remedial actions not involving such treatment. The off-site transport and disposal of hazardous substances or contaminant materials without such treatment should be the least favored alternative remedial action where practicable treatment technologies are available." Section 121 of CERCLA also requires that the selected remedy be protective of human health and the environment, comply with ARARs unless a statutory waiver is justified, cost effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The following sections discuss how the selected remedy meets these statutory requirements.

1. Protection of Human Health and the Environment

The selected remedy provides a sufficient degree of overall protection of human health and the environment, by treating, disposing off-site, and/or containing all source materials in excess of the cleanup levels and eliminating further ground water, surface water, and surface water sediment contamination. Institutional controls will be implemented during remediation to assure protection until confirmation sampling and analyses indicate that all cleanup levels have been achieved and as necessary to protect the effectiveness of the remedy.

Any short term risks associated with excavation of contaminated materials (dust generation and contaminant vaporization) will be minimized by the use of good construction practices. Air monitoring will be conducted during remedial action to assure compliance with all ARARs and other specified air quality standards.

2. Attainment of ARARs

The selected remedy will attain all Federal and State ARARs. Section IX of this Record of Decision provides an overview and description of the potential ARARs and the requirements which significantly impact the remedy are summarized here. The primary chemical-specific ARARs are the Safe Drinking Water Act MCL/MCLG standards for drinking water, Clean Water Act water quality criteria and standards for surface waters, and Clean Air Act standards for fugitive emissions.

The primary action-specific ARARs are RCRA Land Disposal Restrictions (LDRs) at 40 CFR Part 268, RCRA hazardous waste management unit closure requirements at 40 CFR Part 264, and the CERCLA Off-Site Rule at 40 CFR 300.440. Compliance with RCRA will be achieved through consolidation within the Area of Contamination and containment within a RCRA Subtitle C cap. Compliance with the Off-Site Rule will be assured by sending any wastes off-site to a CERCLA “off-site compliant” and RCRA permitted and compliant facility.

The primary location-specific ARAR for the selected remedy relates to the protection of wetlands at the site, as the site is not located in a floodplain. Compliance will be assured by minimizing physical disturbance of the seep wetlands which have developed on the north slope of the site during soil and solid waste removal activities and during bioremediation activities in the seeps.

Regarding application of State ARARs for the selected remedy, it is important to note that when State ARARs are substantially equivalent to Federal ARARs, deference is generally given to the Federal ARARs. The primary State ARARs for this site relate to the Ohio hazardous waste rules, e.g., Management of Hazardous Wastes (OAC 3745-54), Closure and Post-Closure Requirements (3745-55), and Hazardous Wastes Restricted from Land Disposal (3745-59). Other State ARARs which apply to the selected remedy include, but are not limited to, Primary Contaminant Control, i.e., drinking water standards (3745-81), Air Pollution Control requirements (3745-15, 3745-17, and 3745-21), Recyclable Materials (3745-58), and Water Quality Standards (3745-1). The complete list of potential State ARARs for this site can be found in Appendix E of this ROD.

In addition, the selected remedy attains all Federal and State “To Be Considered” requirements. The primary TBCs include the U.S. EPA Groundwater Classification Guidelines and the Integrated Risk Information System, both of which were utilized in developing the selected remedy.

3. Cost-Effectiveness

The selected remedy provides overall cost-effectiveness because it utilizes a variety of on-site and off-site remedial measures to obtain a high level of protectiveness without the need to provide costly soil treatment. A high degree of permanence will be achieved by removing for off-site treatment and disposal those materials which are unsuitable for on-site containment and bioremediating organic contaminants in seep sediments, while containing contaminated soils and non-salvageable solid wastes on-site. Cap maintenance after on-site disposal of soils is required regardless of whether soils are treated or not treated, and the operations and maintenance costs for the selected alternative are no higher while the capital costs are estimated to be only 30% of the lowest cost alternative which includes treatment of soils. In addition, provisions for removal of all salvageable solid wastes prior to consolidation and capping will significantly reduce capping costs.

4. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

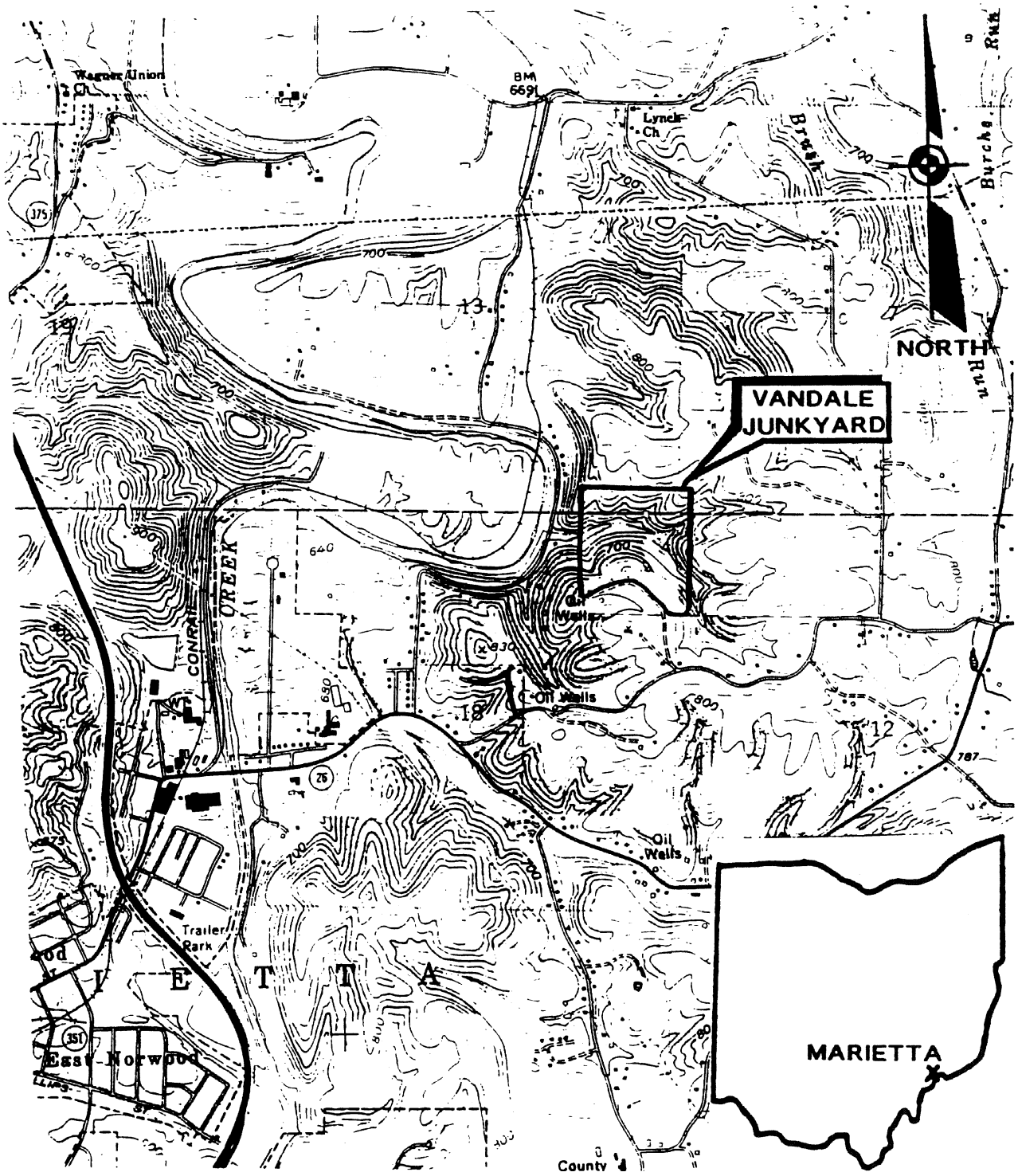
The selected remedy provides the best balance with respect to the nine evaluation criteria as described in Section IX of this Record of Decision. Alternative treatment technologies, including bioremediation of seep sediments, are utilized to the maximum extent practicable while maintaining cost-effectiveness. The presence of a large volume of soils contaminated with inorganic substances makes it cost-prohibitive to develop a remedy which does not require long-term containment, and the selected remedy attains a high degree of permanence as long as the cap is maintained. Although the remedy utilizes off-site disposal for some hazardous materials or wastes, the quantity of these wastes is estimated to be relatively small and the wastes will be treated prior to off-site disposal if appropriate. Resource recovery will be accomplished by segregating any salvageable solid wastes during excavation and decontaminating them as necessary prior to taking them off-site for disposal, thereby reducing the volume requiring on-site containment.

The ground water and surface water/sediment monitoring component of the selected remedial action will assess whether concentrations of contaminants decrease after implementation of the source control remedial action, and whether attainment and maintenance of cleanup levels is achieved. If these cleanup levels are not expeditiously attained then this remedy requires consideration of additional remedial measures which should ensure expeditious compliance.

5. Preference for Treatment as a Principal Element

The selected remedy eliminates the principal threats at the site through excavation of source materials in excess of the cleanup levels, off-site treatment (as necessary) and disposal of source materials unsuitable for on-site containment, on-site containment of contaminated soils and unsalvageable solid wastes, and bioremediation of organic contaminants in seep sediments.

FIGURES



SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET

M&E Metcalf & Eddy

LOCATION OF THE VANDALE JUNKYARD, WASHINGTON COUNTY, OHIO

Project Number 250066-0001

Figure 1

ADAPTED FROM USGS (1975)

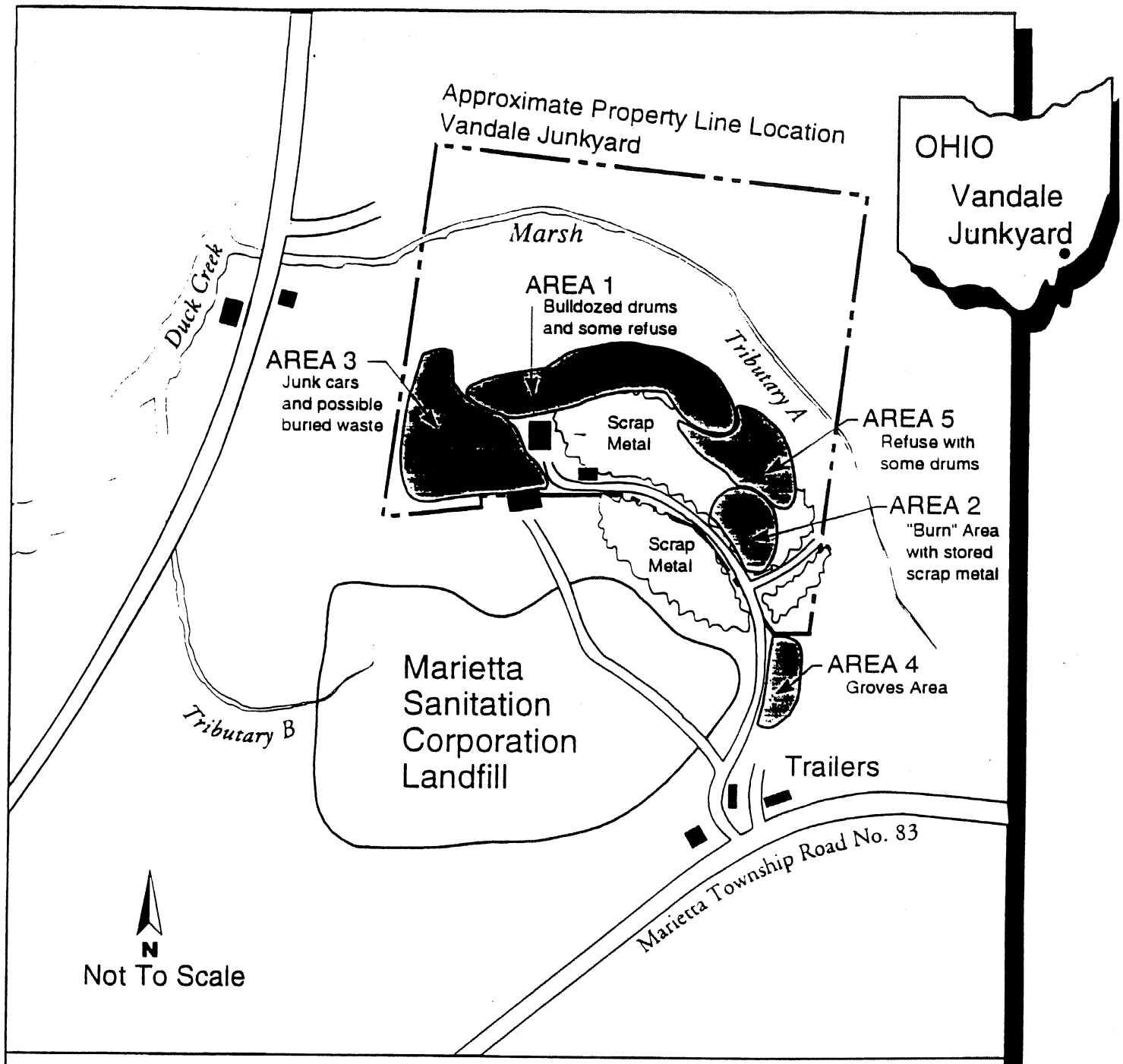
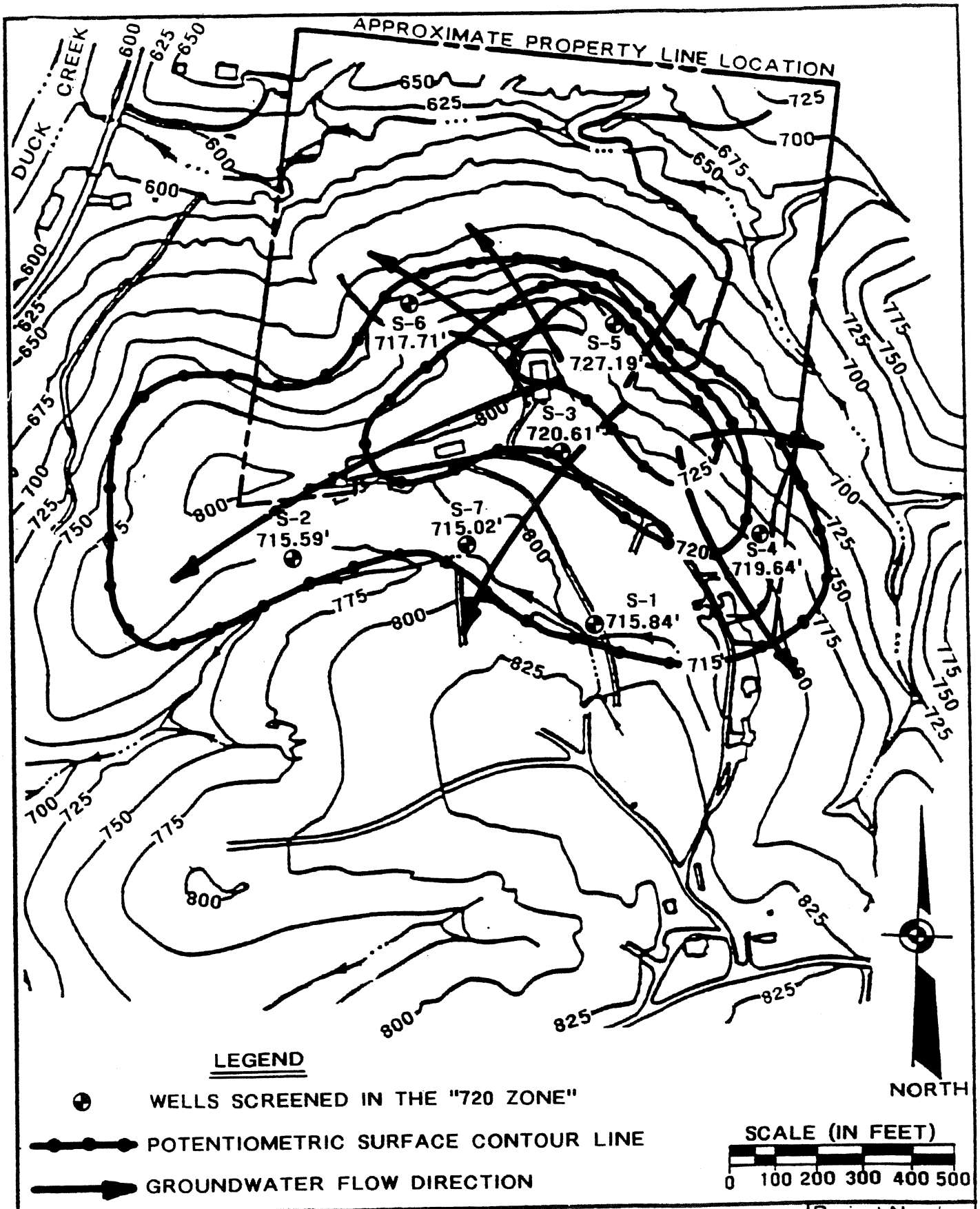
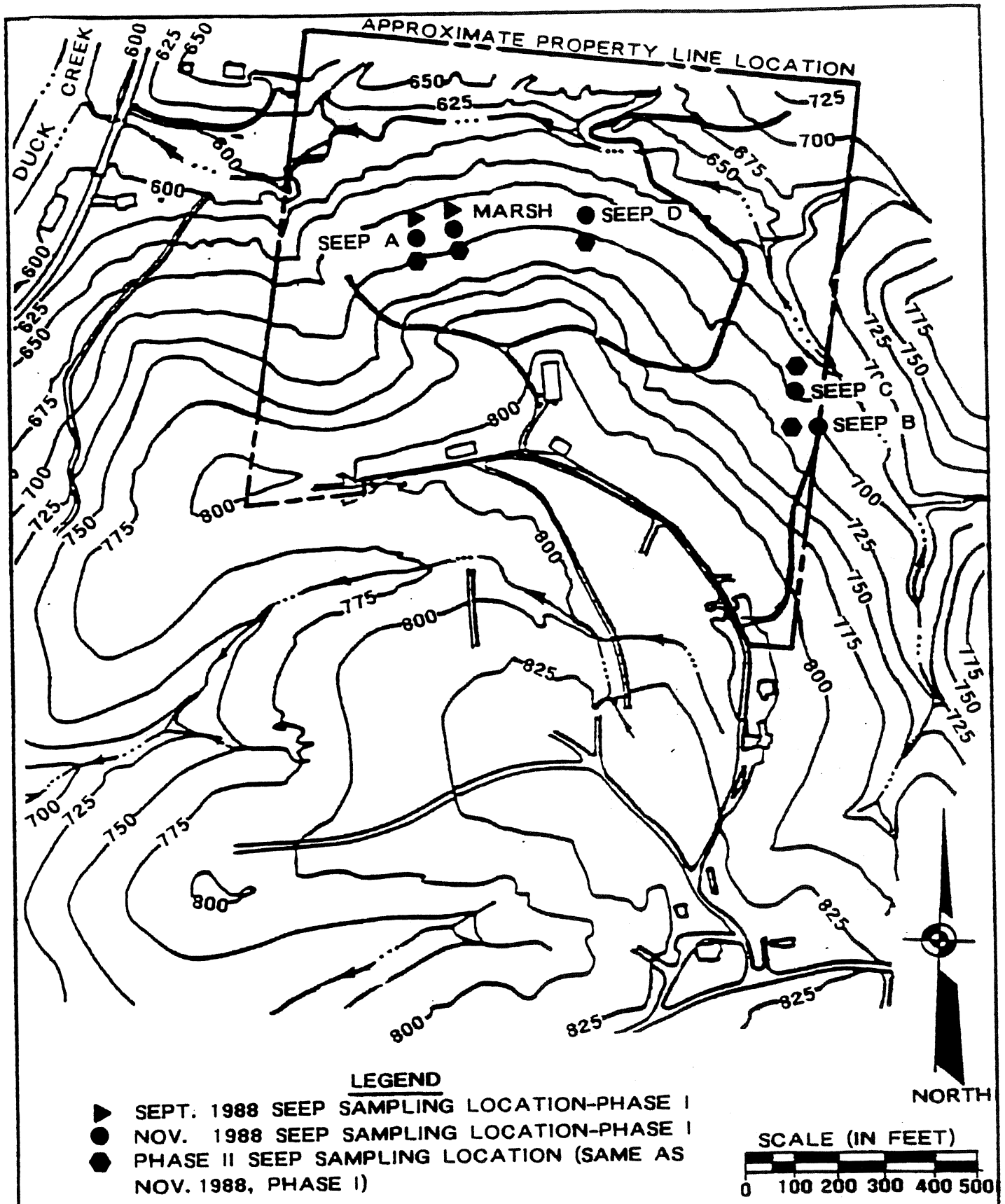


FIGURE 2
VANDALE JUNKYARD SITE



M&E Metcalf & Eddy	POTENTIOMETRIC SURFACE AND FLOW DIRECTIONS OF GROUNDWATER IN THE "720 ZONE"- VANDALE JUNKYARD RI	Project Number 250066-0001 Figure 3

ADAPTED FROM PHASE I RI

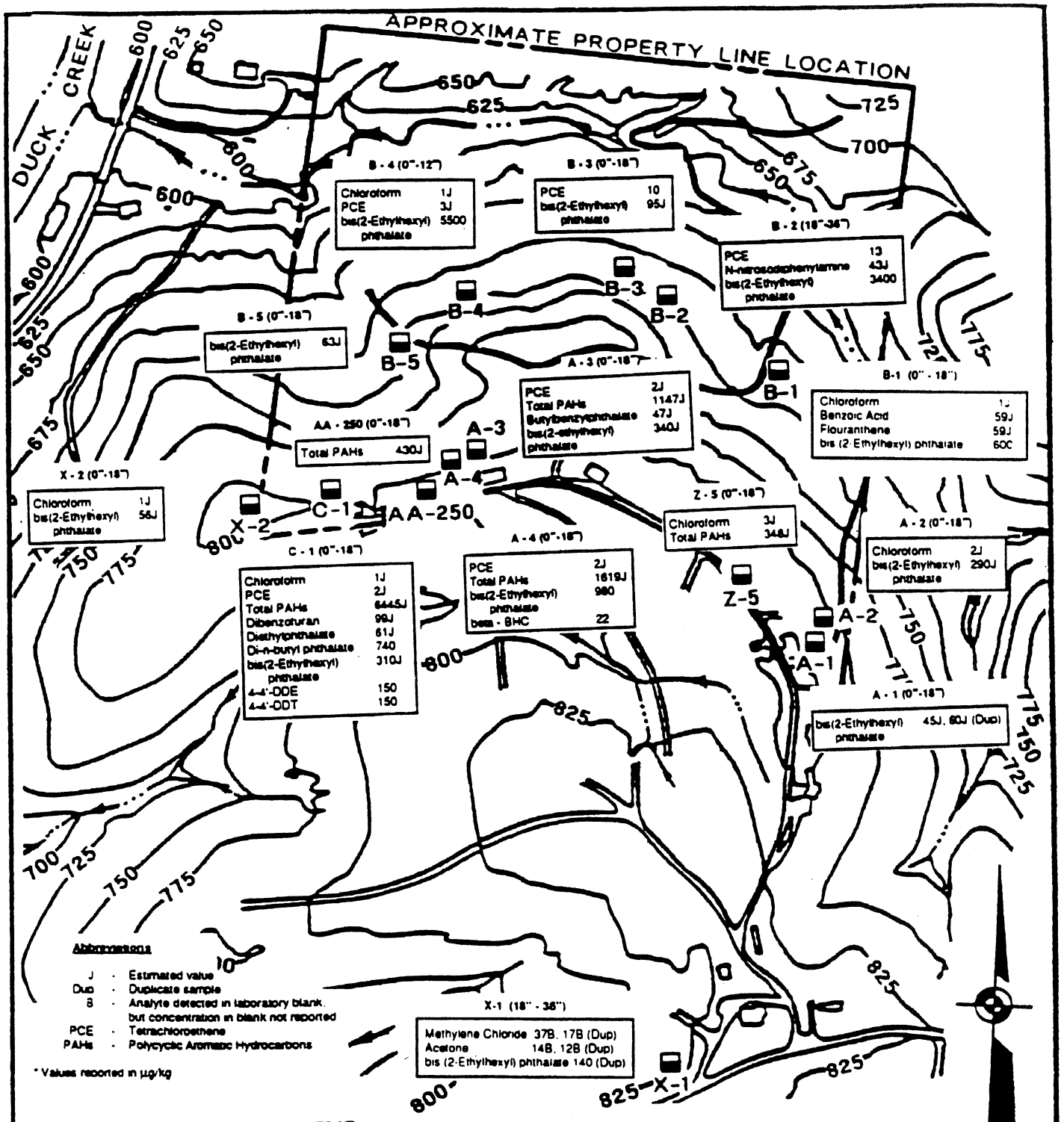


LEGEND

- ▶ SEPT. 1988 SEEP SAMPLING LOCATION-PHASE I
- ● NOV. 1988 SEEP SAMPLING LOCATION-PHASE I
- ⬢ PHASE II SEEP SAMPLING LOCATION (SAME AS NOV. 1988, PHASE I)

M&E Metcalf & Eddy	LOCATIONS OF AQUEOUS AND SEDIMENT SEEP SAMPLES-PHASE I AND II OF THE VANDALE JUNKYARD RI	Project Number 250066-0001 Figure 4

ADAPTED FROM PHASE I RI



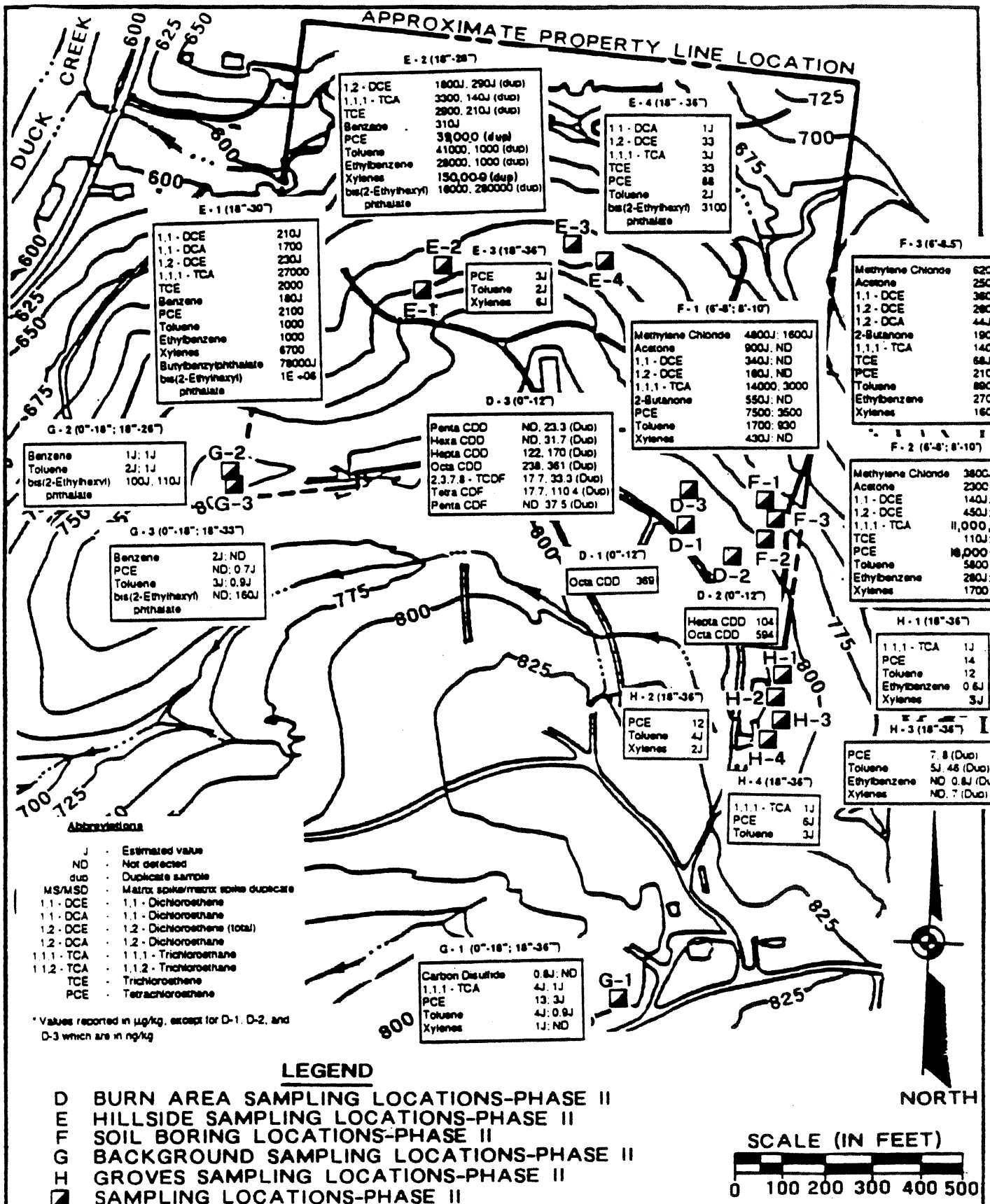
Metcalf & Eddy

AREAL DISTRIBUTION OF TCL ORGANIC CONSTITUENTS IN SHALLOW SOILS-PHASE I OF THE VANDALE JUNKYARD RI

Project Number 250066-0001

Figure 5

ADAPTED FROM PHASE I RI



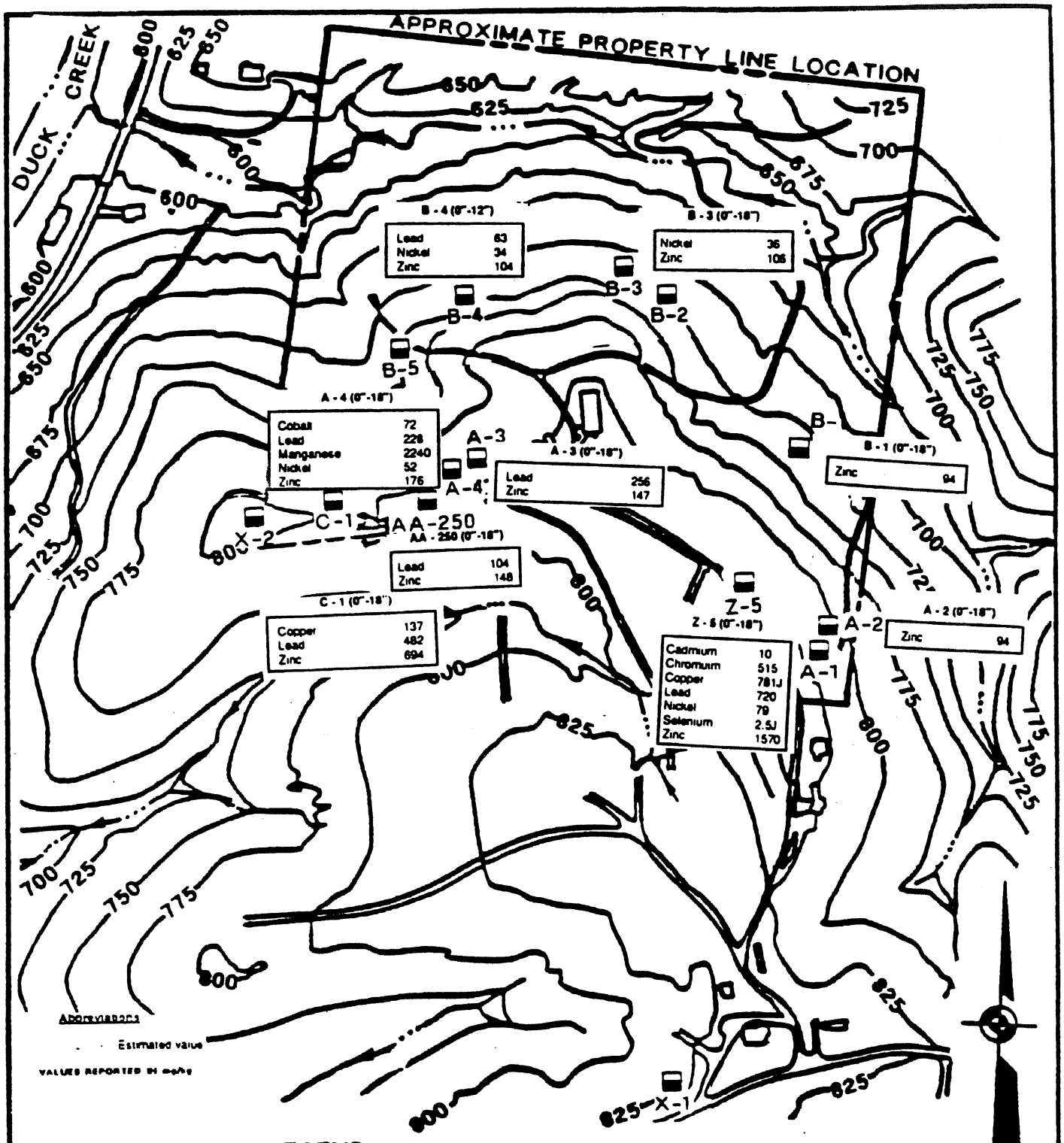
Metcalf & Eddy

AREAL DISTRIBUTION OF TCL ORGANIC CONSTITUENTS IN SOILS-PHASE II OF THE VANDALE JUNKYARD RI

Project Number 250066-0001

Figure 6

ADAPTED FROM PHASE I RI



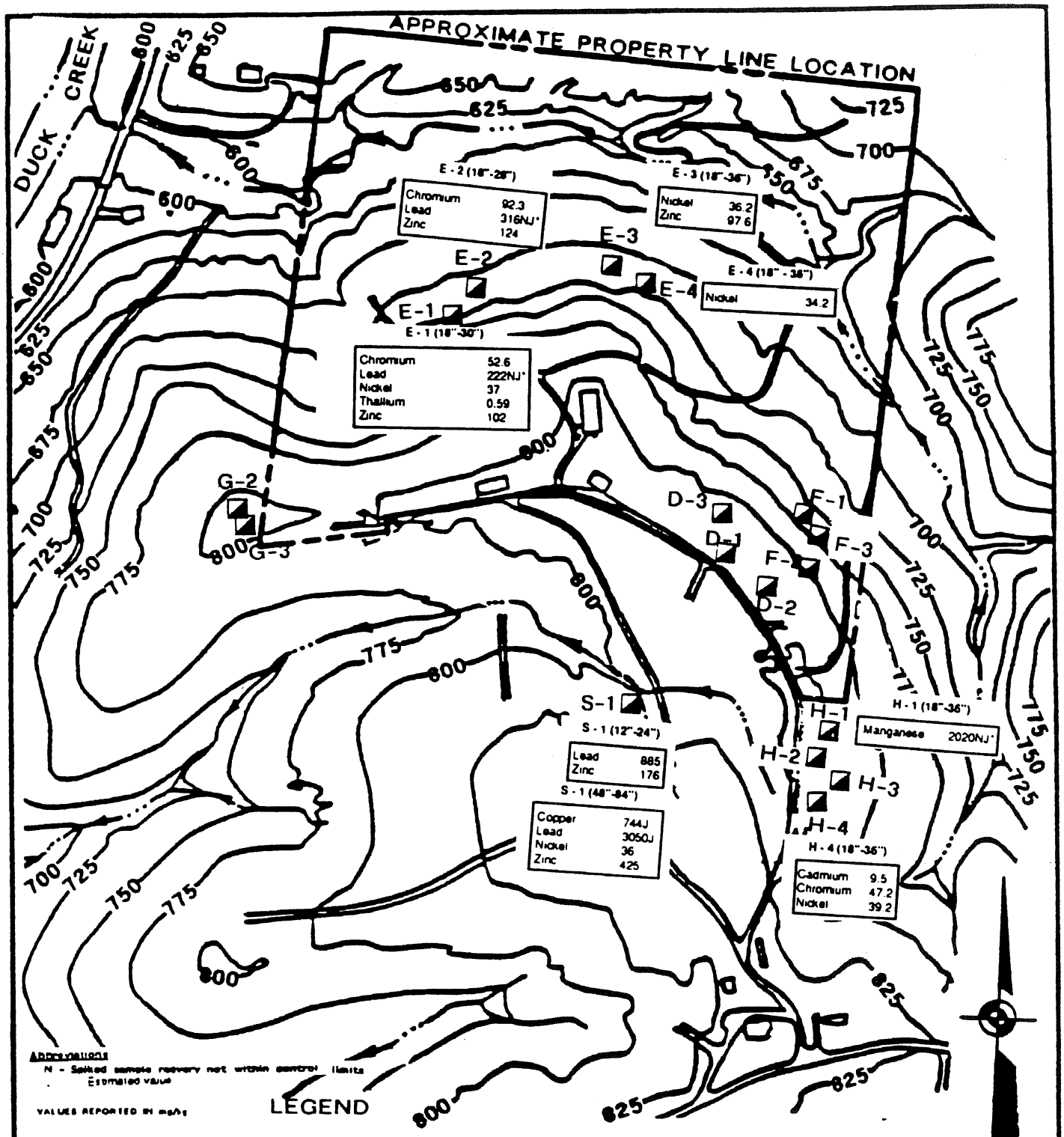
Metcalf & Eddy

AREAL DISTRIBUTION OF TAL METALS IN SHALLOW SOILS WHICH EXCEEDED SITE AND PUBLISHED BACKGROUND CONCENTRATIONS-PHASE I OF THE VANDALE JUNKYARD RI

Project Number 250066-0001

Figure 7

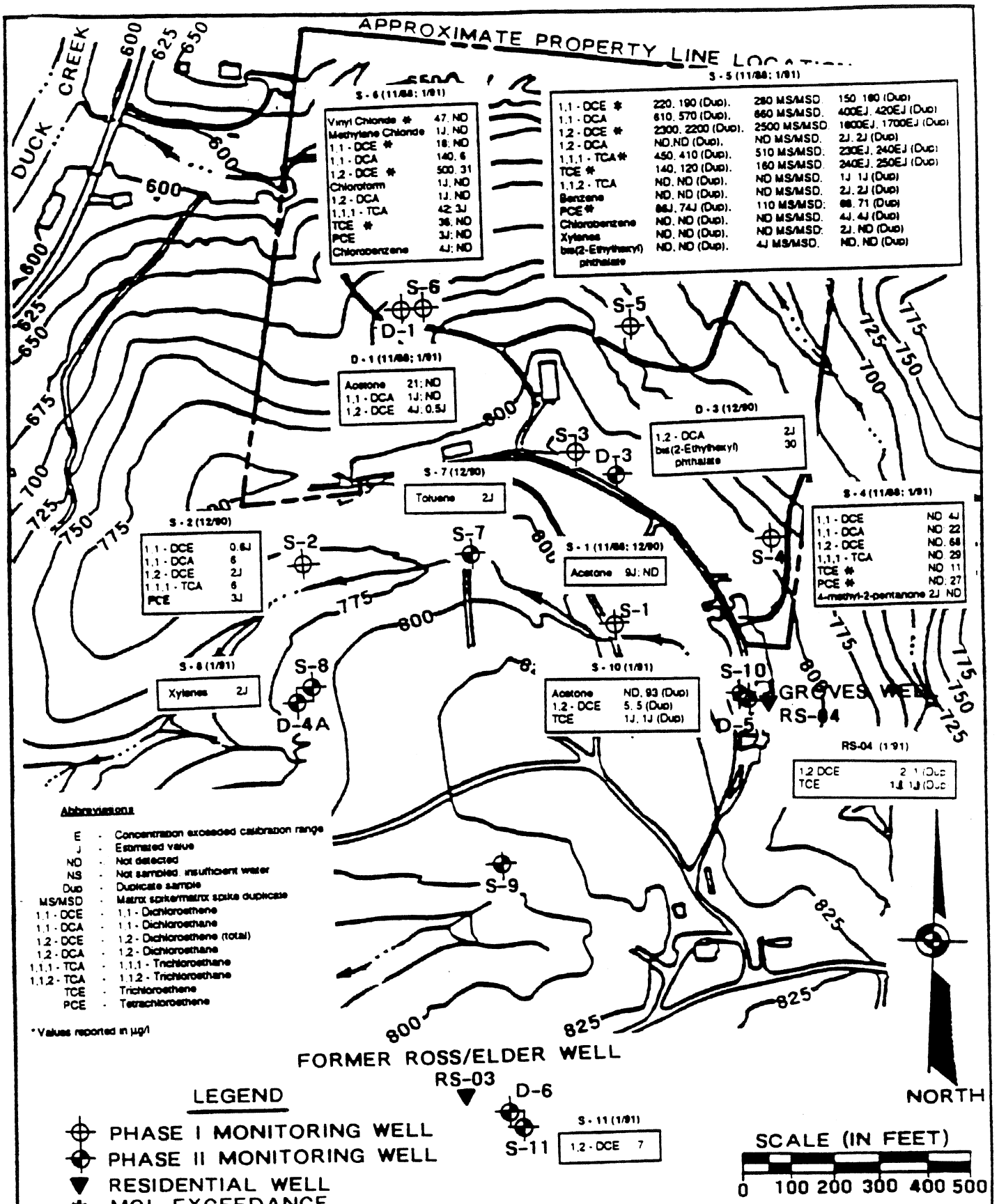
ADAPTED FROM PHASE I RI



D BURN AREA SAMPLING LOCATIONS-PHASE II
E HILLSIDE SAMPLING LOCATONS-PHASE II
F SOIL BORING LOCATIONS-PHASE II
G BACKGROUND SAMPLING LOCATIONS-PHASE II
H GROVES SAMPLING LOCATIONS-PHASE II
SAMPLING LOCATIONS-PHASE II

M&E Metcalf & Eddy	AREAL DISTRIBUTION OF TAL METALS IN SOILS WHICH EXCEEDED SITE AND PUBLISHED BACKGROUND CONCENTRATIONS PHASE II OF THE VANDALE JUNKYARD RI	Project Number 250066-0001
		Figure 8

ADAPTED FROM PHASE I RI



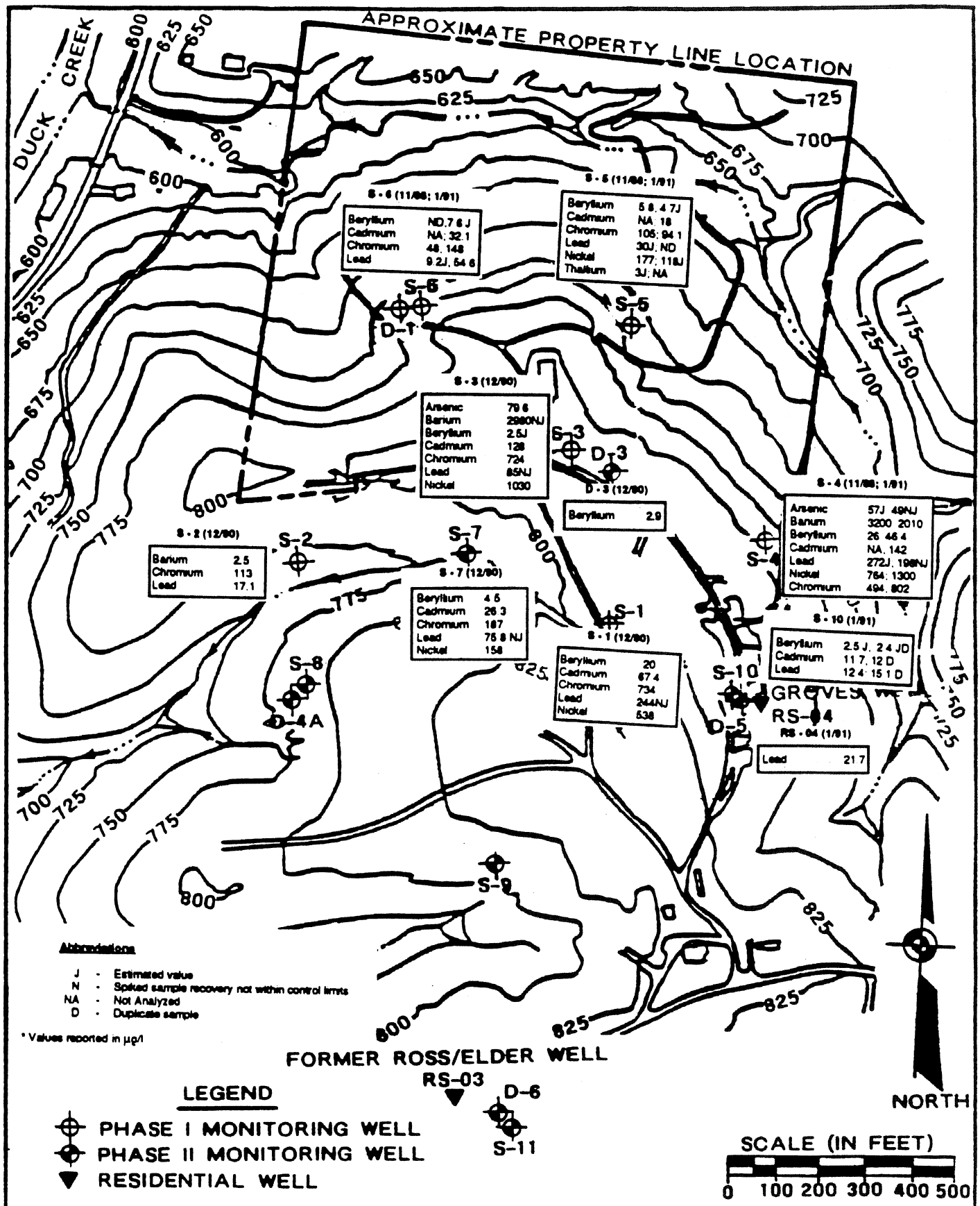
Metcalf & Eddy

AREAL DISTRIBUTION OF TCL ORGANIC CONSTITUENTS IN GROUNDWATER-PHASE I AND PHASE II OF THE VANDALE JUNKYARD RI

Project Number 250066-0001

Figure 9

ADAPTED FROM PHASE I RI



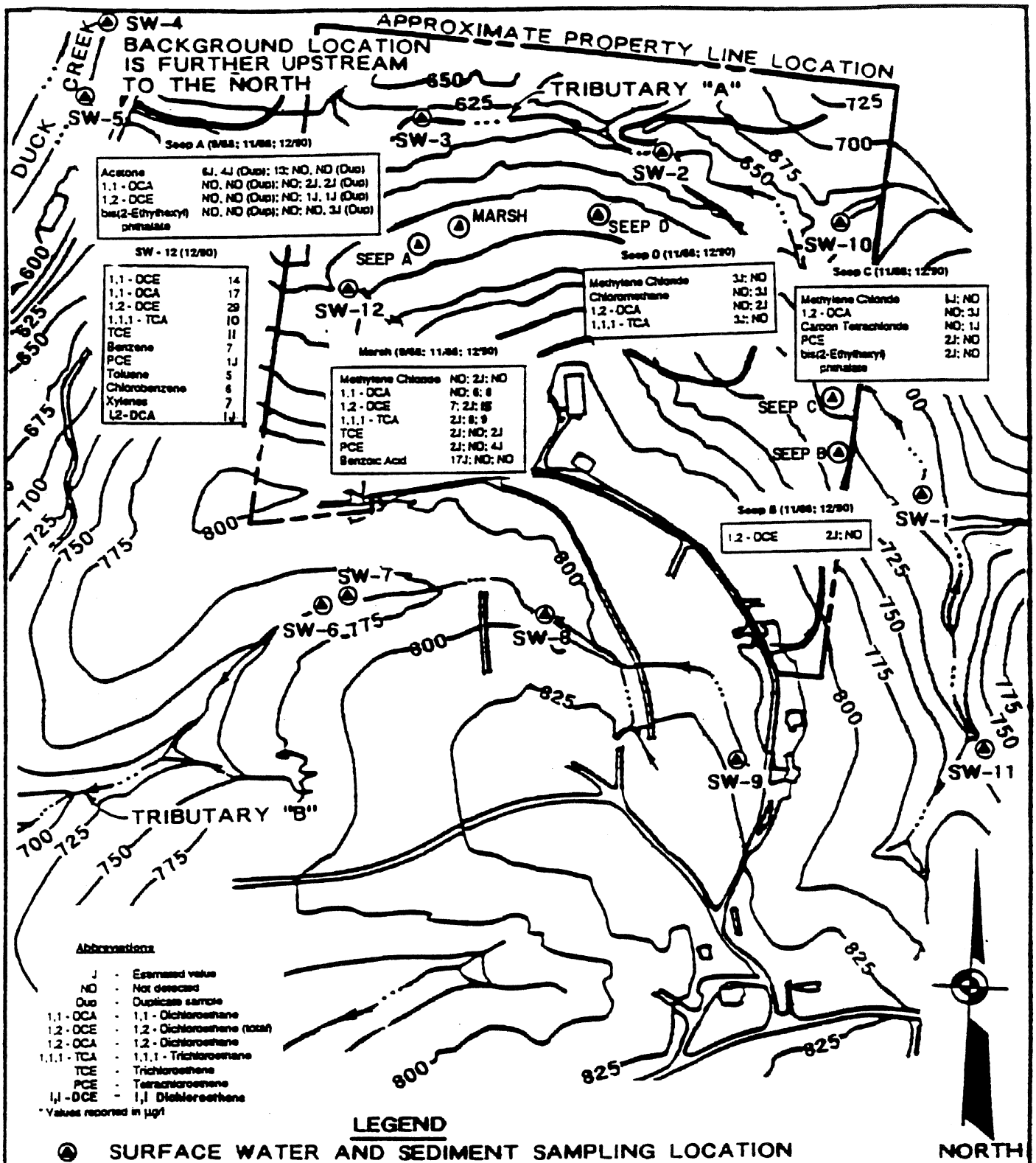
Metcalf & Eddy

AREAL DISTRIBUTION OF TAL METALS IN GROUNDWATER WHICH EXCEEDED MCLs-PHASE I AND II OF THE VANDALE JUNKYARD RI

Project Number 250066-0001

Figure 10

ADAPTED FROM PHASE I RI



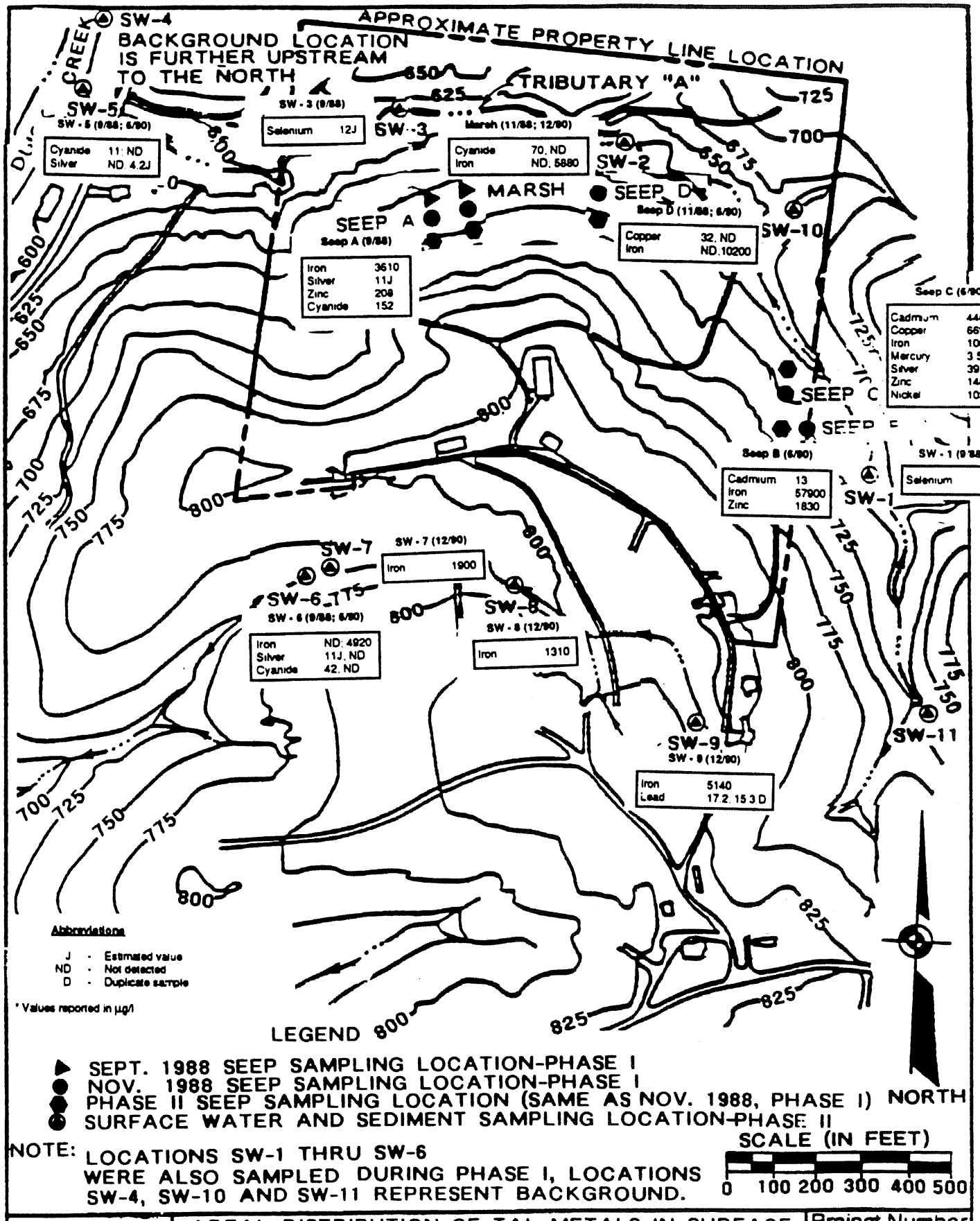
Metcalf & Eddy

AREAL DISTRIBUTION OF TCL ORGANIC CONSTITUENTS IN SURFACE WATERS/SEEPS-PHASE I AND PHASE II OF THE VANDALE JUNKYARD RI

Project Number 250066-0001

Figure 11

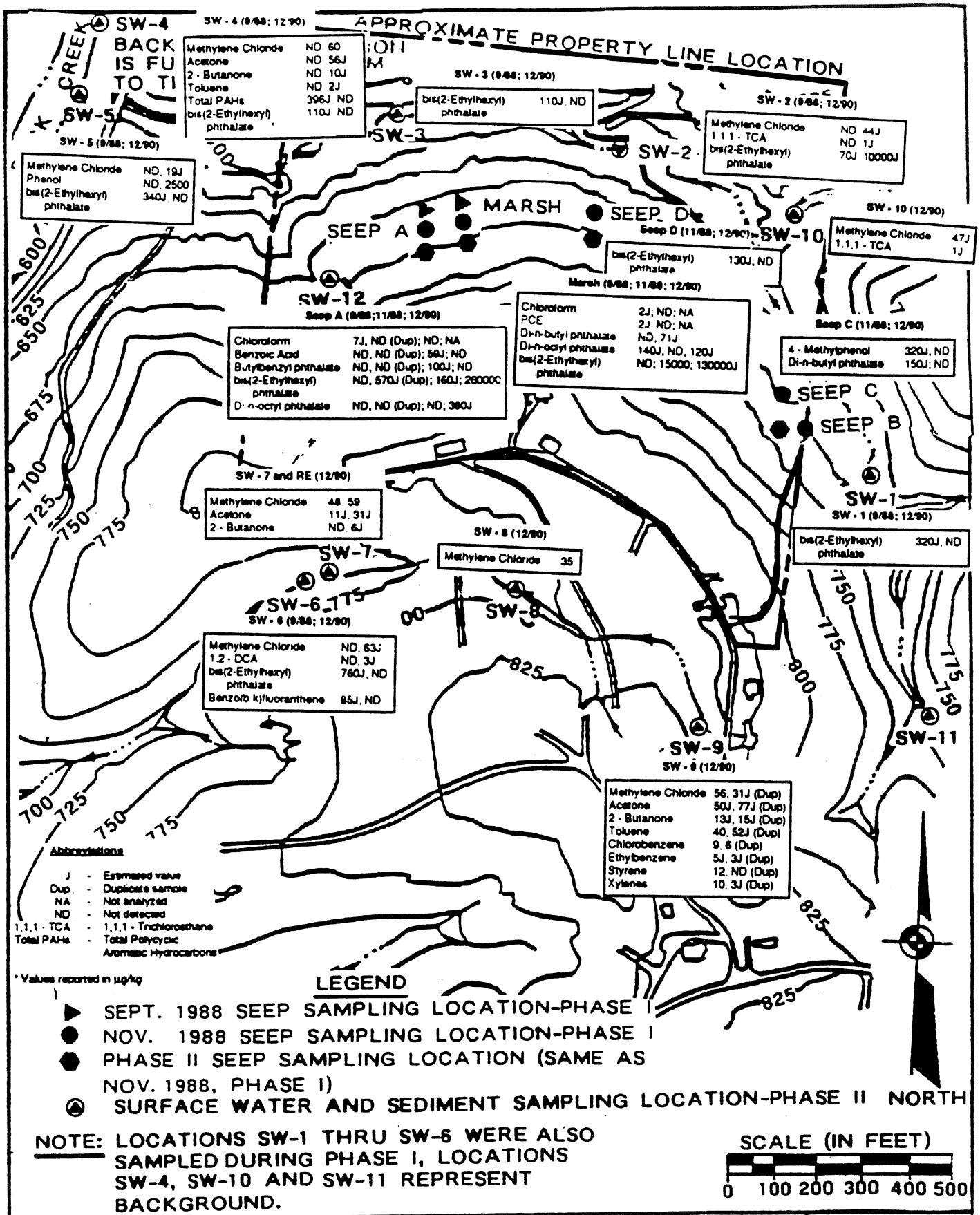
ADAPTED FROM PHASE I RI



NOTE: LOCATIONS SW-1 THRU SW-6 WERE ALSO SAMPLED DURING PHASE I, LOCATIONS SW-4, SW-10 AND SW-11 REPRESENT BACKGROUND.

Metcalf & Eddy	AREAL DISTRIBUTION OF TAL METALS IN SURFACE WATERS/SEEPS WHICH EXCEEDED AWQC AND/OR WQS VALUES - PHASES I AND II OF THE VANDALE JUNKYARD RI	Project Number 250066-0001 Figure 12

ADAPTED FROM PHASE I RI



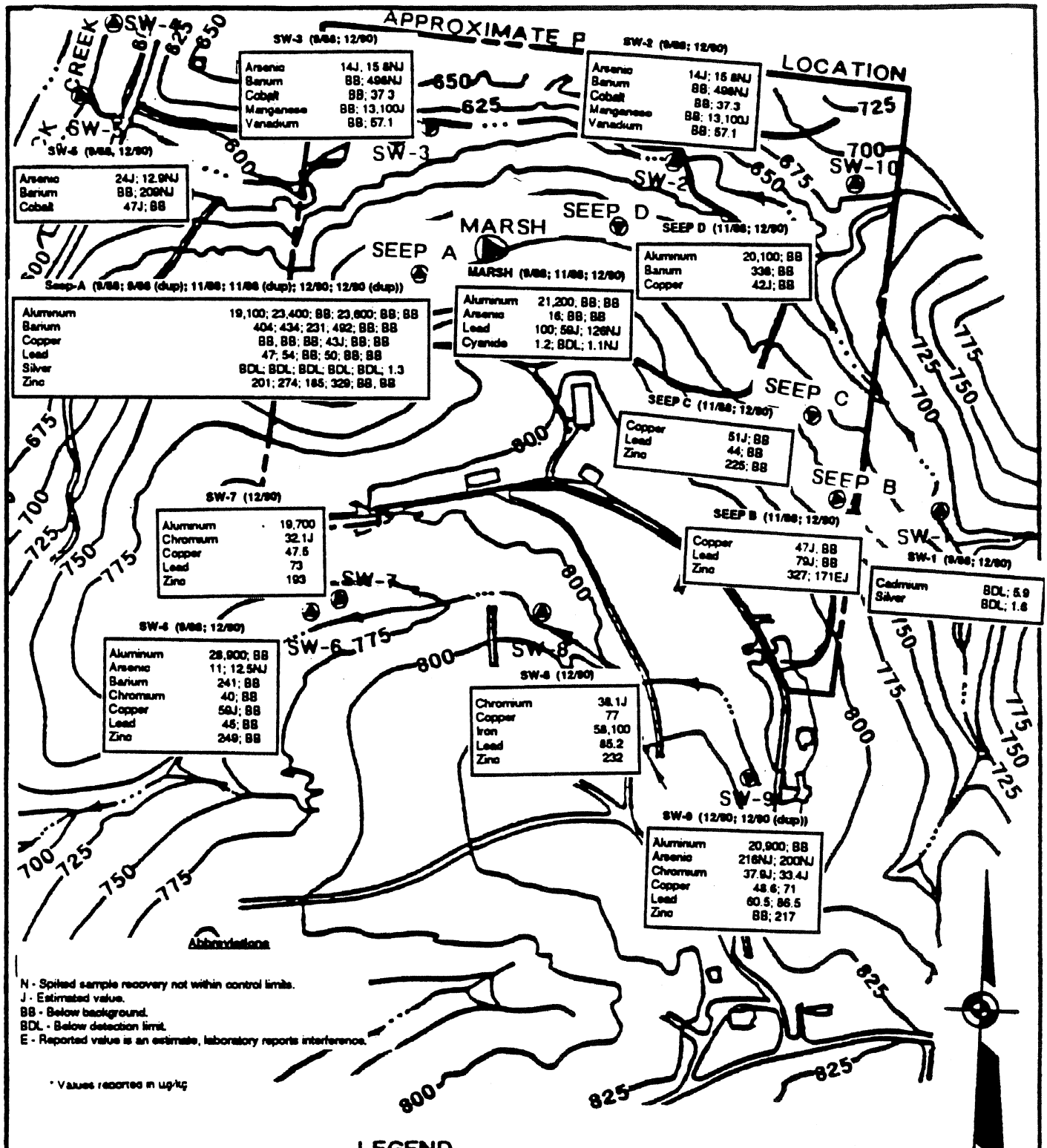
Metcalf & Eddy

AREAL DISTRIBUTION OF TCL ORGANIC CONSTITUENTS IN SURFACE WATER/SEEP SEDIMENTS - PHASES I AND II OF THE VANDALE JUNKYARD RI

Project Number 250066-0001

Figure 13

ADAPTED FROM PHASE I RI



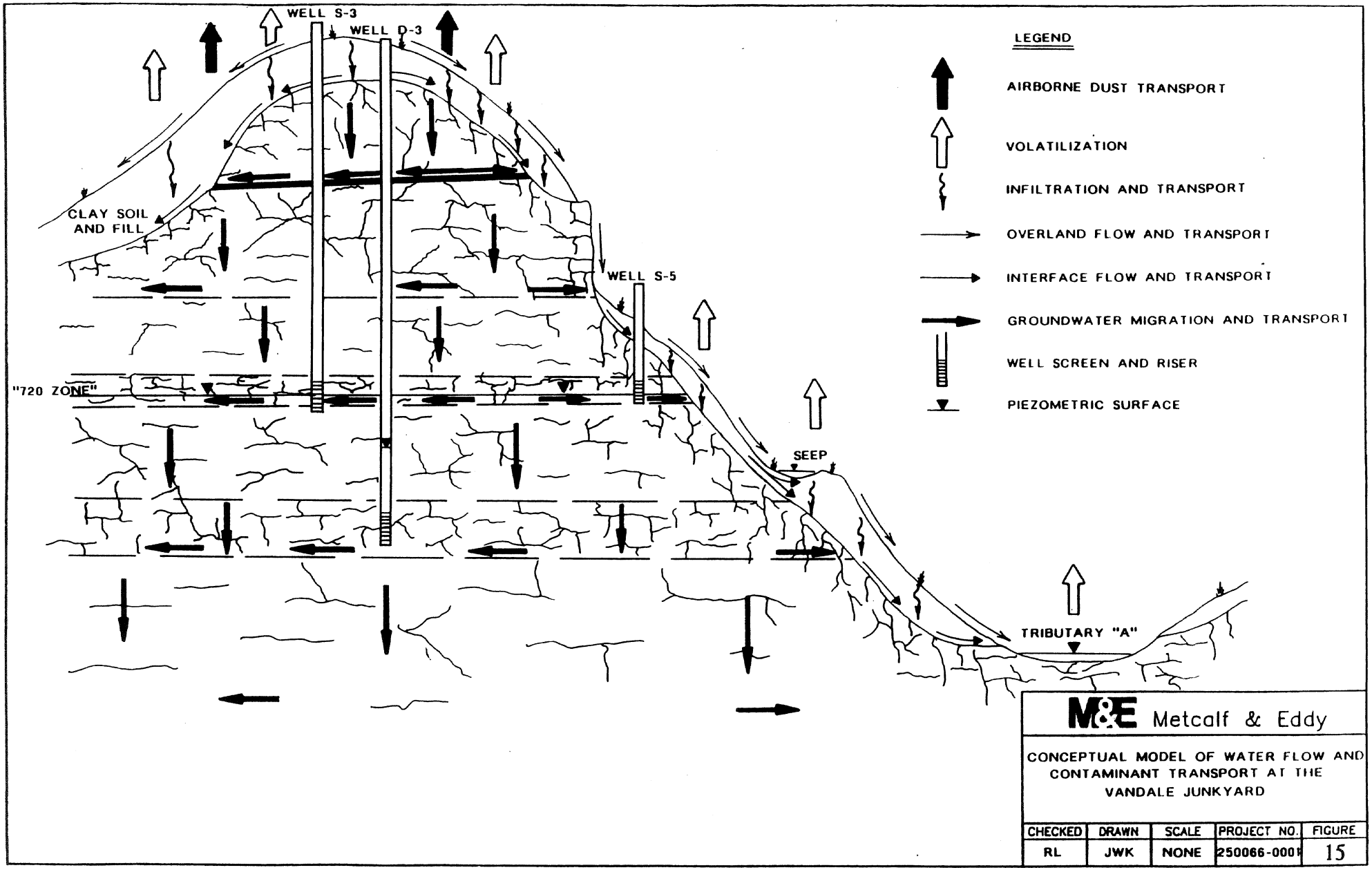
Metcalf & Eddy

AREAL DISTRIBUTION OF TAL METALS IN SURFACE WATER/SEEP SEDIMENTS WHICH EXCEEDED SITE BACKGROUND CONCENTRATIONS - PHASES I AND II OF THE VANDALE JUNKYARD RI

Project Number 250066-0001

Figure 14

ADAPTED FROM PHASE I RI

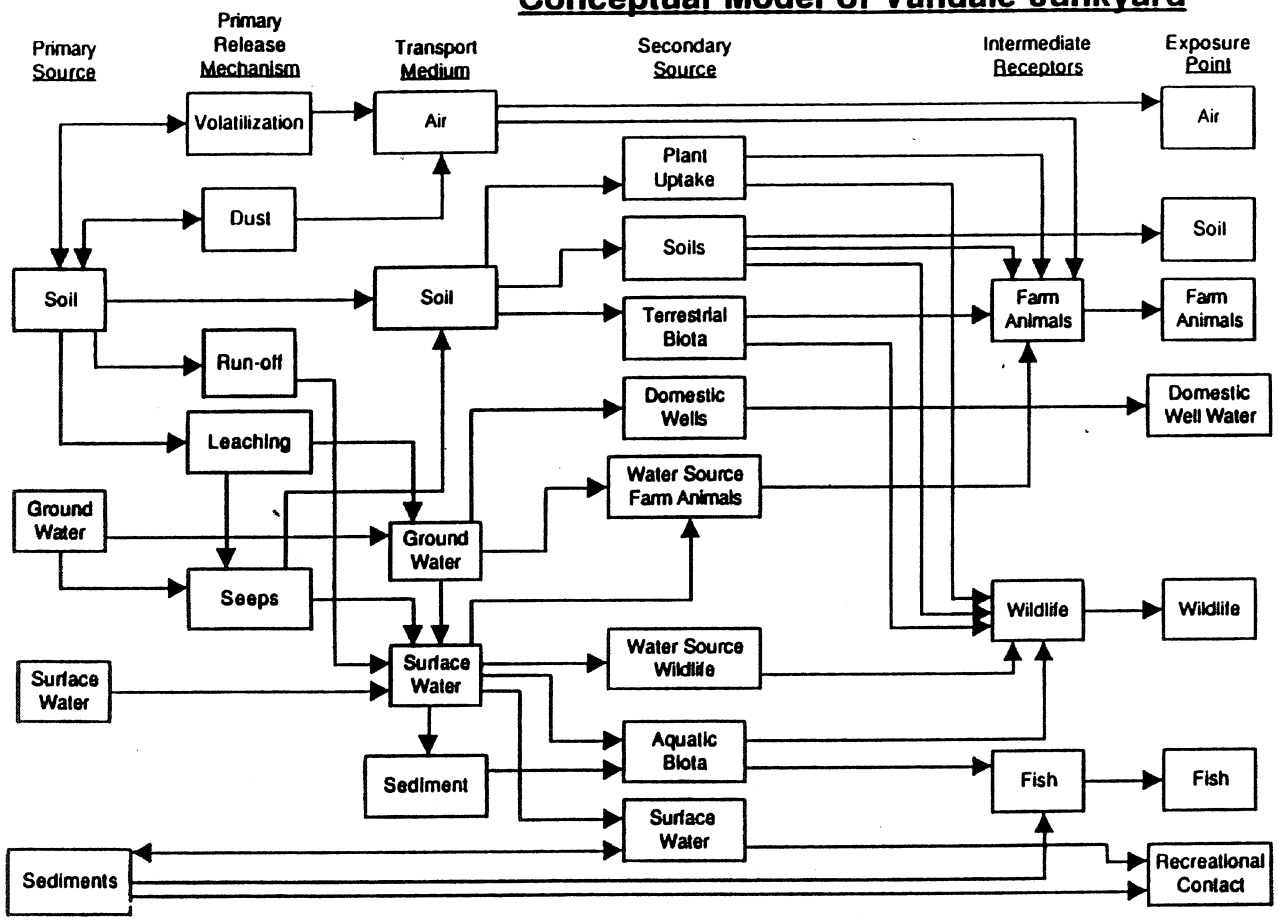


M&E Metcalf & Eddy

CONCEPTUAL MODEL OF WATER FLOW AND CONTAMINANT TRANSPORT AT THE VANDALE JUNKYARD

CHECKED	DRAWN	SCALE	PROJECT NO.	FIGURE
RL	JWK	NONE	250066-0001	15

Conceptual Model of Vandale Junkyard



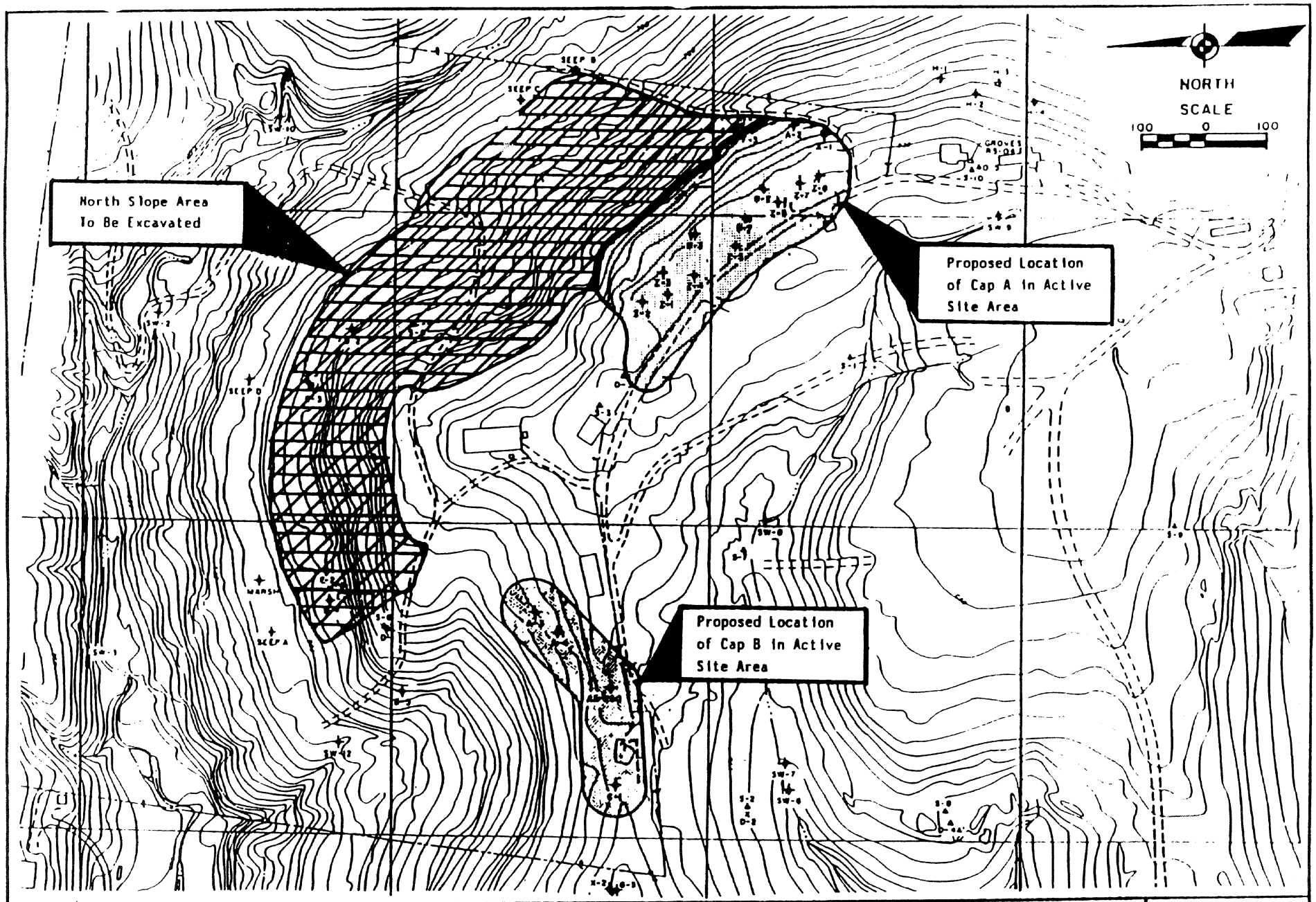
Route	Potential Receptors: Human, Existing	Human, Future	Ecological, Terrestrial	Ecological, Aquatic
Inhalation	X	X	X	
Ingestion	X	X	X	
Dermal contact	X	X	X	
Ingestion	X	X		
Ingestion	X	X		
Dermal contact	X	X		
Inhalation	X	X		
Ingestion	X	X	X	X
Ingestion	X	X	X	X
Dermal contact	X	X		

Metcalf & Eddy

CONCEPTUAL MODEL OF SOURCES, TRANSPORT MEDIUM AND POTENTIAL RECEPTORS OF CONTAMINANTS AT THE VANDALE JUNKYARD

Project Number 250066-0001

Figure 16

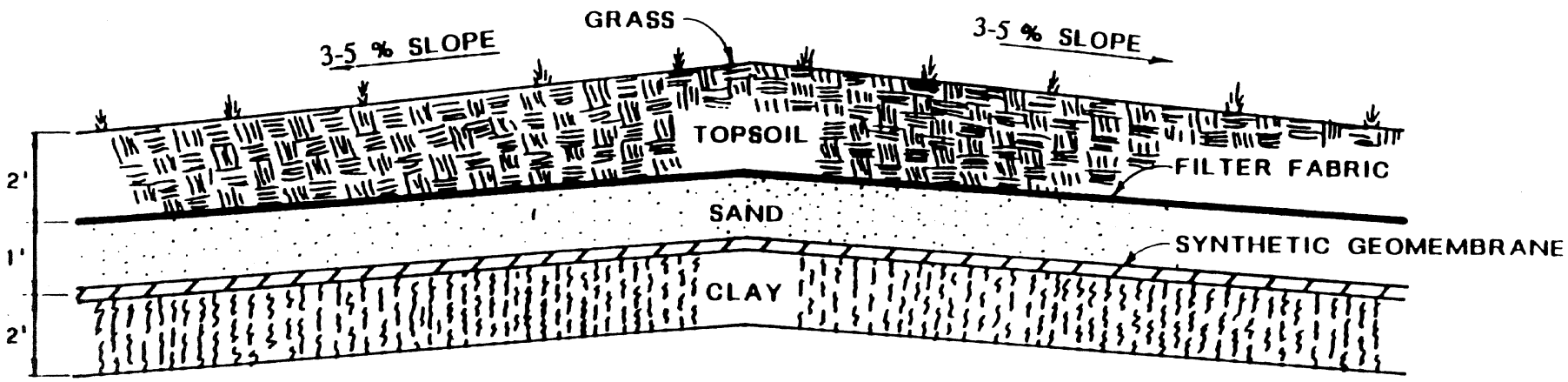


Metcalf & Eddy

DELINEATION OF NORTH SLOPE AREA TO BE EXCAVATED AND THE PROPOSED CAP LOCATIONS FOR THE VANDALE JUNKYARD ALTERNATIVE 2

Project Number
250066

Figure
17



CONTAMINATED SOILS

NO SCALE

M&E Metcalf & Eddy	TYPICAL CROSS-SECTION FOR THE ALTERNATE 2 CAP DESIGN	Project Number 250066
		Figure 18

TABLES

TABLE 1
PRINCIPLE ORGANIC CONTAMINANTS IN SOILS
VANDALE JUNKYARD SITE

Volatile Organic Compounds	**Concentration Range in ug/kg**		
1,1,1-Trichloroethane	ND	-	27,000
1,1-Dichloroethane	ND	-	1,700
1,1-Dichloroethene	ND	-	360*
1,2-Dichloroethene	ND	-	1,800
2-Butanone	ND	-	1,900
Trichloroethene	ND	-	2,900
Tetrachloroethene	ND	-	39,000
Benzene	ND	-	310*
Ethylbenzene	ND	-	28,000
Toluene	ND	-	8,900*
Xylenes	ND	-	150,000
Total VOCs	ND	-	266,300

Semivolatile Organic Compounds	**Concentration Range in ug/kg**		
Bis(2-ethylhexyl)phthalate	ND	-	1,000,000
Butylbenzylphthalate	ND	-	78,000*
Total PAHs	ND	-	6,445*

ND means not detected

*Estimated concentration

TABLE 2
Comparison of Inorganic Concentrations in Shallow and Borehole Soils
To Local and Published Ambient Conditions
Phase I and II Vandale Junkyard RI
(mg/kg)

Parameter	Range in Vandale On–Site Soil		Vandale Site Background Concentrations*	Published Ambient Concentrations#	Vandale Site Background Concentrations* Exceeded	Published Ambient Concentrations# Exceeded
	Min	Max				
Aluminum	12,100	25,200	9,810 - 21,000	20,000 - 65,000	Y	N
Antimony	ND	8.6J	ND	<150 - 500	Y	N
Arsenic	2J	50	1.6J - 9.5J	<0.2 - 73	Y	N
Barium	96	389	62 - 150J	90 - 520	Y	N
Beryllium	0.69	1.6	0.67 - 1.7	<2 - 2	N	N
Cadmium+	ND	10	ND - 8.2	0.2 - 0.4+	Y	Y
Calcium	904J	19,000	372 - 2,800	100 - 34,000	Y	N
Chromium++	23	515	25.9J - 44.9	5 - 20++	Y	Y
Cobalt	14.1	72	11.3 - 15.8	4 - 27	Y	Y
Copper+	18	781J	13.6 - 73.9	13 - 19+	Y	Y
Iron	25,500	64,100	21,500 - 56,400	7,700 - 130,000	Y	N
Lead+	13.5J	3050J	6.7J - 24.6	28 - 36+	Y	Y
Magnesium	2,660	5,240J	3,040 - 5,050	500 - 6,000	Y	N
Manganese	214J	2,240	169J - 1,480J	46 - 1,800	Y	Y
Mercury	ND	0.24	ND	0.01 - 3.4	Y	N
Nickel+	21	79	20.8 - 33.1	20 - 29+	Y	Y
Potassium+	ND	2,750	ND - 2,560	4,200 - 5,400+	Y	N
Selenium	ND	2.5J	ND	<0.1 - 1.4	Y	Y
Silver	ND	1.2	ND	<0.5 - 3	Y	N
Sodium	ND	875	ND - 170	200 - 13,000	Y	N
Thallium	ND	.59	ND	-	Y	-
Vanadium	25J	64.9	32.6 - 67	15 - 120	N	N
Zinc+	61.1	1,570	59.2 - 89.3	65 - 92+	Y	Y
Cyanide	ND	3.2	ND	-	Y	-

Notes:

ND = Not detected.

J = Estimated value

= Vandale ambient soil data obtained from locations X-1, X-2, G-1, G-2 and G-3.

N = Data Source: Connor and Shacklette, 1975; Al, Ba, Be, Ca, Co, Fe, Mg, Na, Th, V, and CN data from uncultivated soil from the A horizon in Kentucky: Sb, As, Hg and Se data from cultivated and uncultivated soil from the A horizon of the Eastern United States; and Ag data from cultivated soil from the A horizon of Missouri.

+ = Data Source: Logan and Miller, 1983; Cd, Cu, Pb, Ni, K and Zn data from 6 samples collected in Muskingum County, Ohio.

++ = Data Source: Logan and Miller, 1983; Cr data from 78 samples collected in Pickaway County, Ohio.

TABLE 3
PRINCIPLE CONTAMINANTS IN GROUND WATER
VANDALE JUNKYARD SITE

Volatile Organic Compounds	**Concentration Range in ug/1**
1,1,1-Trichloroethane	ND - 450
1,1-Dichloroethane	ND - 610
1,1-Dichloroethene	ND - 220
1,2-Dichloroethene	ND - 2300
Trichloroethene	ND - 250*
Tetrachloroethene	ND - 86*
Vinyl chloride	ND - 47

Semivolatile Organic Compounds,	**Concentration Range in ug/l**
Bis(2-ethylhexyl) phthalate	ND - 30

Metals	**Maximum Concentration in ug/l**
Arsenic	80
Barium	3200
Beryllium	46
Cadmium	128
Chromium	802
Lead	272*
Nickel	1300

ND means not detected

*Estimated concentration

TABLE 4

PARAMETERS DETECTED IN GROUNDWATER SAMPLES THAT EXCEED MAXIMUM CONTAMINANT LEVELS (MCLs) FOR DRINKING WATER VANDALE JUNKYARD RI

CHEMICAL	STATUS	MCL (mg/l)	S-1	S-2	S-3	S-4*		S-5*		S-6*		S-7	S-8	S-9	S-10	S-11	D-1	D-3	RS-01	RS-02	RS-03	RS-04
ORGANICS						I	II	I	II	I	II											
1,1-Dichloroethene	F	0.007						X	X	X												
1,1,1-Trichloroethane	F	0.2						X	X													
Trichloroethene	F	0.005					X	X	X	X												
Vinyl Chloride	F	0.002								X												
Tetrachloroethene	F	0.005					X	X	X													
(cis) 1,2-Dichloroethene	F	0.07						X	X	X												
(trans) 1,2-Dichloroethene	F	0.1						X	X	X												
INORGANICS (Metals)																						
Arsenic (As)	* *	0.05			X	X													X			
Barium (Ba)	P	2			X	X	X															
Beryllium (Be)	P	0.001	X	X	X	X	X	X	X		X	X	X	X	X	X		X				
Cadmium (Cd)	F	0.005	X		X		X		X		X	X	X	X	X	X						
Chromium (Cr)	F	0.1	X	X	X	X	X	X			X	X										
Lead (Pb)	F	0.015	X	X	X	X	X	X			X	X		X	X				X		X	X
Nickel (Ni)	P	0.1	X		X	X	X	X	X			X										
Thallium (Th)	P	0.002/0.001						X														

* Exceedences reported for both Phase I and Phase II results for Wells S-4, S-5, and S-6.

X = Concentrations of parameter exceeds MCL

F = Final

P = Proposed

** = Under review

TABLE 5

EXCEEDENCES OF
U.S. EPA AMBIENT WATER QUALITY CRITERIA (AWQC) AND
OHIO WATER QUALITY STANDARDS (WQS)
FOR INORGANIC CONSTITUENTS IN SURFACE WATERS*
VANDALE JUNKYARD RI

Sample	Acute U.S. EPA AWQC (1)		Chronic U.S. EPA AWQC (1)		Ohio WQS (max) (2)		Ohio WQS (30 day avg) (2)	
Location	Analyte	* * Limit (ug/l)	Analyte	* * Limit (ug/l)	Analyte	* * Limit (ug/l)	Analyte	* * Limit (ug/l)
SW-1							Se	5
SW-3							Se	5
SW-4			CN–	5.2			CN–	12
SW-5			CN–	5.2			Ag	1.3
			Ag	0.12				
SW-6	CN–	22	CN–	5.2			CN–	12
			Fe	1000			Fe	1000
			Ag	0.12			Ag	1.3
SW-7			Fe	1000			Fe	1000
SW-8			Fe	1000			Fe	1000
SW-9			Fe	1000			Fe	1000
(and dup)			Pb	12.82,(12.53)				
Seep A	CN–	22	CN–	5.2	CN–	46	CN–	12
(and dup)			Fe	1000	Ag	4.72	*Fe*	1000
					Zn	199,(148)	Ag	1.3
							Zn	180,(134)
Seep B			Cd	11.1	Zn	1358	Fe	1000
			Fe	1000			Zn	1230
Seep C	Hg	2.4	Cd	44.5	Cu	1993	Cd	54.7
			Cu	641	Hg	1.1	Cu	880
			Fe	1000	Zn	6016	Fe	1000
			Hg	0.012			Hg	0.2
			Ni	3332			Ag	1.3
			Ag	0.12			Zn	5449
			Zn	15,535				
Seep D			Cu	18.1	Cu	29.3	Cu	18.7
			Fe	1000			Fe	1000
Marsh	CN–	22	CN–	5.2	CN–	46	CN–	12
			Fe	1000			Fe	1000

* Only analytes which are exceeded by any Phase I and/or II samples are listed.
Please see Tables 5-19, 5-21, 5-28, and 5-29 for the analyte concentration for each location.
* * The limits for Cd, Cu, Pb, Ni, Ag, and Zn were calculated using the hardness of each respective sample.
No iron limits are established for acute AWQC or maximum WQS.
(1)U.S. EPA. 1987. Water Quality Criteria.
(2)Ohio EPA. Water Quality Standards, Chapter 3745-1 OAC.

TABLE 6
PRESENCE OF ORGANIC COMPOUNDS IN ENVIRONMENTAL SAMPLES - VANDALE RI

PARAMETER	Soil	Surface Water	Surface Water Sediment	Seep	Seep Sediment	Ground Water	Residential Wells
1,1,1-Trichloroethane	X	X	X	X	–	X	–
1,1,2,2-Tetrachloroethene	–	–	–	–	–	–	X
1,1,2-Trichloroethane	–	–	–	–	–	X	–
1,1-Dichloroethane	X	X	–	X	–	X	–
1,1-Dichloroethene	X	X	–	–	–	X	–
1,2-Dichloroethane	X	X	–	–	–	X	–
1,2-Dichloroethene (total)	X	X	–	X	–	X	X
2-Butanone (MEK)	X	–	X	–	–	–	–
2-Hexanone	–	–	–	–	–	–	X
Carbon Tetrachloride	–	–	–	X	–	–	–
Chlorobenzene	X	X	X	–	–	X	–
Chloromethane	–	–	–	X	–	–	–
4-Methyl-2-Pentanone (MIBK)	–	–	–	–	–	X	–
Tetrachloroethene	X	X	–	X	X	X	–
Trichloroethene	X	X	–	X	–	X	X
Vinyl Chloride	–	–	–	–	–	X	–
Acetone	X	X	X	X	–	X	–
Benzoic Acid	X	–	–	X	X	–	–
Carbon Disulfide	X	–	–	–	–	–	–
Chloroform	X	–	X	–	–	–	–
Methylene Chloride	–	–	X	–	–	–	–
Phenol	X	–	X	–	–	–	–
Benzene	X	X	–	–	–	X	–
Ethylbenzene	X	–	X	–	–	–	–
2-Methylnaphthalene	X	–	–	–	–	–	–
Naphthalene	X	–	–	–	–	–	–
Toluene	X	X	X	–	–	X	X
Xylenes	X	X	X	–	–	X	–
Styrene	–	–	X	–	–	–	X
Bis(2-ethylhexyl)phthalate	X	X	X	–	X	X	–
Butylbenzylphthalate	X	–	–	–	X		–
Di-n-butylphthalate	–	–	–	–	X	–	–
Diethylphthalate	X	–	–	–	–	–	–
Di-n-octylphthalate	X	–	–	–	X	–	–

X = Present
– = Absent
* = Not Sampled

TABLE 7

SUMMARY OF APPARENT CORRELATIONS BETWEEN

ELEVATED GROUNDWATER AND SOIL CONTAMINANTS

Wells S-3 and S-4 Boring Z-5		Well S-6 Boring E-1		Well S-4 Borings F-1, F-2, and F-3		Well S-5 Borings B-2 and E-4	
Elevated Groundwater Contaminants	Elevated Soil Contaminants	Elevated Groundwater Contaminants	Elevated Soil Contaminants	Elevated Groundwater Contaminants	Elevated Soil Contaminants	Elevated Groundwater Contaminants	Elevated Soil Contaminants
Wells S-3 and S-4	Boring Z-5	Well S-6	Boring E-1	Well S-4	Borings F-1, F-2, F-3	Well S-5	Borings B-2 and E-4
Arsenic	Arsenic	Vinyl Chloride		1,1-DCE	1,1-DCE	1,1-DCE	
Barium		1,1-DCE	1,1-DCE	1,1-DCA		1,1-DCA	1,1-DCA
Beryllium		1,1-DCA	1,1-DCA	1,2-DCE	1,2-DCE	1,2-DCE	1,2-DCE
Cadmium	Cadmium	1,2-DCE	1,2-DCE	1,1,1-TCA	1,1,1-TCA	1,2-DCA	
Chromium	Chromium	1,1,1-TCA	1,1,1-TCA	TCE	TCE	1,1,1-TCA	1,1,1-TCA
Lead	Lead	TCE	TCE	PCE	PCE	TCE	TCE
Nickel		PCE	PCE		Methylene Chloride	1,1,1-TCA	
		Chlorobenzene			2-Butanone	Benzene	
			BTEX		Toluene	PCE	PCE
					Ethylbenzene	Chlorobenzene	
					Xylenes	Xylenes	

TABLE 8
CONTAMINANTS OF CONCERN
VANDALE JUNKYARD SITE

Antimony
Arsenic
Barium
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Beryllium
Bis(2-ethylhexyl)phthalate
Cadmium
Chrysene
1,1-Dichloroethene
1,2-Dichloroethene
Indeno(1,2,3-cd)pyrene
Lead
Naphthalene
Nickel
Silver
Tetrachloroethene
Thallium
1,1,1-Trichloroethane
Vanadium
Vinyl Chloride

TABLE 9
CLEANUP LEVELS FOR VANDALE JUNKYARD SITE

Groundwater		
Substance	Cleanup Level (mg/L)	Type of Cleanup Level
Antimony	5.0E-03	MDL
Arsenic	8.8E-02	BG
Barium	3.02E-01	BG
Beryllium	5.0E-03	MDL
Bis(2-ethylhexyl)phthalate	1.0E-03	MDL
Cadmium	8.58E-03	BG
1,1-Dichloroethene	1.5E-03	MDL
1,2-Dichloroethene	0.10	HBC
Nickel	6.0E-02	HBC
Tetrachloroethene	1.5E-03	MDL
1,1,1-Trichloroethane	2.0E-02	HBC
Vanadium	4.0E-02	HBC
Vinyl Chloride	5.0E-04	MDL

Soil		
Substance	Cleanup Level (mg/kg)	Type of Cleanup Level
Antimony	1.2E+01	MDL
Arsenic	1.09E+01	BG
Barium	1.21E+02	BG
Benzo(a)anthracene	0.33	MDL
Benzo(a)pyrene	0.33	MDL
Benzo(b)fluoranthene	0.33	MDL
Benzo(k)fluoranthene	0.33	MDL
Beryllium	1.43	BG
Bis(2-ethylhexyl)phthalate	0.33	MDL
Cadmium	9.72	BG
Chrysene	0.33	MDL
1,1-Dichloroethene	5.0E-03	MDL
Indeno(1,2,3-cd)pyrene	0.33	MDL
Naphthalene	0.33	MDL
Nickel	3.6E+01	BG
Tetrachloroethene	5.0E-03	MDL
Thallium	2.0	MDL
Vanadium	7.04E+01	BG
1,2-Dichloroethene	6.0E-02	SRPG
1,1,1-Trichloroethane	3.0E-02	SRPG
Vinyl Chloride	1.0E-02	MDL
Lead	5.00E+02	HBC

BG = Background
MDL = Method Detection Limit
RBC = Risk Based Concentration
HBC = Hazard Based Concentration
SRPG = Source Removal for Protection of Ground Water

TABLE 10

SELECTED CHEMICAL-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS -- FEDERAL GOVERNMENT

	CWA Water Quality Criteria for Protection of Human Health		CWA Ambient Water Quality Criteria for Protection of Aquatic Life	
	Water and Fish Ingestion (mg/l)	Fish Consumption Only (mg/l)	Freshwater Acute/Chronic (mg/l)	Federal Sediment Standard (calculated)** (mg/kg)
Antimony	1.4E-02	4.3	9.0*/1.6*	8.0E+04
Arsenic	2.2E-06	1.8E-05	0.85*/4.8E-02*	0.24
Beryllium	7.7E-06	1.3E-04	0.13*/5.3E-03*	
Bis(2-ethylhexyl)phthalate	1.8E-03	5.9E-03	--	
Cadmium	1.6E-02	0.17	3.9E-03+/1.1E-03+	
Chromium	3.3E+01	6.7E+02	1.7+/0.210+	1.035+
Copper	1.3		1.8E-02+/1.2E-02+	5.91E-02+
Cyanide	0.70	2.2E+02	2.2E-02/5.2E-03	2.6E-02
Chloroform	5.7E-03	0.47	--/1.24	5.45E+01
1,1-Dichloroethene	5.7E-05	3.2E-03	11.6*/--	
1,2-Dichloroethene	0.70	1.4E+02	11.6*/--	
Iron	--	--	--	
Lead	5.0E-02	--	8.2E-02+/3.2E-03+	1.59E+01+
Mercury	1.4E-04	1.5E-04	2.4E-03/1.2E-05	6.0E-03
Nickel	0.61	4.6	1.4+/0.16+	
Selenium	0.10	6.8	2.0E-02/5.0E-03	
Silver	0.105	65	4.1E-03+/1.2E-04+	
Tetrachloroethene	8.0E-04	8.85E-03	5.28*/0.84*	3.06E+02
Thallium	1.7E-03	6.3E-03	1.4/0.04	
1,1,1-Trichloroethane	3.1	1.7E+02	--	
Vanadium	--	--	--	
Vinyl Chloride	2.0E-03	0.525	--	
Zinc	--	--	0.12+/0.11+	5.3E+01+

* Lowest Observed Effect Level

** Calculation of Sediment Standards is provided in Appendix III of this report

\+ Hardness dependent criteria (100 mg/l used)

Sources: U.S. EPA, *Quality Criteria for Water 1986*, EPA 440/5-86-001, May, 1986 (51 Federal Register 43665) and *Amendment to the Water Quality Standards Regulation to Establish the Numeric Criteria for Priority Toxic Pollutants Necessary to Bring All States Into Compliance with Section 303 (c)(2)(B), Proposed Rules*, November, 1991 (56 Federal Register 58420.

TABLE 11

SELECTED CHEMICAL-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS - STATE OF OHIO

Chemical Name	Ohio EPA Water Quality Standards for Aquatic Life Habitat (1) (30 day average) (mg/l)	State of Ohio Sediment Standard (Calculated)(2) (mg/kg)
Antimony	0.19	9.5E + 03
Arsenic	0.19	0.95
Beryllium	2.3E - 02+	
Bis(2-ethylhexyl) phthalate	8.4E - 03	1.68E + 07
Di-n-butylphthalate	0.19	3.23E + 04
Butylbenzylphthalate	4.9E - 02	2.45E + 03
2-Butanone	7.1E - 03	1.28E - 02
Cadmium	1.4E - 03+	
Chlorobenzene	2.6E - 02	8.58
Chloroform	7.9E - 02	3.48
Chromium	0.207+	1.035+
Copper	1.18E - 02+	5.89E + 01+
Cyanide	1.2E - 02	6.0E - 02
1, 1-dichloroethene	7.8E - 02	
1,2-dichloroethene	0.31	
Ethylbenzene	6.2E - 02	6.82E + 01
Iron	1.0	
Lead	6.92E - 03+	3.46E + 01+
Mercury	2.0E - 04	0.1
4-Methylphenol	6.2E - 03	0.215
Nickel	0.17+	
Naphthalene	4.4E - 02	
Selenium	5.0E - 03	
Silver	1.3E - 03	
Styrene	5.6E - 02	4.45E + 01
Tetrachloroethene	7.3E - 02	2.66E + 01
Toluene	1.7	4.25E + 02
Thallium	1.6E - 02	
1,1,1-Trichloroethane	8.8E - 02	
Vanadium	-	
Vinyl Chloride	-	
Zinc	0.106+	5.30E + 01+

(1) Source: Ohio EPA Water Quality Standards, Chapter 3745-10AC

(2) Calculation of Sediment Standards is provided in Appendix III of this report.

+ Hardness dependent criteria were calculated with a hardness value of 100 ppm.

TABLE 12

–Cost Estimate for Alternative 2-
On-Site Consolidation and Capping of Contaminated Soils; Off-Site Treatment
and Disposal of Contaminated Solid Waste (including drummed waste)
Vandale Junkyard
Marietta, Ohio

CAPITAL COSTS

Item	Unit Cost		Units	Cost (1992 dollars)
1. North Slope Excavation and Grading Activities				
A. Access Road Construction				
1. Clearing for Road Construction	7,000	/acre	1	7,000
2. Purchase and Place Gravel for Roadway (6-inches deep)	3.16	/sq. yd.	4,800	15,170
B. Clear Areas to be Excavated (includes grubbing of stumps and chipping of trees)	7,000	/acre	1.9	13,300
C. Excavation Activities				
1. Excavation	15	/cu. yd.	18,000	270,000
2. Sample Collection and Analysis	1,215	/sample	40	48,600
D. Backfill and Grading Activities				
1. Place, Grade, and Compact Clean Soils From North Slope Excavation	8	/cu. yd.	3,600	28,800
2. Purchase, Transport, Place, and Compact Additional Fill Material as Necessary for Site Grading	17.64	/cu. yd.	12,900	227,560
3. Purchase, Transport, Place, and Compact Topsoil (6-inches thick)	20.29	/cu. yd.	1,500	30,440
4. Seeding to Provide Vegetative Cover	1,400	/acre	1.9	2,660
5. Covering of Seeded Area With Drainage Net	1.44	/sq. yd.	9,200	13,250
E. Construct Drainage Trench Atop North Slope to Divert Runoff				
1. Trench Excavation	10	/cu. yd.	600	6,000
2. Purchase, Pour, and Mold Concrete for Trench Base	8	/cu. yd.	200	1,600
F. Construct Surface Water Collection Pond to Collect Runoff During North Slope Excavation Activities (3-feet deep)				
1. Excavation	10	/cu. yd.	3,400	34,000
2. Synthetic Geomembrane Liner (tested and installed)	4.45	/sq. yd.	3,400	15,130
G. Equipment Mobilization/Demobilization	– –		– –	30,000
SUBTOTAL (Category I)				743,510

TABLE 12

Item	Unit Cost		Units		Cost (1992 dollars)
II. Segregation/Handling of Excavated Materials and Active Area Solid Wastes (a)					
A. Segregation/Decontamination Activity Labor Costs	640	/day	24		15,360
B. Segregation/Decontamination Equipment Costs	75	/day	24		1,800
C. Sample and Analysis Costs for Solid Waste Material Classification	1,215	/sample	6		7,290
D. Sample and Analysis Costs for Liquid Waste Material Classification	870	/sample	6		5,220
E. Transport and Off-Site Treatment and Disposal of Contaminated Solid Waste	600	/cu. yd.	900		540,000
F. On-Site Treatment and Discharge or Transport and Off-Site Treatment and Disposal of Liquid Wastes from Decontamination Operations and Collected Surface Water Runoff	1.50	/gallon	100,000		150,000
G. Equipment Mobilization/Demobilization	– –		– –		10,000
SUBTOTAL (category II)					729,670
III. Capping Activities					
A. Clear and Prepare Areas for Capping	1,500	/acre	3.2		4,800
B. Place and Compact Contaminated Soils and Unsalvage-able Solid Wastes From North Slope Excavation and Unsalvageable Solid Wastes From Active Areas	8	/cu. yd.	13,100		104,800
C. Clay Borrow Source Testing	1,100	/sample	2		2,200
D. Purchase, Transport, Placement, and Compaction of Clay from Off-Site Borrow Source (2–feet thick)	24	/cu. yd.	12,640	(b)	303,360
E. Synthetic Geomembrane Liner (tested and installed)	4.45	/sq. yd.	15,500		68,980
F. Drainage Layer Material Purchase and Transport (sand, 1–foot thick)	15	/cu. yd.	5,560	(b)	83,400
G. Sand Borrow Source Testing	400	/sample	2		800
H. Sand Placement and Compaction	1.02	/cu. yd.	5,560		5,670
I. Purchase and Installation of Geotextile Fabric	1.28	/sq. yd.	15,500		19,840
J. Purchase, Transport, Place, and Compact Topsoil (2–feet thick)	20.29	/cu. yd.	12,640	(b)	256,470
K. Seeding to Provide Vegetative Cover	1,400	/acre	3.2		4,480
L. Equipment Mobilization/Demobilization			– –		30,000
SUBTOTAL (category III)	– –				884,800
IV. Sediment Remediation					
A. Purchase of Pumps to Aerate Sediments and Nutrients to Enhance Biodegredation	– –		– –		18,000
B. Purchase of Perforated Tubing	– –		– –		2,000
SUBTOTAL (category IV)					20,000

TABLE 12

CAPITAL COST SUMMARY

Item	Cost (1992 dollars)
CAPITAL COST SUBTOTAL	2,377,980
CONTINGENCY (20%)	475,600
TOTAL CONSTRUCTION COST	2,853,580
DESIGN, ENGINEERING, AND CONSTRUCTION MANAGEMENT (30%)	856,070
TOTAL CAPITAL COST	3,709,650

ANNUAL OPERATION AND MAINTENANCE (O & M) COSTS

Item	Unit Cost		Units	Cost
I. Annual O & M Costs, Years 1 through 5				
A. Sampling and Analysis of Surface/Seep Water and Groundwater on a Quarterly Basis (6 samples/quarter)	1,070	/sample	24	25,680
B. Sampling and Analysis of Sediments on a Quarterly Basis (2 samples/quarter)	900	/sample	8	7,200
C. Sediment Aeration Pumps	258.30	/day	100	25,830
D. Cap Maintenance				
1. Mowing (8 times/year)	0.0075	/sq. ft.	140,000	1,050
2. Inspection and Repair	258.30	/day	40	10,330
ANNUAL O & M SUBTOTAL, YEARS 1 THROUGH 5				70,090
CONTINGENCY AND OVERHEAD (20%)				14,020
ANNUAL O & M COST, YEARS 1 THROUGH 5				84,110
PRESENT WORTH O & M, YEARS 1 THROUGH 5 ($84,110/year for 5 years @ 5%)				364,150
II. Annual O & M Costs, Years 6 through 30				
A. Sampling and Analysis of Surface/Seep Water and Groundwater on a Quarterly Basis (6 samples/quarter)	1,070	/sample	24	25,680
B. Cap Maintenance				
1. Mowing of Cap (8 times/year)	0.0075	/sq. ft.	140,000	1,050
2. Inspection and Repair of Cap	258.30	/day	40	10,330
ANNUAL O & M SUBTOTAL, YEARS 6 THROUGH 30				37,060
CONTINGENCY AND OVERHEAD (20%)				7,410
ANNUAL O & M COST, YEARS 6 THROUGH 30				44,470

TABLE 12

Item	Cost (1992 dollars)
PRESENT WORTH O & M, YEARS 6 THROUGH 30 ($44,470/year for years 6 through 30 @ 5%)	491,080
TOTAL PRESENT WORTH O & M COST, YEARS 1 THROUGH 30	855,230
NET PRESENT WORTH COST FOR ALTERNATIVE 2 (Total capital cost + total O & M cost)	**4,564,880**

(a) Cost to transport salvageable solid waste to an off-site facility for reuse is not accounted for because it is assumed that the value of the salvageable materials will be approximately equal to the transport cost.

(b) Extra material for compaction and spilling is included. This extra material is assumed to be 25% of the total compacted cubic yardage for clay and topsoil and 10% for sand (U.S. EPA, 1986)

Note: sq. yd.=square yard; cu. yd.=cubic yard

APPENDIX A

RESPONSIVENESS SUMMARY

SUMMARY OF COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD

This Responsiveness Summary has been prepared to meet the requirements of Sections 113(k)(2)(B)(iv) and 117(b) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (CERCLA), which requires the United States Environmental Protection Agency (U.S. EPA) to respond "...to each of the significant comments, criticisms, and new data submitted in written or oral presentations" on a proposed plan for a remedial action. The Responsiveness Summary addresses concerns expressed by the public and potentially responsible parties (PRPs) in written and oral comments received by U.S. EPA regarding the proposed remedy for the Vandale Junkyard site.

A. Overview

1. Proposed Plan

The Final RI Report, which included the Baseline Risk Assessment, was released to the public in February 1992. A Fact Sheet summarizing the findings of the RI was distributed in June 1992 to approximately 100 members of the public who were on the site mailing list. The Final FS Report and Proposed Plan were released to the public in August 1992. A Fact Sheet summarizing the FS and Proposed Plan was distributed to members of the public on the site mailing list in August 1992.

The Proposed Plan for the remedial action included six alternatives for the site: one No Action alternative and five action alternatives. The action alternatives called for various combinations of containment, treatment and containment, and/or treatment and off-site disposal of contaminated materials. The preferred alternative in the Proposed Plan called for on-site treatment of soils, on-site containment of treated residuals and other wastes, and off-site disposal of materials not suitable for on-site treatment or disposal.

2. Public Comment Period

The Administrative Record file for the site was made available for review by the public at the Washington County Public Library and the County Courthouse Commissioner's Office in Marietta, and at U.S. EPA Region 5 offices in Chicago, during the public comment period which extended from August 27, 1992 through November 13, 1992.

An announcement regarding the public comment period and the availability of the Administrative Record file was published in the Marietta Times newspaper on August 26, 1992. Following a written request from several PRPs, a notice extending the public comment period until October 29, 1992 was published in the Marietta Times newspaper on September 9, 1992. After a second written request from several PRPs, a notice extending the public comment period a final time through November 13, 1992 was published in the

Marietta Times on October 29, 1992.

A public meeting was held in Marietta on September 10, 1992. At this meeting, attended by approximately thirty members of the public, representatives from U.S. EPA and Ohio EPA summarized the findings of the RI/FS and the Proposed Plan, described the remedy selection process, answered questions from the public, and accepted statements from members of the public. Comments, including formal statements from six community members, were recorded by a court reporter and a transcript of the meeting is included in the Administrative Record.

A total of 13 written submittals were received from the public during the public comment period. Two letters were from the general public and 11 comments were from PRPs. A corrected version of one PRP submittal, containing four pages which were inadvertently excluded, was received several weeks after the close of the comment period. The corrected comment has been accepted in lieu of the original comment.

Responses to comments received during the public comment period are contained in this Responsiveness Summary. Several written submittals from PRPs were lengthy and very detailed. Since these submittals did not contain itemized individual comments or questions, U.S. EPA summarized the significant comments, criticisms, and new information contained in these documents and responded as completely as possible.

B. Community Involvement

Although investigations of hazardous substance disposal at the site began in 1980, when Ohio Environmental Protection Agency (OEPA) personnel first visited the site, the site has a history of complaints to local authorities from nearby residents dating back to at least 1969. Most of the complaints appear to have been related to open-burning and accepting wastes which created nuisances, such as odors and rodents. The state of Ohio filed suit against the owner/operator of the facility in 1984, and a settlement was reached which assured access to the site for investigations and prohibited any further collection of solid or hazardous waste, as well as filling, grading, excavation, or burning activities. The owner/operator was allowed to continue junkyard operations permitted by Washington County, and the site remains a licensed junkyard. The level of public interest and involvement regarding the site has been relatively low since this time.

Based on the assessments of the release of hazardous substances at the site, the site was proposed for inclusion on U.S. EPA's National Priorities List (NPL) for Superfund sites in 1982, and was finalized on the NPL in June 1986. A public availability session was held in Marietta on October 6, 1988 to explain the Superfund process and the RI work which began in September 1988. An information repository was established at that time at the Washington County Public Library in Marietta.

C. Summary of Significant Comments

The public comments regarding the Vandale Junkyard site are organized into the following categories:

- Summary of comments from the local community regarding the RI/FS and proposed plan;

- Summary of comments from PRPs concerning the RI/FS and the proposed plan. Due to the extensive number of comments, this section is organized by topic: General Comments, Remedial Investigation Comments, Baseline Risk Assessment Comments, Comments on the Development of Remedial Objectives, Comments on the Development and Evaluation of Remedial Alternatives in the Feasibility Study, and Comments on the Cost and Volume Estimates in the Feasibility Study.

Many of the comments below have been paraphrased in order to effectively summarize the "significant comments, criticisms, and new data" for this document. The reader is referred to the Administrative Record for this site, located at the Washington County Public Library in Marietta and at U.S. EPA Region 5, which contains copies of all written comments submitted. The Administrative Record also contains a copy of the public meeting transcript. The Administrative Record Index is included in Appendix B of the Record of Decision.

Comments from the Community

1. A commenter suggested that U.S. EPA had overlooked a remediation technology which could be utilized at the site. This technology, in-situ vitrification (ISV), would be used to create vitrified cell structures where the contaminated soils and other materials from the site could be deposited. The cells could be constructed by vitrifying a floor liner, and walls and placing contaminated soils inside. Subsequently, clean soils used to cover the contaminated soils could be vitrified to provide a low permeability cap. The commenter offered the services of his company in utilizing this technology.

U.S. EPA Response: U.S. EPA did evaluate ISV for treatment of contaminated soils in the FS and rejected this technology as unproven and inappropriate for the contaminants and soils at the site. However, U.S. EPA is not familiar with the ISV adaptation which this commenter called "barrier/liner concept," and the documentation provided by the commenter does not completely describe the implementation of this concept. As a result, U.S. EPA is not able to assess the feasibility of this process or its potential effectiveness at the site. The construction of vitrified containment cells is not a proven or commercially available remedial technology and was therefore not evaluated in the FS report.

Research is currently being conducted to evaluate the use of vitrified cells for disposal of radioactive wastes and other waste materials but to date the research is inconclusive. One of the most significant unresolved issues associated with the use of vitrified cells is the long-term integrity of the cell, including the potential for cracking and breaking. Cracking or breaking is of particular concern when large volumes of waste material are placed within the cell which cause loading and stress on the vitrified material. Vitrification contractors contacted indicated that large-scale commercial application of vitrified containment cells is not currently available.

2. One set of commenters noted that any on-site containment of materials, even if treated prior to containment, would allow the potential for future releases of contaminants and therefore represents a hazard. The commenters requested that no contaminated materials be left on site.

U.S. EPA Response: U.S. EPA acknowledges that on-site containment of materials does allow the potential for future releases of contaminants, but believes that containment under a RCRA Subtitle C hazardous waste cap is adequate to protect human health and the environment. Off-site disposal of treated materials entails substantial additional costs and does not reduce the overall potential impact of these materials. In addition, the transportation of these materials off-site creates short-term impacts on human health and the environment.

3. One set of commenters asked for an explanation of the bioremediation planned for sediments on the north slope of the site.

U.S. EPA Response: In-place bioremediation of seep sediments on the north slope of the site will be accomplished by adding nutrients and providing supplemental oxygen as necessary to speed the degradation of organic contaminants. Since U.S. EPA wants to minimize physical disturbance of the seeps, nutrients will be added manually and oxygen will be supplemented with small flexible hoses running from aeration pumps. Bioremediation would be initiated after source removal activities are completed and is anticipated to require a maximum of five years.

4. A commenter expressed concern that he and his family may have been exposed to contaminants from the site through his private residential well prior to connection to the local public water supply system. This commenter pointed out on a map at the public meeting that his residence is separated from the site by a ravine, through which Tributary A runs.

U.S. EPA Response: Although the commenter did not provide sufficient information to assess the possibility of his private well being impacted by the site, the current ground water monitoring results indicate that off-site transport of contaminants is limited. In addition, the location of the residence across the ravine from the site makes it unlikely that this well was impacted. Tributary A serves as a natural outlet for ground water from the north and east

slopes of the site.

5. A commenter asked why U.S. EPA was proposing to use the site for disposal of hazardous waste when it appeared that the existing site has never met standards for such disposal and is not an "acceptable facility."

U.S. EPA Response: U.S. EPA is proposing to use the site for disposal of materials, especially soils and debris, which must be classified as hazardous wastes due to its association with the disposal of drummed wastes at the site. However, this material will be capped as a hazardous waste. U.S. EPA believes that the site is an acceptable facility for on-site disposal in accordance with all substantive disposal rules and regulations. U.S. EPA also believes that this is the only reasonable way to handle the large volume of wastes at the site, and that relocating all of this waste to be deposited in another location only adds to the cost and short-term impacts.

6. A commenter asked why U.S. EPA cannot leave the contaminated materials undisturbed at the site since the investigation seemed to show that there is no "off-site hazard" from the site. The commenter went on to say that there must be a number of sites around the country which are in greater need of cleanup than the Vandale Junkyard site.

U.S. EPA Response: U.S. EPA acknowledges that the investigation has not shown that the site is causing substantial off-site hazards at present, and that the peak off-site impacts probably occurred shortly after industrial wastes began to be disposed at the site. However, there is no doubt that in the absence of remedial action, the site will continue to act as a source of contaminants to the surrounding area, particularly during periods of significant precipitation and surface water runoff. In addition, there will continue to be very significant on-site hazards for current and future workers, residents, and visitors. The Superfund law requires U.S. EPA to act to protect human health and the environment under these circumstances. The selected remedy, however, is a reasonable compromise between leaving the site unremediated, which is unacceptable, and a remedy which requires extensive treatment of soils at the site. This is because the physical site characteristics do not allow all wastes to be capped in place. Consolidation of wastes and soils on the active areas of the site, followed by capping, is a protective remedy which is more cost-effective and can be implemented more quickly than the remedy preferred in the Proposed Plan.

7. A commenter asked why U.S. EPA did not address the possibility that the site had been used to dispose materials as long ago as 125 years.

U.S. EPA Response: U.S. EPA is not aware of any information beyond the commenter's speculation that the site has been used for waste disposal for such a long time, and the relevance of this possibility is unclear. U.S. EPA has acknowledged that the site may have been in use for junkyard activities since as early as the 1940's, and that these activities have certainly contributed to the contamination at the site, particularly for metals. The key reason

that the site was investigated and is being proposed for remedial action, however, is the relatively short period during which the site was used for the disposal of drummed industrial wastes.

8. A commenter asked whether U.S. EPA had investigated the possibility that the contaminants found in ground water at the site might have been the result of other sources in the area, particularly the "BFI Landfill."

U.S. EPA Response: U.S. EPA does not believe that ground water beneath the site has been affected by off-site sources. The remedial investigation results showed a very good correlation between contaminants known to be disposed at the site and found in the soils at the site and the ground water. In addition, most of the contaminated ground water was found at elevations above the level of surrounding areas. This ground water is effectively isolated from other influences.

9. A commenter asked what health risks might result from site cleanup activities, particularly for children in the vicinity of the site. The same commenter asked what reassurance there is that the current problems at the site will not be repeated some time in the future.

U.S. EPA Response: Health risks associated with implementation of the remedy will be controlled through compliance with all regulations for emissions and through development of a health and safety plan for all on-site activities during remediation. Air modelling will be used as necessary to assure that all nearby residences are not affected. Short-term risks to area children are expected to be negligible.

Repetition of the current problems at the site will be avoided through institutional measures necessary to protect the effectiveness of the remedy particularly since contaminated materials will be left on-site. These measures include deed restrictions and fencing to protect the remedy and control exposure to the residual contamination. Future waste disposal at the site, if any is allowed at all, must comply with all federal, state, and local laws.

10. A commenter expressed concern about where the funds will come from to implement the remedial action at the site.

U.S. EPA Response: U.S. EPA anticipates providing all identified PRPs at the site an opportunity to fund and conduct remedial design and/or remedial action. If negotiations with the various PRPs are not successful, U.S. EPA has the option of conducting these activities with Superfund monies and billing the PRPs later or issuing an order to the PRPs to conduct the activities.

11. A commenter expressed concern about U.S. EPA's understanding of the relationship between contaminants in the different site media and whether U.S. EPA believes it has discovered all contaminants which pose a threat at the site.

U.S. EPA Response: As U.S. EPA attempted to explain in the RI/FS and Proposed Plan, complete characterization of contaminant distribution in all media at the site is very difficult. U.S. EPA believes that the nature and extent have been adequately characterized to reach a decision on a course of action at the site, but readily concedes that further characterization will be necessary before contaminant sources can be removed for treatment or containment. In addition, after the necessary sources are removed and treated or contained, continued monitoring will be necessary to assure that all media on site, especially ground water, surface waters, and sediments, achieve the cleanup goals.

12. A commenter noted that vinyl chloride was the only known human carcinogen identified at the site, claiming that all other carcinogens are "speculation."

U.S. EPA Response: U.S. EPA acknowledges that the only known human carcinogens at the site are arsenic and vinyl chloride. All other carcinogens are termed probable or possible human carcinogens. U.S. EPA disagrees that assessing the potential risks from these other carcinogens is speculative. The protocols adopted to address these contaminants have undergone extensive scrutiny and U.S. EPA believes that it is important to go with the "weight of the evidence" under such circumstances.

13. A commenter asked whether U.S. EPA had any plans to install a permanent automated water quality monitoring station on Tributary A where it joins Duck Creek.

U.S. EPA Response: U.S. EPA does not plan to install any permanent or automated monitoring stations at this time. However, water quality will be monitored on a quarterly basis at the site and this will include at least one monitoring location on Tributary A. U.S. EPA believes that it is important to have the flexibility to alter sampling locations as necessary.

14. A commenter expressed concern about the amount of space available on-site for deposition of contaminated materials and capping. The commenter also noted that slippage of soils has occurred on the north slope of the site and expressed concern about the stability of any deposited materials on-site.

U.S. EPA Response: U.S. EPA believes that sufficient area is available for deposition of excavated materials on-site and capping. U.S. EPA shares the commenter's concern about slope stability and the limitations this will impose on both contaminant source removal and containment. These activities will be carefully engineered to assure that additional contaminants are not released due to slope instability. The locations chosen to consolidate and subsequently cap treated materials will be evaluated in detail during the remedial design stage to ensure that they are appropriate locations for disposal. The disposal locations will be properly prepared prior to placement of excavated materials and the cap will be designed to ensure long-term effectiveness and stability. In addition, implementation of an Operation and Maintenance Plan will require activities to maintain the long-term effectiveness and stability of the contained wastes and cap.

15. A commenter expressed concern about the necessity to monitor the cap at the site for an extended period, and asked who would conduct this monitoring and how it would be funded.

U.S. EPA Response: U.S. EPA's selected remedy calls for monitoring the cap for a minimum of thirty years. Vegetation on the cap will be cut and maintained to prevent deep-rooted vegetation from damaging the cap. Inspections of the cap will be performed and the necessary repairs made (an estimated 40 days/year will be adequate to perform inspection and repair activities as noted in the FS). U.S. EPA understands the concern about the need to monitor and maintain the cap for an extended period, and the Superfund law provides for funding of this activity if U.S. EPA is not successful in requiring PRPs to conduct the monitoring. Any agreement with PRPs for implementing the remedy will require monitoring and maintenance of the cap for the minimum thirty year interval.

16. A commenter expressed concern about the effectiveness and cost of the bioremediation planned for seep sediments on the north slope of the site.

U.S. EPA Response: U.S. EPA appreciates the concern of the commenter. The bioremediation planned for the sediments is intended to accelerate natural degradation of organic contaminants. Bioremediation is expected to occur for a maximum of five years and is a very small fraction of the total estimated costs for remediation. If a reasonable effort to implement bioremediation is found to be unsuccessful, appears to be causing more harm than good, or is excessively costly relative to its benefits, U.S. EPA may decide to curtail or eliminate these efforts. In this case, U.S. EPA will continue to monitor the sediments to assure that natural degradation and attenuation assures expeditious compliance with cleanup levels.

17. A commenter stated that the most cost-effective solution to the problem at the site would be to move any people at risk off-site, put a fence around the site, and monitor. The commenter went on to indicate that he felt that the worst was over at the site and that the estimated cost of 15 million dollars for remedial action was excessive relative to the risks posed by the site. Another commenter added that as a nearby resident, she had already been exposed to the worst the site had to offer and that she preferred to "leave it be."

U.S. EPA Response: U.S. EPA appreciates the concern of the commenter, and reiterates that, as expressed in the response to Comment 6 above, the Superfund law does not allow U.S. EPA to fence off sites and abandon them when there is a feasible remedy to the situation. However, U.S. EPA agrees that the alternative which was preferred in the Proposed Plan is too costly relative to its benefits. As a result, U.S. EPA has selected a remedy which is estimated to cost less than one-third as much and can be accomplished in approximately half of the time. U.S. EPA believes that remedy implementation can be accomplished without appreciably increasing the exposure of nearby residents to site contaminants over the short-term, thereby greatly reducing potential exposure of these

residents over the long-term.

18. A commenter stated that since a public water supply is available for all residents in the vicinity of the site, there is no need for anyone to consume ground water from private residential wells. As a result, there is less of a need for remediation of the site. Another resident added that Superfund could fund the connection of residences which are currently not connected to the public water supply system and that this was an acceptable alternative to remediating the site.

U.S. EPA Response: U.S. EPA appreciates the comments and wishes to state for the record that whenever ground water supplies are affected by a Superfund site to the extent that existing residential wells are rendered unsuitable for consumption, U.S. EPA will act to connect the affected residences to a public water supply, if available. However, this is typically done in conjunction with other actions intended to protect and eventually restore the affected ground water supplies for future use. For the Vandale Junkyard site, U.S. EPA believes that the existing residential wells in the vicinity of the site which are in use have not been affected by the site. The identified remedial action is intended to protect the possible future use of ground water at the site.

Comments from PRPs

GENERAL COMMENTS

1. The PRPs commented that U. S. EPA intends to require other PRPs to fund the remedy for the site and return the site to the owner "free of charge" when the owner is responsible for the "mess now found there."

U.S. EPA Response: U.S. EPA considers the site owner a PRP under CERCLA. The owner will receive a notice letter for remedial design and remedial action, just as the owner received a notice letter for the remedial investigation. The implication that the owner will be able to avoid his responsibility for contributing to the contamination at the site is not true. However, U.S. EPA's primary responsibility under CERCLA is to protect human health and the environment. U.S. EPA cannot compel the owner to cooperate with the other PRPs in funding the site cleanup, but CERCLA does allow cooperating PRPs to pursue funds or other contributions toward site cleanup from non-contributing PRPs.

2. The PRPs stated that the RI/FS fails to adequately characterize the site and that as a result U.S. EPA's selected remedy is arbitrary and capricious, and inconsistent with the NCP.

U.S. EPA Response: U.S. EPA believes that the RI/FS was developed and the remedy selected in accordance with the NCP. Specific comments and criticisms are addressed

below.

3. The PRPs contend that the RI, Risk Assessment, and FS contain fundamental errors and show disregard for U.S. EPA Guidance and the NCP, thereby rendering the RI/FS useless.

U.S. EPA Response: U.S. EPA believes that all work during the RI/FS was conducted in a manner consistent with the NCP and the applicable guidance available at the time of the RI/FS investigation.

4. The PRPs stated that the RI fails to establish the need for any remedial action, and that institutional controls already in place would adequately address any risks at the site.

U.S. EPA Response: U.S. EPA disagrees. The RI and Baseline Risk Assessment were conducted in accordance with the NCP and applicable guidance, and the findings of the investigation clearly necessitate remedial action at the site. Specific comments and criticisms are addressed in detail below.

5. The PRPs recommend that U.S. EPA should issue a "flexible ROD" which would allow for the evaluation and selection of additional technologies for soil treatment during remedial design, more precise determination of soil volumes, and a closer evaluation of the feasibility of the selected remedy. This recommendation was provided despite the claims that the RI/FS and Proposed Plan were completely inconsistent with the NCP.

U.S. EPA Response: U.S. EPA has selected a remedy which does not require on-site treatment of soils. As a result, the flexibility requested by the PRPs is not necessary.

6. The PRPs commented that the Administrative Record compiled by U.S. EPA is incomplete because it does not include documents submitted to U.S. EPA by the PRP group during Phase I of the RI (and related correspondence). The PRPs submitted copies of nine documents for inclusion in the Administrative Record, dated from April 1989 through August 1990, which the PRPs maintain helped "form a basis for selection of a response action."

U.S. EPA Response: Since these documents were submitted as comments during the public comment period, U.S. EPA accepts the documents as a supplement to the Administrative Record. However, U.S. EPA excluded these documents from the Administrative Record compiled for the Proposed Plan after careful consideration. The nine documents essentially comprise the various drafts of and correspondence concerning a Phase I Summary Report, which the PRPs were required to submit after the first phase of the RI. Draft reports and related correspondence are generally not included in an Administrative Record, since the final reports are relied upon to form the basis for selection of a response action. U.S. EPA's

repeated rejection of this report as technically flawed and inconsistent with the requirements of the Administrative Order on Consent, resulted in the eventual termination of the PRPs' authority to conduct the RI/FS.

U.S. EPA clearly acknowledged in the RI Report that all data from the PRP-conducted Phase I investigation which was properly collected and satisfied quality assurance criteria was utilized in the RI Report. The basis of the dispute between U.S. EPA and the PRPs over the Phase I Summary Report primarily concerned the presentation and interpretation of the results of the work and the additional work necessary to complete the RI. U.S. EPA did not utilize the various drafts of the disputed report or related correspondence in developing a basis for remedy selection, and therefore they were properly excluded from the Administrative Record.

7. The PRPs focussed criticism specifically on U.S. EPA's contractor, Metcalf & Eddy, Inc. (M&E), for their performance during Phase II of the RI, and the preparation of the RI Report, including the Baseline Risk Assessment (Risk Assessment), and the FS Report. Throughout their comments and reports, the PRPs continually refer to perceived errors made by M&E and the alleged failure of M&E to comply with U.S. EPA guidance. In addition, the PRPs commented that M&E "rushed" to submit the RI and/or FS, implying that the quality of the reports suffered as a result.

U.S. EPA Response: U.S. EPA takes full responsibility for the RI and FS. It should be noted that before all RI and FS work was conducted, U.S. EPA approved a Work Plan Package for this work. This package consisted of a Work Plan, a Quality Assurance Project Plan (QAPP), a Field Sampling Plan, a Health and Safety Plan, and a Data Management Plan. All work to be conducted during the Phase II RI and FS was outlined in detail. In addition, the preparation of the RI Report, the selection of exposure scenarios in the Risk Assessment, and the screening and selection of remedial alternatives in the FS were all conducted and written in conjunction with U.S. EPA. The RI/FS reports were carefully reviewed by U.S. EPA prior to finalization. The implication that M&E had "free rein" in preparing the RI/FS documents or was encouraged to rush the documents, and that U.S. EPA willingly accepted the prepared documents "as is" without first undergoing scrutiny and review for technical quality and adherence to the established guidelines and protocol, is simply not true.

8. The PRPs contend that during the public meeting on the Proposed Plan, community members commented that the proposed remedial action was so far out of line with economic reality and site conditions that the RI/FS documents must have contained fundamental errors.

U.S. EPA Response: U.S. EPA believes that this assertion does not fully characterize the community member comments. A review of the public meeting transcript reveals that the only comment made by community members similar to this assertion was a question regarding the proposed expenditures to clean up the site when there was no apparent threat to

off-site populations and the funds might be better spent cleaning up a site which was more of a threat. See Comment 6 above in the Comments from the Community section.

REMEDIAL INVESTIGATION COMMENTS

1. The PRPs contend that the RI, and therefore the selection of the remedial alternative, was flawed in that the lateral and vertical extent of soil contamination was not adequately defined, and in the case of the "areas" delineated in Figure 6-1 of the RI Report, that the extent of contamination was visually delineated without an adequate number of soil samples.

U. S. EPA Response: U.S. EPA acknowledges that the number of soil samples collected is not sufficient to precisely delineate all soil contamination. As the RI Report indicates, the nature of waste disposal at the site resulted in "hot spots" of soil contamination as well as widespread contamination at lower levels. The purpose of the RI was to characterize the nature and extent of contamination to the extent necessary to support an informed risk management decision regarding whether remedial action was necessary and, if so, which remedy appears to be most appropriate for the site. As a result, the soil sampling program focussed on known and suspected areas of past waste disposal.

The areas of contamination delineated in Figure 6-1 show, as stated in the RI report on page 6-15, the maximum lateral extent of contaminated soils. It is further stated on page 6-15 that all soils within these areas are not likely contaminated but "hot spots" within these areas represent potential point sources of contaminants. It is true that these areas were partially delineated visually, but this was done to identify areas within which "hot spots" likely occur (such as, where drum fragments were observed at the surface), not to delineate the extent of contamination. As stated in the FS Report, the extent of soil contamination will be better defined through more extensive sampling in these areas during the initial stage of Remedial Design/Remedial Action (RD/RA) activities before the implementation of the selected remedial action, rather than during another phase of RI sampling. U.S. EPA believes that this is more efficient since experience has shown that additional soil contaminant characterization is typically necessary during RD.

With respect to the vertical extent of soil contamination, soil samples were collected during both phases of the RI mainly with a hand auger. A hand auger was used primarily because of the lack of accessibility for a drill rig to collect split spoon soil samples in a majority of the contaminated areas, specifically on the steep, wooded slopes at the site. It would have been possible to modify portions of the slope with heavy construction equipment to provide access to additional sample locations on the slopes, but this would have required measures to insure slope stability which would have been time and cost prohibitive for purposes of the RI. This could also have resulted in the disturbance and movement of waste materials and caused additional releases of contaminants.

The utility of a hand auger to collect samples from depth was limited at times due to the difficulty of turning the auger by hand in tight, clayey material containing roots and waste material. At many of the locations along the slopes, the depth to bedrock was very shallow (for example, 30 inches at E-1 and 28 inches at E-2), and the hand auger was sufficient. Knowing the depth to bedrock at some locations gave an indication of how thick the soils on the slope may be and the depth of potential vertical soil contamination. As stated on page 6-15 of the RI Report, "the maximum vertical extent of soil contamination may extend down to bedrock, especially where"... the soils are "... underlying point sources of contaminants and depths to bedrock are shallow". Again, the vertical extent of soil contamination will be better defined during the initial stages of RD/RA activities.

2. The PRPs contend that the horizontal and vertical extent of contaminant sources (such as buried drums) were not adequately defined in the RI Report and could have been done so by visual observation for surface waste and by borings and/or trenches for buried wastes.

U.S. EPA Response: U.S. EPA disagrees. Based on historical information such as site visit photos and reports, visual observations, discussions with the owner/operator of the site, and sampling results, the primary areas of past waste disposal on-site appeared to be the north slope, the "burn area", and the area behind the red barn. The "red barn area" and "burn area" were investigated during Phase I of the RI by the PRPs using a magnetometer survey and a soil gas survey.

Both measures were relatively unsuccessful in that possible areas of waste materials and sources of contaminants could not be defined adequately. Because of interference from surface metal in these two areas (a large number of junked automobiles behind the red barn and scrap salvageable metal throughout the "burn area"), the results of the magnetometer survey were considered inconclusive by U.S. EPA. This does not mean, as contended by the PRPs "that no evidence of buried drums was produced". It means that anomalies detected during the magnetometer survey could not conclusively be attributable to buried metal such as drums because of possible interference from nearby surface metal.

U. S . EPA also considered the results of the soil gas survey to be inconclusive because the clayey nature of soil at the site inhibited a sustainable "flow" or "migration" of soil vapors surrounding the probe. Therefore, hot spots or source areas of contaminants would not likely be identified unless one was fortunate enough to obtain a soil gas reading within a hot spot at a depth of approximately three feet (the depth of the slotted soil probe tip). The results of soil gas surveys conducted within clayey soils are often unreliable.

The delineation of subsurface wastes by borings or trenching in the source areas identified in Figure 6-1 of the RI Report was not conducted for several reasons. First, drilling and/or trenching activity along the sloped portions of the site would have required measures to provide access to the slope and insure slope stability which would have been time and cost prohibitive for purposes of the RI. Second, drilling and/or trenching in the "burn area" was

not considered because the site owner/operator was allowed to continue his metal salvaging activities in this area, and drilling and/or trenching would have interfered with his right to conduct his business in the area. Third, drilling and/or trenching was not conducted in the area behind the red barn because U.S. EPA was not aware that Mr. Vandale had removed the junked automobiles from that area just before the initiation of Phase II RI field activities (it was first noted on the first day of field activities). The area by the Groves trailer was not addressed because U.S. EPA did not believe that there was sufficient evidence of possible buried drums to justify disturbing this private property. Another primary factor in not drilling and/or trenching in the five areas to identify waste was that these activities would have resulted in the disturbance and movement of possible buried waste materials which may have caused additional releases of contaminants, and possibly exposed the field personnel to unnecessary health and safety hazards.

3. The PRPs identified several pieces of information missing from the RI Report that renders the report "incomplete" or would add to its completeness, if included.

U.S. EPA Response: U.S. EPA disagrees that the RI Report should be considered incomplete. Specific items are addressed below.

Boring logs were not included for boreholes F-1 through F-3 because, as stated in the RI/FS Work Plan, the sole purpose of these borings was to collect samples of soil to determine whether vinyl chloride was present from a depth interval (6 to 10 feet) at which vinyl chloride was possibly identified with a Draeger tube during Phase I drilling of well S-4 (conducted by the PRPs). These three boreholes were initially drilled to six feet, at which depth two, two-foot long split-spoon samples (6 to 8 feet and 8 to 10 feet) were collected for analysis. Samples were collected from these depths because the "positive" reading of vinyl chloride on the Draeger tube was detected at these depths from the well S-4 borehole during Phase I of the RI. Because these boreholes were drilled within approximately 25 feet of well S-4 (the well log is included in Appendix A of the RI Report) in similar soil, boring logs were not completed.

The air compressor used during drilling activities was outfitted with a filter to prevent any compressor lubricants from being introduced into the borehole.

The outcrop of "weathered" coal used to determine the strike and dip of bedrock at the site was located approximately 500 feet southwest of well S-3, approximately half way between wells S-2 and S-7. The elevation of this outcrop is 775.07 feet mean sea level (msl). The Washington Coal was not projected into the "weathered zone" in geologic cross section D-D' and E-E' (Figures 5-2 and 5-3) because the coal was not encountered during the drilling of well S-7. From review of historical aerial photographs, well S-7 is located along the toe of landfilled material across the access road from the red barn. Therefore, the Washington Coal outcrop within the "weathered zone" near well S-7 was removed during past landfill activities. The outcrop of coal in the "weathered zone" that was used to help calculate the strike and dip of the beds was half way between wells S-2 and S-7 in an area that, according

to review of historical aerial photographs, the soil of the “weathered zone” was not removed during past landfill activities.

Hydraulic conductivity of soils was determined on five samples during Phase I of the RI. The hydraulic conductivity for all five samples was determined to be less than $1x10^{-7}$ cm/sec with all samples being identified as clay except one, which was identified as silt.

The HNu results of shallow soil samples were not included in the report during Phase I or Phase II of the RI. During Phase II, the selection of the soil interval to be sampled based on HNu readings was conducted for the “E” and “H” samples. No “H” sample had elevated HNu readings above background, and therefore, in accordance with the approved RI Work Plan, the 18"-36" interval was submitted for analysis. The 18"-36" interval from E-l, E-2, E-3, and E-4 had the highest HNu reading of the two respective intervals. These values were recorded in the field logbook.

A diagram showing the distribution of TAL constituents in various media was not done (as it was for TCL constituents) because listing the name and concentration of at least one round of every TAL metal result next to each sampling location would have resulted in a cluttered and unreadable diagram. However, the FS Report does include a series of figures which show TAL constituents as compared to background or regulated standards.

A structural contour map of bedrock units was not constructed because, as shown in the cross sections constructed for the RI, there were prominent and identifiable beds that could be correlated between wells, indicating the attitude of the beds on-site. The cross sections thus show the general structure of the beds on-site, as well or better than would a structural contour map.

4. The PRPs identified some apparent discrepancies in the RI Report.

U.S. EPA Response: U.S. EPA believes the noted discrepancies are based on erroneous assumptions or misunderstanding of the information presented in the report. They are addressed below.

One comment indicated that the RI Report states that background soil samples X-1 and G-1 were collected at a location “where waste disposal is now known to have occurred”. This is an incorrect statement. The report states that the owner/operator claimed, after the completion of Phase II RI field activities, that his house is built on land that he brought to a level grade by piling junked cars into a gully and then grading soil over the top. Background soil samples X-1 and G-1 were collected from a sloped, wooded area adjacent to the owner/operator’s house, not from within the level area that he supposedly brought to grade. What is actually stated in the report is that the “trace concentrations of VOCs in G-1 indicates that soils used to build up the land may have been somewhat impacted by wastes”. This statement was made in the report to possibly explain the presence of some trace concentrations of VOCs in G-1. Nowhere in the report does it state that “waste disposal is

now known to have occurred" in the area from which X-1 and G-1 were collected. In fact, the evergreen trees in the small wooded area from which samples X-1 and G-1 were collected are fairly mature which may indicate that the immediate area may not have been disturbed by the owner/ operator's alleged filling and grading activities. This would depend how long ago these alleged filling activities would have taken place (before or after the planting of the trees).

Another comment indicated that detailed geologic logs of the site borings should have been maintained by an experienced geologist, in reference to the statement in the RI Report that "it is difficult to determine precisely the elevation of the top of the underlying claystone from the information on the driller's logs". The geologic logs of all site borings were maintained by an experienced geologist during both Phase I and Phase II. Most of the borings into bedrock were logged by examining fine drill cuttings blown up and out of the hole during air rotary drilling and noting color changes in the fine cuttings. It is difficult to determine precise depths of beds by this or any other drilling method (except coring) because of the "lag time" for cuttings from a certain depth to be blown up and out of a hole. The deeper the borehole and the larger the cuttings, the longer the lag time.

The PRPs also erroneously assume that it is inferred in the report that "the prominent siltstone bed that outcrops below the ridge top above the Marsh and seeps" is the siltstone of the 720 Zone. It was not inferred in the report that this siltstone is of the 720 Zone.

5. The PRPs question some of the methods used during Phase II of the RI.

U.S. EPA Response: The following are brief responses to the methods followed during Phase II which were questioned.

It was stated by the PRPs that the method of placing soil in sealable plastic bags and placing them next to a heater in the field trailer to collect headspace reading may have caused excessive heating of the plastic which could have contributed to elevated headspace readings. Because Phase II of the RI was conducted during the winter months, it was necessary to heat the soil samples and the air in the plastic bags to a temperature of above 40 degrees F so that an HNu reading could be taken. An HNu does not take accurate readings below a temperature of 40 degrees F. Therefore, the sealable plastic bags (Ziploc), of soil were placed next to a small radiator-type heater in the trailer to sufficiently raise the soil and headspace temperatures above 40 degrees F. The bags were placed close enough to the heater to heat them but far enough from the heater so that excessive heating did not occur.

The method of placing all decontaminated Phase II sampling equipment into new plastic bags for transportation from the decontamination station to the sampling station was questioned because the plastic bags may have introduced contaminants (particularly phthalates) into the samples. U.S. EPA felt that it was very important to protect decontaminated equipment from possibly getting "contaminated" during transport to the sampling stations and that transporting equipment in new plastic bags was the best method. It is true that some

phthalates may have been introduced into the samples but the concentrations would have been very minimal and would not account for the very high phthalate concentrations detected in some site media such as soils (3100 to 1,000,000 μg/kg) and seep sediments (130,000 [estimated] to 260,000 μg/kg). Also, phthalates are known to have been disposed at the site. Therefore, the high phthalate concentrations are likely the result of past disposal on-site and not from transporting equipment in new plastic bags.

The PRPs question whether an avenue of contaminant migration between shallower to deeper zones may have been created from an "improper"" seal in borehole D-4 and from allowing drill cuttings to fill the borehole below the well screens of wells D-5 and D-6. At borehole D-4, 19 feet of 10-inch ID steel casing was installed to the soil/bedrock contact and approximately 47.5 feet of 6-inch ID PVC casing was installed through the soil into the bedrock to seal off the first water encountered. After the 6-inch casing was grouted in, no water was detected inside the casing. In the first core run started inside the PVC casing, a chunk of PVC was noted in the core. Apparently, as indicated by water dripping inside the casing, the core barrel had punctured the PVC casing. It was believed that the integrity of the annular seal along its length between the casing and borehole wall had not been breached. Because a portion of the casing and the annular seal was breached from inside the casing, it was believed that the problem was corrected by filling the inside of the casing with grout. At boreholes D-5 and D-6, because water was not detected during coring below the water zones sealed off by the 6-inch PVC casing, it was felt that a "significant" pathway for contaminant migration was not introduced by allowing cuttings to backfill the corehole. Because well D-6 was at an off-site residence and was to serve as a background well, it was assumed that contaminants would not be present. The coreholes of D-5 and D-6 were not sealed with bentonite below the screen depth because of the possibility of grout contamination in the wells as apparently occurred at well D-4A, when the borehole below the well screen was sealed with a bentonite grout. Apparently, grouting of the bottom of the well D-4A borehole with a tremie pipe resulted in splashing of the grout on the wall of the borehole or grout got on the borehole wall of the screened interval when the tremie pipe was pulled out of the borehole. The PRP's oversight contractor during Phase II also agreed that these methods were acceptable. Contrary to the assertion of the PRPs, U.S. EPA does not believe that a "significant" pathway for contaminant migration was created in boreholes D-5 and D-6.

The PRPs state that the monitoring wells may not have been developed properly because residual materials in the upper or unsaturated portion of the well screen were not flushed or removed during development. It is further stated that to properly develop the wells, "high purity water" should be added to the wells to "flush" the residual material from the upper, unsaturated portion of the well screen. First, residual materials containing contaminants were likely <u>not</u> carried down from shallower depths during drilling because the air pressure used during drilling was great enough to blow all cuttings up and out of the borehole. Also, the drillers always "cleaned out" the borehole of any remaining drill cuttings after reaching the desired depth. Second, the static water levels in the monitoring wells installed during Phase II were not "significantly" below the top of the intake interval. Of the six water-

producing monitoring wells (S-7 through S-11, and D-3) installed and sampled during Phase II, the static water level before development in Well S-11 only was below the top of the well screen (approximately 4 feet). Of the wells installed and developed during Phase I conducted by the PRPs, all wells except well S-5 had a water level below the top of the well screen before development.

Third, U.S. EPA does not believe that possible residual materials in the unsaturated portion of the well screen could "contaminate" ground water samples if ground water is not in contact with these residual materials. Also, all wells were adequately purged before sampling anyway. U.S. EPA is not aware of any protocol or guidelines that mandate the removal of residual materials in the unsaturated portion of a well screen before sampling. In fact, most monitoring wells are installed so that approximately 6 to 8 feet of screen is in ground water with 2 to 4 feet out of the water to allow for better detection of VOCs dissolved in ground water and LNAPLs floating on ground water, and to allow for seasonal fluctuations in the water levels. Fourth, it may be difficult to get a "turbid-free" water sample from a monitoring well because the wells are partially screened through claystone units of varying thicknesses, and clay- and colloidal-size particles could easily enter into, and accumulate in the well while suspended in the water that recharges in a well after development and/or purging. These accumulated fine particles could get "stirred up" during subsequent purging and/or sampling activities, resulting in varying degrees of turbidity and thus never assuring a completely turbid-free water sample. This scenario was potentially observed during the Phase II RI investigation as four monitoring well samples were slightly "cloudy" or "milky", seven samples were "turbid", and two samples were "very turbid". Fifth, it is out of line with any accepted U.S. EPA protocol or guidelines to propose "flushing" the residual materials out from the unsaturated portion of a well screen by introducing high purity water to a well, especially low yielding wells as some of the wells are at the site. Introducing high purity water to a well would dilute the concentrations of any contaminant present, and there is no assurance that all of this water would be removed during development. In very few cases, if any, is it an acceptable practice to the U.S. EPA to allow any "foreign" material such as distilled or deionized water to be introduced into a monitoring well, especially ones of lower yield. Finally, it is an accepted practice to develop monitoring wells with a bailer. The development method used during Phase II was approved by U.S. EPA in the RI Work Plan Documents Package and was the same method used by the PRPs to develop the wells during Phase I of the RI.

6. The PRPs contend that the RI Report does not provide an adequate characterization of the hydrogeologic conditions at the site, and that several "essential" components necessary to properly characterize the site hydrogeology are not provided in the report.

U.S. EPA Response: U.S. EPA disagrees. The combined information on the site hydrogeology collected during Phase I (conducted by the PRPs) and Phase II is sufficient and adequate for the purposes of the RI. Specific aquifer characteristics such as horizontal and vertical hydraulic conductivity of the bedrock, porosity of specific bedrock units, ground

water flow rate, and quantity of ground water, were not determined because to do so would have been time and cost prohibitive for purposes of the RI and would have resulted in tenuous information for the time and cost invested to gather it. Porosity was not considered an important parameter because, as stated in the RI Report, the hydrogeology of the site is controlled by secondary permeability, or the number, size, and orientation of joints and fractures in the bedrock. Because all of the bedrock units are predominantly claystones and siltstones, porosity was not considered an important parameter.

Hydraulic conductivity values (K) were not determined because a sustainable supply of water was not available in a well to do a pump test. Also, the thickness of the water column in almost all of the on-site wells was not sufficient to totally immerse an adequately-sized slug to perform a "slug in" or "slug out" test. A packer test was not done because it would have resulted in the introduction of water "foreign" to the bedrock unit (see previous response #5 on introducing water from an outside source into a well). The collection of rock cores for laboratory testing of K values would have resulted in artificially induced fractures in the core from the coring process and possibly from the release of stress when bringing the core sample from depth to the ground surface. Also, laboratory testing of K values on rock cores results in very inaccurate, biased K values. Because it was noted during Phase I of the RI that several wells recharged very slowly, it was felt that this was an indication that the K values were small.

Because of the complex and heterogeneous nature of the site geology and hydrogeology, the quantity and flow rate of ground water could not be determined. Again, these two parameters are controlled by the secondary permeability which could vary widely across the site. To determine flow rates, it would be necessary to have at least two wells screened in the same bedrock unit and the fractures encountered within the screened interval of the two wells would have to be interconnected. There would be no assurances that the two wells would be interconnected through fractures.

Examples of the complex and heterogeneous nature of the site geology and hydrogeology noted in the RI Report include the presence of ground water in the borehole of D-2 at a depth of approximately 56 feet whereas water was not initially present at the same depth in well S-2 located approximately a few feet away. Another example is that water encountered within two to three productive zones during drilling of wells S-10 and D-5 indicates that the Groves residential well, which is approximately 10 feet from either well S-10 or D-5, receives enough water from each of these zones to collectively produce a sustainable supply of water for private residential use. This scenario appears to also hold true with wells S-11/D-6 and the former Ross/Elder well. Contrary to the comment made by the PRPs, these two statements <u>do not</u> conflict. Each statement was made based on actual observations made by field staff during the field program. The same holds true for the statement made in the RI Report that the higher water level in well S-5 is present because water from a shallower siltstone <u>may</u> be entering the well. The PRPs question why this is not true also at well S-3 which, like well S-5, is screened within the 720 Zone and a shallower siltstone. It cannot be determined whether this is true at well S-3 because it does not have a higher water level like

well S-5. It was an attempt to possibly explain the higher water level actually noted in well S-5. The same scenario was not applied to well S-3 because it was not actually noted to have a higher water level.

With respect to their comment on this scenario, it is rather confusing for the PRPs to state, "(c)onclusions based on conditions observed in one area should be applied to all areas of the site", which completely contradicts what they stated for a previous comment which said, "(p)rojecting stratigraphic conditions from one location to another should not be done due to the complex nature of the site geology". It is not clear how the PRPs believe that data on site geology and hydrogeology should be used. U.S. EPA believes that because of the complex and heterogeneous nature of the site geology and hydrogeology, certain conditions observed at one location should not be projected across the site. This is another reason hydraulic conductivity values, ground water flow rates and quantity, potentiometric surfaces, etc. were not determined for bedrock units at the site. The values determined at one location may vary widely with values determined at other locations because of differences lithologically and in the effect of secondary permeability.

The PRPs state that the RI Report fails to mention that saturated rocks of very low porosity and permeability are often not readily detected as water-bearing using air rotary drilling methods. U.S. EPA believes that coring and drilling with air was the best method used for drilling. Any other type of bedrock drilling (mud rotary, cable tool) would have required the use of water or other materials to drill which would have made the detection of water in the rocks even less apparent than it was using air rotary. Even if a well was installed into rocks of very low porosity and permeability, it would not likely yield any water initially and may take several months to do so. Regardless, the amount of water that this hypothetical well would yield is minimal and insignificant when compared to the yield of wells within water-producing fractures (which are the primary routes for water yield and potential contaminant migration at the site).

The PRPs correctly state that during Phase II well drilling, wells were initially installed into the first zone of producing water, regardless of the elevation. However, they assumed that this criteria was used to ensure a sufficient quantity of ground water for sampling, and that this strategy was marginally successful as indicated in discussions of water available for sampling. Furthermore, they state because of this strategy, potentiometric surfaces could not be determined.

First, contrary to the implication of the PRPs, water availability in Phase II wells during sampling was more than "marginally successful". In the Phase II wells (wells S-7 through S-11) installed into the first water-producing zone in bedrock, enough water was available to develop/purge at least three well volumes and sample each well for all TCL and TAL parameters, except for well S-7. Most wells that did not produce enough water for sampling of all TCL and TAL parameters were installed into the "720 Zone" by the PRPs during Phase I. The varying amounts of water determined during Phase II in the wells screened within the 720 Zone further illustrates the heterogeneity of the hydrogeologic system at the

site. Some wells produced little water (wells S-1, S-2, and S-4) whereas others in the same unit produced enough water to purge three well volumes and sample for all TCL and TAL parameters (wells S-3, S-5, and S-6).

Second, this well installation criteria was used to monitor whether the first producing water encountered during drilling into bedrock (especially wells S-7 and S-10) was impacted by site-related contaminants migrating down from the ground surface, not to ensure sufficient ground water quantity for sampling. This criteria was also followed to illustrate the anticipated heterogeneity of the presence, quantity, and elevations of ground water in the bedrock. Also, because of the heterogeneity of the site hydrogeology, installing wells to similar elevations so that potentiometric maps could be developed was of secondary importance to identifying whether a release had occurred to the first producing water. It was believed that other than discharging towards the slopes of the hill, lateral movement of ground water would predominantly follow the dip of the bedrock until encountering vertical joints and fractures, which is generally true as shown for the 720 Zone in Figure 5-10 of the RI Report.

Contrary to the PRPs' statement, U.S. EPA does not believe that horizontal ground water flow directions may "vary significantly" from that determined for the 720 Zone. Moreover, potentiometric maps of any specific zone may be of local extent; the contours could change radically over short distances in the vicinity of vertical conduits and such maps would add little to the conceptual understanding of the flow system. U.S. EPA also does not agree with the PRPs assertion that "there is a piezometric surface that could represent horizontal flow" within the deeper portion of the bedrock. To make this statement, one would have to assume that water is present in fractures throughout a deeper unit and that these fractures are interconnected. As previously stated, very little water was found in boreholes drilled to deeper depths. It appears rather unlikely that water in one deep well, if present, would be interconnected with water in a separate well in the same unit any distance from the first well because of the heterogeneity of the hydrogeological system, especially with respect to the presence of water at depth. To investigate each and every water-producing unit and to install wells to similar depths of a producing unit throughout the site to produce potentiometric maps of these units would require the installation of tens of monitoring wells, some of which would have to be double- and triple-cased to monitor water below shallower producing units. The time and cost of this would be very prohibitive for the purposes of the RI and the selection of a remedial alternative.

The PRPs contend that drilling with compressed air may be responsible for the absence of water in the 720 Zone in off-site boreholes D-4A, D-5, and D-6 and further states that because "hydraulic communication" apparently exists between the 720 Zone and the Groves well, then the 720 Zone siltstone was misinterpreted as being dry because ground water was blown out or evaporated during coring. During coring of borehole D-5 at a depth of approximately 116 feet (712 ft msl), some slight "bubbling" of the water in the adjacent Groves well could be heard, which had a depth of approximately 98 feet (730 ft msl). Because this bubbling was heard in the Groves well while coring D-5, the PRPs correctly

state that there is hydraulic communication between the Groves well and D-5, but they also assume that this communication is via ground water. It is also very possible that the bubbling in the Groves well, the bottom of which is approximately 18 feet higher than the elevation in D-5 at which the bubbling was noted, was caused by air enlarging dry fractures between D-5 and the Groves well, eventually resulting in the "release" of air into the Groves well. It was not necessarily water in the 720 Zone of D-5 being blow up into the Groves well. The fractures may have allowed forced air to pass through them while still small enough that capillary forces within the fracture network in the 18 vertical feet of bedrock between D-5 and the Groves well may have been great enough to exhibit the migration of water. Also, the air may have enlarged the fractures enough to form a new "avenue" of water migration. It is true that it is possible that if borehole D-5 was left open long enough at a depth of 116 feet, water from the Groves well would eventually migrate into it along the new "avenue". It is also possible that any water originally present in the 720 Zone at D-5 and D-6 were drained by the vertical fracture. The PRPs are incorrect in stating that the Groves well is exerting 80 or more feet of hydraulic head in the 720 Zone because the bottom of the Groves well (approximately 730 ft msl) does not intersect the 720 Zone.

Two other minor issues raised by the PRPs on ground water are briefly addressed. First, the horizontal component of ground water flow in the 720 zone is indeed radial. Second, vertical head differentials can generally be noted during drilling if hydraulic heads (water levels) drop abruptly from each specific water-bearing zone to the next lower zone, especially if the vertical distance between water-bearing zones are not that close. However, it is true that accurate determination can only be made by comparing static water levels in monitoring well clusters.

BASELINE RISK ASSESSMENT COMMENTS

1. The PRPs commented that the use of a future residential use scenario for the site was highly improbable and not appropriate. The PRPs went on to point out that many residences in the vicinity of the site are mobile homes and/or currently unoccupied.

U.S. EPA Response: U.S. EPA disagrees. The decision to use the future residential use scenario is well documented in the risk assessment and addressed extensively in this section of the responsiveness summary. The permanence of residences in the area of the site is not a consideration for U.S. EPA, as the past and current use of the area and the site provide sufficient evidence of the probability of a future residential use scenario.

2. The PRPs questioned the inclusion of vinyl chloride in the Baseline Risk Assessment. The PRPs stated that the risk assessment was based on incorrect vinyl chloride test "data" which seriously misrepresented actual field test results (for example, the RI listed a maximum reported concentration of 90 μg/l in Table 2.2 of Appendix H, whereas vinyl chloride was, in fact detected at only 47 μg/l in only one well sample).

U.S. EPA Response: The vinyl chloride data was used because it was suspected that vinyl chloride may have been a chemical which was disposed at the site historically. Furthermore, vinyl chloride is a known degradation product for the numerous chlorinated organic compounds which have historically been disposed and detected at the site. U.S. EPA guidance for the performance of Risk Assessments, the Human Health Evaluation Manual (U.S. EPA, 1989), recommends that chemicals historically associated with site activities should not be eliminated from evaluation as a chemical of concern. Although it cannot be stated with absolute certainty that biodegradation of chlorinated organic compounds is occurring at the site, the conservative approach is to assume that biodegradation to vinyl chloride may be occurring or may occur.

The only detection of vinyl chloride occurred in the sampling and analysis of ground water performed during Phase I of the RI. Vinyl chloride was not detected in any samples analyzed during Phase II. Vinyl chloride did fit the primary requirement for inclusion in the group of potential chemicals of concern in that the compound was detected at least once, in at least one of the environmental media investigated. Despite the relative infrequency of detection of vinyl chloride across the different environmental media, the decision was made to retain vinyl chloride as a chemical of concern based on the toxic potential of the compound. The maximum reported concentration of 90 μg/l in Table 2.2 of Appendix H is indeed incorrect. The maximum reported concentration should be 47 μg/l. However, the incorrect maximum reported concentration was not carried through the risk calculations. Rather, the 95 percent upper confidence limit value was carried through the risk assessment (i.e. , 52 μg/l vinyl chloride).

If a detection limit of 0.4 ug/l or less had been utilized in the risk assessment and the single detection of vinyl chloride was not considered in the data set, the overall total risks for ground water exposures at the site would be as follows for vinyl chloride:

FUTURE RECEPTORS/RISKS FOR VINYL CHLORIDE

CHILD	$3x10^{-5}$
TEEN	$2x10^{-5}$
ADULT	$1x10^{-5}$

However, the total future risks associated with all of the chemicals of concern would remain on the order of at least $1x10^{-2}$ for each of the receptors regardless of this change, with the primary contributor to risk being 1,1-dichloroethene.

3. The PRPs commented that monitoring well installation, development, and pre-sampling purging were improperly performed during Phase II, thereby generating suspect and unscientific test data. U.S. EPA guidelines preclude the use of such suspect data in developing risk assessments.

U.S. EPA Response: U.S. EPA followed proper data collection procedures as outlined in

the approved RI Work Plan Documents Package. Methods for data utilization outlined in the U.S. EPA Risk Assessment Guidance for Superfund and Guidance for Data Usability in Risk Assessment (U.S. EPA, 1989; 1990) were employed in the Baseline Risk Assessment.

4. The PRPs commented that U.S. EPA incorrectly used only unfiltered samples in determining metals contamination. The commenters felt that approved procedures require the use of filtered as well as unfiltered samples for metals testing and, in cases such as this where there are wide discrepancies noted in such results, the filtered results must be used in determining environmental risks [see, e.g., Kent County v. U.S. EPA (May 1, 1992, U.S. Dt. App. S.D., 1992 U.S. App. LEXIS 8606) and Anne Arundel County v. U.S. EPA (May 1, 1992, U.S. Ct., App. S.C., 1992 U.S. App. LEXIS 8607)].

U.S. EPA Response: U.S. EPA guidelines for risk assessment require that unfiltered ground water samples be utilized to estimate exposure if the unfiltered water is of potable quality (U.S. EPA Risk Assessment Guidelines for Superfund, 1989, pages 4-12, 4-13, 6-26, 6-27, and 6-34). It is conceivable that residents would utilize unfiltered ground water in the site vicinity. The Vandale Junkyard site is in a rural area where residents in the vicinity do utilize ground water as a potable supply. In fact, several nearby residences were identified during the RI at which ground water is used as the sole source of water and which is not treated before use. It is pumped directly into an equalization tank for distribution throughout the house.

There are no regulations which forbid a resident from driving water from a well in Washington County. To install a potable drinking water well, the land owner must get a permit from the county Health Department and the installation must be performed by a licensed drilling firm. If the private landowner installs a well and upon sampling and analysis of the well, the Health Department finds the water unfit for consumption, there is no enforcement action in place to prohibit the landowner from using the well for drinking water purposes. Also, a well permit is not needed if the intended purpose of the well is to provide water to non-dairy farm animals. In this case, the Health Department would not even have to be notified.

While arguments can be made on both sides of the issue for using filtered versus unfiltered water samples to evaluate ground water at hazardous waste sites, U.S. EPA must consider site-specific information to determine which data will provide the best characterization of potential exposure. Filtered ground water samples are a reasonable alternative for sites where it is not likely that ground water users will utilize water which has not undergone some type of filtration or purification. Unfiltered ground water provides a better characterization of potential exposure at sites where ground water is not filtered or purified.

There are residents in the vicinity of the site who do not filter, purify, or treat their ground water supplies before potable utilization of the groundwater. Because of the long time potentially needed (over the course of possibly several weeks to months) to attempt to

develop a low-yielding monitoring well installed in claystone/siltstone units to provide a relatively turbid-free ground water sample, U.S. EPA decided to develop the wells as best as possible during the course of RI field work rather than returning daily, weekly, or monthly to remove recovered ground water during the development of the wells. Also, because the monitoring wells are partially screened through claystone units of various thicknesses, clay- and colloidal-size particles could easily enter into, and accumulate in the wells while suspended in the water that recharges in the well after purging. These accumulated fine particles could get "stirred up" during subsequent purging and/or sampling, thus never assuring a completely turbid-free water sample. This was potentially observed during the RI investigation as indicated by the varying degrees of turbidity of the well samples. For example, of the 13 monitoring wells sampled during Phase II of the RI, four samples were slightly "cloudy" or "milky", seven samples were "turbid", and two samples were "very turbid".

U.S. EPA recognizes that it is unlikely that water used by local well users is as turbid as some or most of the ground water samples collected at the site during the RI, and that the use of the unfiltered metals data from these samples could overestimate the risk calculated for ground water consumption in the Baseline Risk Assessment. Conversely, it is just as unlikely that any ground water used by local well users are or will be filtered through a 0.45 micron membrane as are samples for filtered metals. The use of the filtered metals data in the risk calculations would result in an underestimate of risk. Because the standard acceptable protocol for ground water sampling for metals concentrations is to submit an unfiltered sample and/or a filtered samples (through a 0.45 micron membrane), U.S. EPA decided to take the conservative approach and use the unfiltered metals data in the Baseline Risk Assessment for the Vandale Junkyard. While the use of unfiltered ground water data for metals concentrations in the risk assessment can provide an overestimate of potential exposure, hazard, and risk, the approach is justified because some local residents are using (and could possibly use in the future) unfiltered ground water for their domestic water supply, and the use of filtered data would provide an underestimate of calculated risks and hazards.

5. The PRPs commented that the Baseline Risk Assessment did not adhere to U.S. EPA's recommendations for exposure assessment and utilized exaggerated exposure assumptions in developing the risk analysis.

U.S. EPA Response: U.S. EPA disagrees. The exposure scenarios evaluated in the Baseline Risk Assessment were selected based on several years of on-site observations and conversations with area and site residents. In particular, the scenario of the trespassing child was based on the knowledge that children (the site owner's grandchildren) were observed and were known to enter onto the site on a regular basis. U.S. EPA felt it particularly important to evaluate the exposure to this population of receptors because they potentially represent one of the most sensitive populations for site-related exposures. The site is not secured to prohibit trespassing. The exposure pathways evaluated and the exposure parameters utilized for the child receptor characterized a child playing on-site. Because of the nature of the

activities in which a child/adolescent of this age might engage in such an area, it was assumed that the receptor would likely play without regard to becoming wet through wading or splashing in the seeps or surface water, or dirty from contact with the soils or sediments. While the site cannot be considered akin to a playground, in the rural area in which this site is located, children do engage in such outdoor activity. In fact, because of the rural nature of the area, children and adolescents would be more likely to play in such a setting, compared to a suburb, due to the distance to the nearest playground.

U.S. EPA supplemental guidelines for standard default exposure factors (U.S. U.S. EPA, 1991, OSWER Directive 9285.6-03, March 25, 1991) for commercial/ industrial exposures provides soil ingestion rates "that should be used to estimate exposures for certain workplace activities where much greater soil contact is anticipated, but with limited exposure frequency and/or duration." The soil ingestion rate for site workers was based on the recommendations of these guidelines (page 10 and Attachment B) to characterize exposures for outdoor activities such as landscaping. The activities evaluated for the site workers were based on site-specific observations and information.

With respect to ground water consumption by the adult site worker, U.S. EPA evaluated the consumption of ground water by the adult worker because ground water has historically been utilized by residents in the area. It was assumed that the site worker would be exposed to the area ground water while at work and at home. U.S. EPA evaluated this scenario as a current scenario to determine whether some immediate action should be taken to limit ground water consumption at the site. U.S. EPA recognizes that while no individual MCL was exceeded in samples from the residential wells, the simple comparison of chemical levels to chemical-specific MCLs will not account for any additivity of effect from exposure to more than one chemical.

With regard to future exposures to site soils which exist on slopes or beneath the surface, U.S. EPA sought to evaluate the potential future exposures for receptors where soils had been excavated or moved for construction or landscaping purposes to a location where receptors could come in contact with the contaminated soils. The potential for a future residential scenario was based to some degree upon the stated desire of the current site owner to build a house on the property in the future. The site has historically been utilized for residential and agricultural purposes. In addition to houses in close proximity to the site, the site owner's son lives in a mobile home on-site.

The idea that people have historically and are currently living on the site seems incomprehensible to the PRPs. However, the lack of understanding may in part be because the reviewers have not had the opportunity to observe the site activities as U.S. EPA has over the past three years. U.S. EPA believes that the potential exposures for receptors at this site must be evaluated from a conservative perspective because people either historically have or currently do reside on-site or in very close proximity to the site, work on-site, drink ground water, hunt on-site, and trespass on-site.

6. The PRPs commented that upper-bound limits of cancer risk due to inhalation of arsenic (entrained dusts) were incorrectly quantified because U.S. EPA's IRIS system advises risk assessors to assume that no more than 30% of inhaled arsenic will be systemically absorbed. They contended that such disregard of IRIS's explicit instructions in this instance resulted in at least a three-fold overestimation of the 95% upper-limit of lifetime cancer risk associated with inhalation of arsenic present in respirable dusts.

U.S. EPA Response: U.S. EPA disagrees. The inhalation cancer slope factor (CSF) for arsenic utilized in the baseline risk assessment is based on an administered dose for inhalation. The toxicity factor utilized does take into account that 30 percent of the inhaled arsenic is systemically absorbed. However, an administered dose must be utilized for comparison to the intake estimate calculated using the U.S. EPA standard equation for inhalation exposure (U.S. U.S. EPA Risk Assessment Guidance for Superfund, 1989, page 6-44). If the intake was derived such that the estimated intake was an absorbed dose, then the absorbed dose CSF would have been employed in the calculation of the risk.

7. The PRPs commented that risk analysis was based on invalid, worse-than-worst-case assumptions, rather than utilizing scientific data. In particular, the comments noted that PAHs do not bioaccumulate to any significant degree in animal tissue and should not have been evaluated.

U.S. EPA Response: U.S. EPA acknowledges that the modeling of soil to animal meat concentrations in the Risk Assessment does not provide a valid representation of potential uptake and bioaccumulation of the chemicals of concern by cattle or deer. However, the model was retained in the Baseline Risk Assessment to demonstrate that an attempt to evaluate such exposure had been made, but that the model results in highly unlikely exposure, risk, and hazard estimates. U.S. EPA acknowledges, both here and in the text of the Baseline Risk Assessment that the model overestimates exposure, hazard, and risk. The calculation of the ingestion and bioaccumulation of site-related contaminants by cattle and/or deer and subsequent ingestion of the animal meat by humans was qualified in the text of the Baseline Risk Assessment:

> "It should be noted that inherent uncertainties as to the actual bioaccumulation of the chemicals of concern in animal tissue may have resulted in an overestimate of exposure and the associated risks and hazards. For example, PAHs (and related compounds) and low molecular weight chlorinated solvents, which contribute to the majority of the estimated or calculated risks, are rapidly metabolized by organisms and do not bioaccumulate to any great degree." (RI - Section 8.6.4, page 8-37)

Furthermore, the results of this evaluation of meat consumption were not included in the calculation of the total site risk or hazard. Rather, they were considered separately and qualified as an overestimate of true exposure, hazard, and risk.

8. The PRPs indicated that the report ignored data validation qualifiers and failed to note that certain data utilized were suspect.

U.S. EPA Response: Data validation qualifiers were not ignored in the report. Methods for data utilization outlined in the U.S. EPA Risk Assessment Guidance for Superfund and Guidance for Data Usability in Risk Assessment (U.S. EPA, 1989; 1990) were employed in the Baseline Risk Assessment. According to these guidelines, J-qualified sample results (i.e., estimated concentrations for compounds) are to be evaluated in the risk assessment in the same way as detections that are not J-qualified. What may be lacking in the Remedial Investigation and Risk Assessment is a more detailed accounting of the relative uncertainties associated with using such qualified data and the potential effects of the estimation of exposure, hazard, and risk. When a J-qualifier is attached to a chemical result it represents some uncertainty as to the true concentration for the chemical. A J-qualifier may be placed on the results for a particular analyte for a number of reasons (exceedances of sample holding time, calibration errors, low surrogate recoveries, variations in instrument quantitation and detection limits). The implications of applying a J-qualifier to a sample result may be as follows:

The reported concentration may underestimate the true value for the sample;

The reported concentration may overestimate the true value for the sample; or

The reported result may be of poor precision and highly variable.

Therefore, depending on whether the actual chemical concentration is higher or lower, the exposure, risk, and hazard could be correspondingly over- or underestimated. While the J-qualifier is meant to be interpreted as an indicator of uncertainty in the reported concentration of a chemical, it does not represent uncertainty as to the presence of the chemical in a sample. Rather, as stated in U.S. EPA Guidelines for Superfund, Human Health Evaluation Manual (U.S. EPA, 1989), J-qualified data are to be used as positive data indicating that the identified chemical has been detected in the sampled media.

9. The PRPs commented that U.S. EPA guidelines stress the crucial importance of employing analytical techniques which will afford detection sensitivities necessary for proper risk analysis. They took issue with the use of analytical methods yielding detection limits of between 10 and 100 μg/l for vinyl chloride despite stated efforts to specifically determine the presence of this compound in various media.

U.S. EPA Response: As stated in the response to Comment 1, vinyl chloride was suspected as a potential chemical of concern for the site based on historical information concerning the types of chlorinated organic compounds dumped or released at the site over time. A major problem at any hazardous waste site is the accurate characterization of chemical concentrations in environmental media. The sampling and broad-scan laboratory analysis of samples of environmental media may or may not capture the range of chemicals which exist

at a site. However, it is the best overall methodology for at least identifying the presence or absence of different chemicals at a site. The available data as collected and analyzed for the site is all that can be employed to perform this exposure and risk characterization.

Vinyl chloride was detected in one ground water sample and is a chemical associated with a relatively high toxic potential. While the detection limits varied for vinyl chloride, the actual chemical concentration carried through the risk assessment was 52 μg/l. The maximum detected vinyl chloride concentration was 47 μg/l. The difference between these two concentrations is minimal. The assumption of one half the sample quantitation limit obviously did not result in an exposure concentration which overestimated the maximum detected concentration by an order of magnitude. Further, it is feasible that the maximum vinyl chloride concentration for the site may not have been encompassed by the concentration of 47 μg/l.

The selected remedy does include a more sensitive detection limit for vinyl chloride in ground water.

10. The PRPs commented that comparisons of naturally-occurring analytes detected in on-site samples with corresponding samples collected from locations upgradient or beyond significant site influence were not properly evaluated in accordance with U.S. EPA guidance.

U.S. EPA Response: The naturally occurring analytes detected on-site were compared to appropriate background results. A statistical comparison was not performed. Rather the 95 percent UCL or maximum concentration, whichever was lower, was compared to background levels. The data for the site was grouped. Therefore, the grouped data was compared to background levels rather than individual sample location compared to background levels.

11. The PRPs commented that the selection of "chemicals of concern" was based largely on whether toxicity values (e.g., risk reference doses) for chemicals identified were available in U.S. EPA's IRIS or HEAST. They stated that. U.S. EPA's RAGs states that this is not a valid justification for eliminating chemicals from the quantitative risk assessment process. They felt that a high level of uncertainty in the estimates of risk is the inevitable and direct result of omitting contaminants from the assessment.

U.S. EPA Response: The selection of chemicals of concern was based in part upon whether toxicity values were available for the chemicals of concern. Additional information, however, was also considered as to whether a chemical's toxic potential was high. A case in point is that of the inclusion of lead as a chemical of concern despite the fact that a toxicity factor was unavailable for the metal. If anything, exclusion of chemicals resulted in an underestimate of the potential risk for the site. When more chemicals are evaluated, the exposure, risk, and hazard estimates will increase due to the summation of these estimates.

12. The PRPs stated that a qualified, well trained toxicologist should be involved in the

risk assessment process and that all chemicals of concern be quantitatively evaluated. The PRPs also questioned the toxicity values utilized and the uncertainties associated with the values.

U.S. EPA Response: U.S. EPA agrees that toxicity assessments are an integral part of a risk assessment. A qualified toxicologist at M&E was responsible for the interpretation of toxicity values for use in the risk assessment process. For additional guidance for derivation and use of toxicity values, appropriate sources are sought which include U.S. EPA's Office of Health and Environmental Assessment (OHEA) and Superfund Health Risk Technical Support Center Environmental Criteria and Assessment Office (ECAO).

Chemicals lacking RfD or CSF toxicity values were not quantitatively evaluated in the risk assessment. Reference dose toxicity values are estimates of acceptable daily exposure to a chemical that would not result in deleterious noncarcinogenic effects. Cancer slope factors are the upper bound estimates that represent the carcinogenic risk associated with daily exposure to the chemical. The slope factor converts estimated daily intake directly to incremental risk of an individual developing cancer. Noncarcinogenic effects are not expressed as a probability but rather evaluated by comparing an exposure level over a time period with a reference dose derived for a similar exposure period. Therefore, if toxicity values do not exist for a chemical, then exposure to that chemical cannot be quantified. The risk assessment does provide critical toxic effects (Table 8-19) as well as toxicological profiles (Appendix K) for each chemical of concern. Uncertainties associated with the risk assessment process are addressed in Section 8.6.6.

13. The PRPs contend that the toxicity value for the oral carcinogenic slope factor (CSF) of arsenic is not acceptable because sound scientific data for the development of a slope factor does not exist.

U.S. EPA Response: The oral CSF of 1.75 per mg/kg/day for arsenic was derived from the unit risk value of $5.0x10_{-5}$ per ug/l in drinking water. According to an IRIS printout (December 3, 1992), U.S. EPA recommends that the unit risk be adopted. Furthermore, contact with Office of Health and Environmental Assessment (OHEA) supported the use of the unit risk value in risk assessments.

The inhalation slope factor for arsenic of 50 per mg/kg/day is listed in the 1992 Health Effects Assessment Summary Tables (HEAST). According to the Associate Director of the Superfund Health Risk Technical Support Office, the slope factor value was derived by assuming a 30% absorption of inhaled arsenic. The value of 50 risk units per mg/kg/day is intended to be used as an administered dose in the risk evaluation. Furthermore, the Associate Director explained that the unit risk of $4.3x10^{-3}$ per ug/m3 is derived from the slope factor. The following equation shows the derivation of the unit risk from the slope factor taking into account the 30% absorption value for arsenic:

(SF) (Inh) (Abs) / (BW) = Unit Risk

where:	SF	=	slope factor, 50 per mg/kg/day
	Inh	=	inhalation rate, 20 cu. m/day
	Abs	=	absorption, 30%
	BW	=	body weight, 70 kg

(50 per mg/kg/day)(20 m3/day)(0.3) / (70 kg) = 4.3×10^{-3} per ug/cu.m

14. The PRPs commented that the toxicity values for 1,1-dichloroethene were not applied correctly in the Risk Assessment.

U. S . EPA Response: The U.S. EPA Cancer Slope Factor of 1.2 (mg/kg/day)-1 was applied to the estimated inhaled intake (administered dose) of 1,1-DCE. The PRPs contend that the CSF should have been applied to the metabolized dose of 1,1-DCE. Although the PRP comment specifically mentions 1,1-dichloroethene, the issue of toxicokinetics is of generic relevance to risk assessment models.

According to IRIS (December 3, 1992), the inhalation CSF for 1,1-DCE was calculated using estimated animal administered doses. It should also be noted that U.S. EPA accounted for interspecies differences, including metabolism of 1,1-DCE in mice, when the Agency estimated human equivalents to the mouse dose schedule used in the studies from which the inhalation CSF was derived (Maltoni et al.. 1977, 1985).

Other than the method by which U.S. EPA derived the CSF for 1,1-dichloroethene, there are several other reasons why the approach taken in the toxicity assessment is defensible in the context of this risk assessment.

Many chemicals produce toxic effects through active metabolic intermediates. However, U.S. EPA's Risk Assessment Guidance for Superfund does not account for the amount of administered dose which is converted to active metabolite(s). It is only rarely that the metabolic fate of a non-pharmacologic substance such as 1,1-DCE is well delineated in humans. Although the U.S. EPA approach contributes to the conservatism of the risk estimate, it is a consistent method for dealing with the paucity of toxicokinetic data for humans.

It is not appropriate to assume that the relative proportions of 1,1-dichloroethene metabolites (or many other xenobiotic substances) produced in humans would be similar to laboratory rodents. There is a considerable difference in the proportion of metabolites formed in mice as compared to rats (ATSDR Toxicological Profile, 1989). Furthermore, the toxicokinetics of 1,1-DCE may be quite different at the very low concentrations encountered in the ambient environment as compared to laboratory studies. Since this type of information is not readily available in the published literature, it would be inappropriate to estimate the proportion of

inhaled 1,1-DCE which is converted to the oxirane (epoxide) or other electrophilic species in a hypothetical human receptor under the conditions potentially encountered at the site.

U.S. EPA agrees that applying the inhalation CSF to an administered dose of 1,1-dichloroethene (or similar compound) rather than the dose of the active metabolite is very likely to overstate the risk. The influence of metabolism on the estimate of risk posed by constituents of concern is discussed in the uncertainties section of the Baseline Risk Assessment.

The uncertainties for the slope factor for arsenic are acknowledged in the toxicity profile for arsenic (Appendix K): "There is a fair amount of uncertainty about the studies from which the oral slope factor was derived. At present, the ingestion unit risk estimate for arsenic is undergoing further review and a final ingestion unit risk is pending." The toxicity value for utilization of the arsenic oral slope factor was based on consultation with the U.S. EPA Environmental Criteria and Assessment Office (ECAO). Further, the uncertainties associated with the use of all of the slope factors are discussed on page 8-39 of the report.

15. The PRPs commented that improper statistical analysis was applied to generate the upper-95th confidence limit for the mean concentrations of chemicals in various media.

U.S. EPA Response: U.S. EPA Risk Assessment Guidance for Superfund, Human Health Evaluation Manual (U.S. EPA, 1989) does not provide a specific methodology for deriving the exposure concentration. New guidelines for deriving the exposure concentration have since been released by U.S. EPA in 1992. However, the U.S. EPA Guidance for Superfund, Human Health Evaluation (U.S. EPA, 1989) simply provided references to statistical analysis text books. These analyses were based on the concept of normality and sample size is key to the particular method of analysis selected.

In the Baseline Risk Assessment, a normal Gaussian distribution of the data was assumed based on the availability of 30 sample results. When a sample size is greater than 30, it is assumed that the sampling distribution approaches that of a normal distribution (Daniel, 1983). The 95 percent UCL values calculated were based on the sample standard deviation rather than the population standard deviation. In the former the denominator is n-1 rather than the n utilized in the calculation of the latter case. The sample standard deviation will therefore be greater in magnitude than the population standard deviation.

16. The PRPs commented that the seeps and intermittent streams do not support the sensitive aquatic life which may be present in Duck Creek and therefore, Ambient Water Quality Criteria (AWQC) do not apply to the evaluation of the seeps and intermittent streams.

U.S. EPA Response: Ambient Water Quality Criteria (AWQC) were evaluated for the seeps and intermittent streams as a pertinent ARAR or toxicity values for comparison to chemical

concentrations detected in these surface water bodies. Specific biota were identified during the ecological survey which could indeed be subject to exposure to site related contaminants in the seeps and intermittent streams. Such receptors included crayfish, tadpoles, salamanders, and frogs. Furthermore, the seeps may runoff into the intermittent streams during precipitation events and the intermittent streams feed into Duck Creek which has been designated as an exceptional warmwater habitat, capable of supporting/maintaining exceptional or unusual warmwater organisms. The potential eventual contribution of the seeps and intermittent streams to Duck Creek must also be considered in evaluating potential risks to environmental receptors.

17. The PRPs commented that the shower model utilized in the Baseline Risk Assessment was unscientific and overly conservative.

U.S. EPA Response: At the time of the preparation of the Baseline Risk Assessment, models for evaluating shower-related inhalation exposure were not approved or recommended by U.S. EPA guidance for risk assessment, ECAO, or by U.S. EPA or Ohio EPA toxicologists. Although models which predict the rate of volatilization of chemicals from potable water and subsequent exposure to receptors are reported in the literature, none of these models have been incorporated into U.S. EPA guidelines for the performance of human health risk assessments such as the Human Health Evaluation Manual [(HHEM) U.S. EPA, 1989], HEM Supplemental Guidance: “Standard Default Exposure Factors” (U.S. EPA, 1991), the Superfund Exposure Assessment Manual (U.S. EPA, 1988), or the Exposure Factors Handbook (U.S. EPA, 1989).

The model used in the risk assessment was simplistic in that it is assumed that the total concentration of the volatile organic chemicals will be released into the area of a shower stall and will be available in air for inhalation during the showering period. The model employs exposure parameter values (such as the shower water flow rate, and shower duration) from the Exposure Factors Handbook (U.S. EPA, 1989). The parameter values utilized were based on maximum or upper 95 percent confidence level estimates for the general population. No factor such as an octanol water partitioning coefficient (Koc) or other indicators of relative volatilization rates were employed in the model. Ranges of inhalation-to-ingestion doses for volatile organic compounds have been reported in the literature whereby the exposure from inhalation exceed that from ingestion. In addition, dermal exposure of volatile organic compounds has also been noted to occur during showering (Risk Analysis, Vol. 10, Jo, Weisel, and Lioy, 1990).

In the case of the shower model used in the risk assessment, dermal exposure was not evaluated quantitatively as contributing to overall exposure. Similarly, the contribution of volatiles remaining in the showering room air, or the rest of the house after the shower were not incorporated into the model. Other sources of inhalation exposure to volatile chemicals in indoor air not quantified using the showering scenario include washing dishes, washing clothes, and cooking. There is also the possibility that more than one occupant in a residence may take a shower in close proximity to the time that other residents have taken

showers. In this case, volatile chemical concentrations in the bathroom air may not decline, but will likely increase to levels higher than predicted for a single showering event. Exposure levels, therefore, would also be expected to be much higher than levels predicted for a single showering event scenario.

Thus, the shower model provides some under- and overestimation of overall exposure. The model utilized was developed to provide a conservative estimate of exposure. Because actual air measurements were not available, the model was designed to err on the side of conservatism rather than to potentially underestimate risk because ground water has historically been utilized as a potable source in the vicinity of the site.

18. The PRPs commented that the assumption that ground water was used as a potable supply was overly conservative and is not consistent with U.S. EPA guidelines. In addition, the PRPs stated that ground water at the site does not need to be returned to beneficial uses because this is not "practicable," due to site complexity and the difficulty of implementation of "treatment technologies."

U.S. EPA Response: U.S. EPA disagrees. Private wells have historically been utilized as potable water supplies on and near the site. A well survey, detailed in Section 4.4 of the RI report, indicates that 27 residences within a one-mile radius of the site rely on the use of the wells as a ground water resource. In fact, the former Ross/Elder residence is again occupied and the sole water supply is provided by a private well. Another residence (Drennen's) down the road from the site owner was identified during Phase II of the RI at which a private well provides the sole source of water to the residence. Also, there are no regulations that could stop the future use of the Groves well (located just adjacent to the site), if the Groves or future owners so desired. It was determined during Phase II of the RI that the residential wells nearest the site (Groves and former Ross/Elder) receive water from two or three water-producing horizons which collectively produce enough water to supply a private residence.

U.S. EPA also disagrees that the ground water at the site should not be returned to beneficial use due to impracticability. The NCP clearly recognizes that ground water restoration through source removal and natural attenuation is an acceptable alternative to implementation of ground water treatment. U.S. EPA has acknowledged the difficulty of actively remediating the ground water and identified source removal measures which should expeditiously restore this resource.

19. The PRPs commented that chemicals such as arsenic, beryllium, and the polycyclic aromatic hydrocarbons (PAHs) should not have been included in the risk assessment because they occur at levels that are consistent with background soils concentrations. The PRPs and their consultants also commented that the "midpoint" of USGS soil level of metals would result in a risk level of $2x10^{-4}$.

U.S. EPA Response: Chemicals of concern were selected based on an evaluation of all of the environmental media sampled on-site. Thus, while the chemical may not have occurred

at levels which were higher than background in one media, it may have exceeded background levels in another media. In the case of the arsenic, soil concentrations were higher than site-specific background soil concentrations. However, ground water concentrations of arsenic were in the same range as the site-specific background data for groundwater. Site ground water concentrations of beryllium were higher than background ground water concentrations. Yet, the soil levels found in on-site and site-specific background samples were comparable. The summary for the Baseline Risk Assessment, Section 8.7, recognized that chemical concentrations in some media did not exceed background. Furthermore, in the Feasibility Study, the remedial objectives selected for arsenic and beryllium in soil were set at the background concentrations.

Polycyclic aromatic hydrocarbons (PAHs) were also cited as chemicals of concern which should not have been evaluated in the Baseline Risk Assessment or the Feasibility Study because the concentrations were considered by the commenters to be in line with natural and anthropogenic background concentrations. The PAHs were detected in the soils samples collected from the site; however, the PAHs were not found above detection limits in background soils. Furthermore, elimination of chemicals from further consideration in the risk assessment or the feasibility study is typically limited to inorganic analytes. The PAHs were also associated with historical disposal activities at the site. Therefore, these chemicals were retained as chemicals of concern in both the Baseline Risk Assessment and the Feasibility Study.

Overall, the risk assessment serves to provide an evaluation of potential risk associated with the chemical concentrations detected in environmental media on-site. The initial evaluation of site-to-background metals concentrations was performed to identify analytes which exceed the site-specific chemical concentrations. Arsenic is one metal which provides a significant contribution to the overall risk from exposure to soil and ground water. Site soil, sediment, and surface water arsenic concentrations exceeded background concentrations. Site ground water arsenic concentrations did not exceed background levels. The maximum arsenic concentration in soil was 50 mg/kg. Concentrations of arsenic in Ohio farm soils may range from approximately 5 to 10 mg/kg (personal communication from Terry Logan, The Ohio State University, 1991) . Other sources report that arsenic in some parts of the country may be much higher.

However, environmental conditions may vary across the United States whereby, metals concentrations may be much higher or lower than at the site, some of this variability may be related to man-made or anthropogenic sources of chemical concentrations. However, site-specific background sampling data were collected from the site vicinity to determine appropriate comparison data for this site in particular. The Baseline Risk Assessment must focus on potential site-related exposures, risks, and hazards which exceed background levels for the site. The summary of the Baseline Risk Assessment concedes that “inclusion of media-specific concentrations that are not higher than background could result in an overly conservative, exposure, hazard, or risk estimate.”

With respect to the PRP's comment concerning the risk associated with the midpoint of USGS soil levels, it should be noted that the variability associated with the USGS data may result in ranges of soil concentrations across the United States which may not be comparable to site-specific information. The basis for collecting such soil data may differ in terms of the data quality, sampling distribution, soil stratigraphy, and laboratory analyses and quality assurance compared to the data collected for the Vandale site. Furthermore, it is not clear what is meant by the term “midpoint”. Such a value may represent the average or median values for samples collected from the same or different areas in the country. The “midpoint” of the number and type of samples collected in the USGS data may not provide a representative point of comparison for the site.

20. The PRPs commented that a functional uncertainty analysis was not performed in the Baseline Risk Assessment.

U.S. EPA Response: A qualitative evaluation of uncertainties associated with the Baseline Risk Assessment was presented in Section 8.6.5 of the Remedial Investigation Report. In addition, uncertainties associated with various assumptions utilized in the risk assessment were provided throughout the report and appendices. A quantitative analysis of uncertainties in the risk assessment process can be performed but is not required according to U.S. EPA Risk Assessment Guidance for Superfund, Human Health Evaluation Manual (1989). The guidance states that “highly quantitative statistical uncertainty analysis is usually not practical or necessary for Superfund site risk assessments for a number of reasons, not the least of which are the resource requirements to collect and analyze site data in such a way that the results can be presented as valid probability distributions.”

21. The PRPs commented that the risk and hazard estimates should not have been expressed using more than one significant digit.

U.S. EPA Response: U.S. EPA agrees that this comment is consistent with the U.S. EPA Risk Assessment Guidance for Superfund, Human Health Evaluation Manual (U.S. EPA, 1989). The risk assessment tables should have expressed the risk and hazard using only one significant digit. The results have been presented to two or three significant digits in the text and tables. However, such presentation does not change the overall findings of the risk assessment.

22. The PRPs expressed concern that the risk assessment consists of a worst case risk assessment and cautioned U.S. EPA to pay heed to a 1991 report from the Office of the President. This report claimed that the use of worst case assumptions by U.S. EPA distorts the results of risk assessments.

U.S. EPA Response: U.S. EPA disagrees that the risk assessment is excessively conservative. The risk assessment was conducted in accordance with the NCP and U.S. EPA guidance available at the time of the assessment. In addition, the Vandale Junkyard site is currently and has historically been inhabited by residents and used for occupational

purposes. The population of residents in the vicinity of the site are known to utilize ground water as a potable water source, raise livestock on-site, live and/or work on-site, and hunt and fish in the site vicinity. There is also the potential of gardening on-site. The population in the vicinity of the site is comprised of both very young and older aged individuals. Further, there are virtually no prohibitions to trespassers entering the site premises.

From an environmental (rather than human health) standpoint, there are many ecological receptors located on-site and associated with on-site biota which may be subject to exposure to chemicals detected in environmental media at the site.

In many cases the mention of a Superfund site brings to mind an industrial site where residents are not likely to come into contact with site contaminants, on-site entry is limited, ground water is not used for potable purposes, food is purchased at a local grocery, and on-site work and living activities are typically very limited. Yet, at the Vandale Junkyard site, residents do live in the site vicinity, and also live and work on-site. In this situation, U.S. EPA would be failing its statutory mandate to protect human health and the environment by conducting a risk assessment at this site which errs on the side of potential under-estimation of risk.

23. The PRPs commented that volatile organic compounds would be expected to vaporize and would not be available for skin absorption.

U.S. EPA Response: U.S. EPA followed the guidance outlined in the U.S. EPA "Interim Guidance for Dermal Exposure Assessment" (U.S. EPA, 1991) to evaluate dermal (skin) exposures to chemicals detected in soils. Chemical-specific dermal absorption values were not available for the chemicals of concern at the site. Therefore a default absorption factor of 25 percent was utilized for volatile organic compounds. However, as is the case with any modeled exposure pathway, direct measurements of relative skin absorption and ultimate exposure were not available. This approach may have resulted in an overestimate of potential exposure, hazard, and risk for volatile organic compounds which may volatilize. However, in no case did the dermal exposure route result in an unacceptable risk or hazard (i.e., risk greater than $1x10^{-4}$ to $1x10^{-6}$ or hazard greater than 1.0) for the volatile organic compounds. Overall, the risks and hazards associated with dermal exposure did not provide a significant contribution to the total site risks and hazards for the chemicals of concern.

24. The PRPs commented that a Monte Carlo analysis should have been performed to provide a less conservative, more reasonable approach to evaluating exposure.

U.S. EPA Response: Monte Carlo analyses can indeed provide much insight into the evaluation of exposure at a site. However, for the most part, such analyses are typically applied to uncertainty analysis rather than to the determination of reasonable maximum exposure. U.S. EPA Risk Assessment Guidance for Superfund, Human Health Evaluation (1989) provides a description of some of the uncertainty associated with such an analysis as follows:

> "These quantitative techniques require definition of the distribution of all input parameters and knowledge of the degree of dependence (i.e., covariance) among parameters. The value of first-order analyses or Monte Carlo simulations in estimating exposure or risk probability distributions diminishes sharply if one or more parameter value distributions are poorly defined or must be assumed. These techniques also become difficult to document and to review as the number of model parameters increases. Moreover, estimating a probability distribution for exposures and risks can lead one into a false sense of certainty about the analysis."

It should be noted that the pool of scientific data from which exposure parameter values have been derived is very limited for a number of the parameters. Complete distributions for the general population are not be available for parameters such as intake rates, exposure durations, exposure frequencies, etc. Therefore, while the PRPs contend that exposure, risk, and hazard have been overestimated at the site, the potential also exists that Monte Carlo analysis/development of exposure parameters may also significantly under- or overestimate exposure depending upon the default values assumed for missing data from the distributions of data evaluated in the Monte Carlo simulations.

Furthermore, a Monte Carlo analysis may be a viable path to take for sites where more variability in the probability of exposure may occur and there is room for the risk assessment to potentially err on the side of a lesser degree of conservatism. However, the site is known to be an area where people work, live, farm, hunt, and trespass on-site. Ecological receptors also inhabit and traverse the site. U.S. EPA cannot afford to err on the side of under-estimation of exposure and risk at such a site.

25. The PRPs commented that the Baseline Risk Assessment for the Vandale Junkyard site provides a bounding or screening estimate of risk rather than a realistic estimate of risk.

U.S. EPA Response: U.S. EPA disagrees. The Vandale Junkyard site is not a site where exposures to human and ecological receptors can be considered hypothetical (as might be true at some sites in more restricted, or lesser inhabited, industrial areas, etc). The site is one where the potential for human or environmental exposures is very high. It is for this reason that U.S. EPA felt very strongly that a conservative evaluation of risk must be performed for the site. The site owner has indicated that he would like to build a house on the site in the future, and his son lives in a mobile home on-site. Livestock and poultry are being raised on-site. The owner's grandchildren visit the site frequently. The owner and people who reside in the site vicinity hunt deer and other game animals on-site. The owner works on-site. Ground water use as a potable source has been documented over time in the site vicinity. There is a potential for the raising of vegetables on-site. These points all resulted in U.S. EPA's decision to prepare a risk assessment which would err on the side of conservatism rather than underestimation of exposure, hazard, and risk. While it is true that only a small number of human receptors may be affected by or subject to exposure at the site currently, such individuals and potential future users of the site are entitled to the same

attention and protection by the U.S. EPA as a larger receptor population.

26. The PRPs commented that if exposure concentrations were set to one half the detection limits for all of the chemicals of concern, a total risk of $2x10^{-3}$ would result for the site.

U.S. EPA Response: It should be noted that the toxic potential of the chemicals detected at the site weighed heavily in the selection of chemicals of concern for the Baseline Risk Assessment. Many of the chemicals are considered carcinogens. As such, and in view of the cancer-causing potential of any exposure to carcinogens, it is not surprising that the simple assumption of the presence of the chemicals of concern, albeit at very low concentrations, may be associated with unacceptable risk estimates. U.S. EPA's regulation of drinking water contaminants includes the setting of maximum contaminant level goals (MCLGs). For the most ideal situation, an MCLG would be the nonexistence of carcinogens in drinking water to provide the maximum protection against exposure to a carcinogen. Because the exact mechanism for the initiation of cancer is not currently known, U.S. EPA attempts to be as conservative as possible in the evaluation of available toxicity data and the associated development of cancer toxicity data and the associated development of cancer toxicity factors (slope factors) for carcinogens. Therefore, the detection of carcinogens, even at very low concentrations, at a site may be unacceptable because of the relative toxic potential of the contaminants. Proof of the lack of an unacceptable risk for a site would be the absence of contaminants. However, detection of chemicals in environmental media indicates that contamination is present. If the chemicals were never detected (at whatever quantitation or detection limit), there would be no need to evaluate risk or hazard at the site, and no calculations of excess risk (associated with even one-half of the detection limit) would be performed.

27. The PRPs identified an apparent contradiction in the RI/FS documents in that no dilution is assumed to occur as water infiltrates through contaminant sources to the first water-producing zones within the bedrock, but potential mixing and dilution of a contaminated water zone is identified for private residential wells, because these wells were observed to intersect two to three water producing zones.

U.S. EPA Response: It is true that drilling of monitoring wells adjacent to residential wells at the former Ross/Elder (RS-03) and Groves (RS-04) residences identified that each residential well receives water from two to three water zones. However, this does not necessarily mean that any potential residential well drilled on or near the site would have to intersect multiple water zones to receive a sufficient water supply for residential use. It is possible that there are potential well locations on or near the site that would produce a sustainable and adequate water supply for residential use by only intersecting the first water-producing zone. Although pumping tests were not conducted on any monitoring wells during the RI, possible evidence of this is that a few of the wells (S-8, S-9) installed into the first water zone produced a good quantity of water, even though it was not determined whether the quantity was sufficient to supply a residential well. Even if a residential well intersected

two or three water-bearing zones, there are no assurances that the lower zones would be less contaminated than the uppermost zone.

REFERENCES FOR REMEDIAL INVESTIGATION COMMENTS

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COMMENTS ON THE DEVELOPMENT OF REMEDIAL OBJECTIVES

1. The PRPs commented that MCLs should have been considered as ARARs for ground water during the development of remedial objectives.

U.S. EPA Response: MCLs were evaluated in the context of the relevant exposure pathways identified for the site. When these evaluations were performed, the total risk associated with ground water exceeded a $1x10^{-4}$ risk. The PRPs appear to have misconstrued that U.S. EPA had evaluated the total risk associated with the chemical-specific MCLs based on a $1x10^{-06}$ risk. The language in the FS which refers to a $1xl0^{-6}$ risk was directed at the development of total allowable site risk, rather than the determination of the risk associated with the MCLs as remedial objectives. As noted on page 2-3 of the FS, when the risk associated with the MCLs was evaluated, the total site risk was $1.16x10^{-3}$. This risk exceeded the $1x10^{-04}$ criterion as described in the NCP at 40 CFR 300.430(e)(2)(i)(D).

2. The commenters indicated that arsenic, beryllium, vinyl chloride, polycyclic aromatic hydrocarbons (PAHs), and diethylhexyl phthalate [DEHP, or as referred to in the RI/FS, bis(2-ethylhexyl phthalate)] should not have been considered as chemicals of

concern in the evaluation of site remediation.

U.S. EPA Response: U.S. EPA disagrees. Arsenic in soils at the site exceeded site-specific background concentrations by a five-fold factor. The development of ground water remedial goals included the evaluation of arsenic because the soil-related contamination of ground water could potentially occur at the site. The overall cleanup level for arsenic was set at the method detection limit which is equal to the MCL for arsenic at 0.005 mg/L. U.S. EPA guidelines for the development of preliminary remedial goals (U.S. EPA Human Health Evaluation Manual, Part B: "Guidelines for the Development of Preliminary Remediation Goals" OSWER Directive 9285.7-01B, December 13, 1991) stipulate that for a medium which does not exceed applicable preliminary remediation goals, but which may contribute to the protectiveness criterion for another medium (i.e., soil to ground water in this case), clean up goals should be developed for that potentially contributing medium.

The rationale for the inclusion of vinyl chloride has been discussed in the comments on the RI and Risk Assessment. However, the major considerations were the knowledge that the vinyl chloride may have been associated with site disposal activities and that vinyl chloride is a chemical breakdown product of other contaminants which were disposed at the site.

The commenters contended that beryllium was found at concentrations on-site which were below naturally occurring levels. The site-specific and background ground water concentrations of beryllium at the site were 0.04 mg/L and 0.001 mg/L, respectively. Beryllium concentrations were not lower than the site-specific background concentrations.

In the case of the PAHs and the DEHP, these organic chemicals were detected on-site at levels which were higher than background site-soil concentrations. In fact, PAHs were not found above detection limits in the background soils. Both the PAHs and the DEHP are associated with past disposal activities at the site. Although DEHP is a component of plastic materials and can be associated with field or laboratory error, evaluation of quality control samples of field and laboratory blanks did not demonstrate that DEHP should be qualified as the result of sample contamination during field or laboratory sampling and analysis. Further, detections from the site were higher than background concentrations for all of these chemicals. If field and or laboratory contamination were the cause of such detections, it would be expected that background concentrations would also be subject to the contamination.

3. The PRPs commented that a total site cleanup goal of $1x10^{-6}$ should not have been utilized for the purposes of developing remedial goals.

U.S. EPA Response: Current U.S. EPA guidelines concerning the development of preliminary remedial goals (U.S. EPA Human Health Evaluation Manual, Part B: "Guidelines for the Development of Preliminary Remediation Goals" OSWER Directive 9285.7-01B, December 13, 1991) are indeed directed toward determining remedial goals based on a chemical- and media-specific basis. However, the guidelines also allow for the

fact that exposure to receptors may occur through more than one medium. For the Vandale site, U.S. EPA felt particularly compelled to account for the combined exposures relative to soil and ground water as a measure of protection at a site where people have historically had access to the site and utilized ground water as a potable supply. U.S. EPA guidelines allow for such a determination to ensure the protection of human health and the environment.

4. The PRPs commented that remedial "alternatives 3A and 4A unnecessarily include treatment of sediments [sic], "stating that metals were shown to be near or below background and that "neither the organic nor the inorganic substances present [in sediment] contributed significantly to the cancer risk or non-cancer hazard."

U.S. EPA Response: U.S. EPA disagrees that metals were found to be near or below background. Table 1 in Appendix III of the FS (page III-6) shows the maximum metals concentrations for the seep sediments, as compared to the 95% upper confidence level (UCL) for background metals concentrations. None of the maximum concentrations for the RCRA metals shown on this table is consistent with, or below, the 95% UCL for background. The maximum concentration for chromium III is 1.12 times greater than the 95% UCL for background, and all other RCRA metals exceed their respective 95% UCL by even greater factors. Barium, a metal which often contributes significantly to site hazards, was detected at a maximum concentration 2.3 times that of the 95% UCL for background. To consider these concentrations to be "near or below background" is incorrect and unfounded.

The PRPs contend that remediation of the sediments is unnecessary because the risk assessment showed acceptable risks and hazards. The risk assessment results which the PRPs reference comprise the human health risk assessment, based solely on primary human contact with contaminants in the sediments. The calculated human health risks for such contact are below $1x10^{-6}$. However, sediment criteria were calculated using water quality standards which are protective of aquatic life, and these criteria were exceeded, showing the potential for effects on ecological receptors. The potential for related human health impacts, as a result of ecological impacts, also exists. The bioremediation of organic contaminants in sediments is recommended in all remedial alternatives because this treatment should accelerate degradation of these contaminants and reduce such impacts. Treatment of inorganic contaminants in the seeps is not recommended due to the lack of a non-destructive remediation approach.

Another case-in-point for remediation of the seep sediments is that the concentrations of metals in these sediments exceed the 95% UCL for background. Numerous other studies and the calculated sediment criteria also indicate that metals concentrations are elevated at this site. These elevated levels in sediments may cause organics and inorganics to be released to the receiving streams and other surface waters at concentrations which exceed applicable water quality standards. Please see the comments which follow for additional discussion of data that indicate that seep sediment metals concentrations are elevated.

5. The PRPs state that the terms "criteria" and "standards" are used interchangeably

throughout the discussion of the sediments, and that the precedence of state water quality over federal standards was ignored. The PRPs state that "(t)here are no federal or state sediment criteria or standards." The PRPs cite a recent U.S. EPA report, which states that "(t)he specific regulatory uses of SQC [Sediment Quality Criteria] have not been established."

The PRPs also disagree with the use of an Illinois sediment study for comparison with, and assessment of, the site sediments.

Finally, the PRPs question the lack of "discussion regarding the classification of Duck Creek as a surface water affected by mining activities." The PRPs state that time-varying water quality standards should have been used when calculating sediment quality criteria for this stream.

U. S. EPA Response: Any references to "sediment standards" are intended to read "sediment criteria." These criteria are not state or federal criteria, but they are based on state and federal water quality standards.

In regards to the use of water quality standards, it should be noted that, with the exception of lead from sample SW-9 and Seep A, all maximum detected metals concentrations that are shown to exceed sediment criteria, exceed both the Ohio EPA and U.S. EPA-based criteria. The maximum detected organics concentrations that exceed calculated criteria, exceed Ohio EPA-based criteria in every case. Therefore, the precedence of state water quality standards over federal is of little consequence. In SW-9 and Seep A, lead only exceeds the U.S. EPA-based criteria.

Although calculating criteria for sediment quality is an idea open to much debate, there is a scientific foundation for the concept, and criteria are evolving. Preliminary criteria already exist, as evidenced by the quote cited in the comments by the PRP's consultant. The quote reads "(t)he specific regulatory uses of SQC [Sediment Quality Criteria] have not been established." This statement implies that such criteria do exist. The use of such criteria is appropriate, despite the fact that specific regulatory uses have not been established. U.S. EPA believes that such criteria can be a useful tool in identifying contaminated sediments. Although preliminary, this is a reasonable approach in making sediment remediation decisions.

Ohio EPA uses the Illinois study as a screening tool to identify elevated levels of inorganics in sediment. In the absence of state- or site-specific criteria, such a study can prove useful in assessing sediments. The Illinois study provides additional evidence that seep sediments contain elevated levels of many of the inorganics. For further comparison, Table 1 shows other sediment criteria and background values for inorganics from a variety of sources. Please note that, in every case, the maximum inorganic concentrations detected in site sediments exceed the background and criteria values reported.

Regarding Duck Creek water quality standards, the only exemptions are total dissolved solids (TDS) for the mainstem and TDS, Ph, iron, and zinc criteria for the east and west forks. These exemptions exist because Duck Creek receives mine drainage. Aside from these exemptions, Duck Creek and its forks are subject to all warmwater habitat water quality standards. The sediment criteria tables are based on water quality standards for Duck Creek, which is only exempt from the TDS criterion. Therefore, no standards were used inappropriately.

6. The PRPs state that the water quality standards used in calculating sediment criteria should have been calculated based on site-specific hardness values. The PRPs also question the substitution of the Koc for chromium (VI) for chromium (III), since chromium (III) is not hazardous, and chromium (VI) is a carcinogen.

U.S. EPA Response: Site-specific hardness values were used in Tables 6 and 7 of Appendix III of the FS. These tables show sediment criteria based on hardness-dependent water quality standards. Seep A sediments exceed criteria based on U.S. EPA hardness-dependent water quality standards for lead and Ohio EPA- and U.S. EPA-based criteria for zinc. The marsh sediments exceed both Ohio EPA- and U.S. EPA-based criteria for chromium and lead. Certain surface water sediments also exceed Ohio EPA- and U.S. EPA-based criteria for chromium and federal-based criteria for lead. It should be noted that copper is the only inorganic which did not exceed any sediment criterion based on site-specific hardness. Chromium, lead, and zinc all exceed the site-specific criteria in at least one sediment sample.

The Koc for chromium (VI) was substituted for that of chromium (III) because no Koc was available for chromium (III). Because chromium (VI) has a greater affinity for organic matter than does chromium (III)(U.S. EPA 1979), the use of the Koc for chromium (VI) results in a higher calculated sediment criterion. That is, because chromium (VI) tends to bond to organic matter more readily than does chromium (III), more chromium (VI) will be “locked up” in sediment. Therefore, it is not as easily released to the aquatic environment. If a Koc were available for chromium (III), the resulting sediment criterion would be lower (more conservative) than that which was calculated using the Koc for chromium (VI).

The fact that chromium (VI) is a carcinogen, while chromium (III) is not considered hazardous, has no bearing on the use of Koc values in the calculation of sediment criteria. The Koc relates only to the partitioning of a chemical between sediment organic carbon and water. The organic carbon to water partitioning properties of a chemical are not determined by its health effects.

7. The PRPs state that Duck Creek is affected by acid mine drainage and is exempt from certain water quality standards. The PRPs also state that “Metcalf & Eddy should use the 30 day average concentration outside the mixing zone to determine sediment criteria. Sediment pore water will be diluted as it enters surface waters, so the use of the outside the mixing zone standards is more appropriate to derive sediment criteria [sic].”

U.S. EPA Response: The Duck Creek exemptions are addressed in the response to comment 2. U.S. EPA did use the 30-day average, outside the mixing zone standards, as listed in Appendix III.

8. The PRPs state that the procedure used to derive sediment criteria is appropriate only for non-ionic organic chemicals. The PRPs also question the fact that the uncertainties regarding the sediment criteria are not addressed. The PRPs mention that if 95% UCLs had been calculated for the sediment criteria, lead would no longer exceed the sediment criterion.

   The PRPs state that the source of Koc values for inorganics was not identified and that "the partitioning coefficient derived from the well waters cannot be used for this purpose since the organic matter regime is different. Chemicals in sediments are partitioned into three phases; 1) free, 2) sorbed on to particulate organic carbon, and 3) sorbed onto particulate organic carbon. Metcalf & Eddy should have determined the total and dissolved organic carbon content of the well water before attempting to develop partitioning coefficients that would be applied to seep sediments [sic]."

   The PRPs also state that information which became available since the publication of the U.S. EPA report which was referenced in the FS should have been used. This new information suggests that acid volatile sulfides (AVS) control the availability of trace metals and, therefore, the AVS of ground water and sediments should have been analyzed.

   Finally, the PRPs state that the derived sediment criteria were not appropriately applied. The consultant cites a U.S. EPA document, which reads "(t)he EqP [Equilibrium Partitioning] method is presently restricted to computing effects-based criteria for the protection of benthic organisms. The direct extension of this methodology for computing sediment criteria that are protective of human health, wildlife, and marketability of fish and shellfish requires that the equilibrium assumption be extended to the water column and to water column organisms. ...Hence, the application of the final residue values from the WQC [Water Quality Criteria] for the computation of SQC ...is not technically justifiable."

U.S. EPA Response: The equilibrium partitioning (EP) approach is intended for the calculation of sediment criteria for organics. However, because a method of calculating criteria for inorganics was not available, U.S. EPA computed some sediment criteria for inorganics using the same method. Koc values were found for most of the metals in the U.S. EPA document about determining soil response action levels (U.S. EPA, 1989). The calculated criteria were intended to support what was already shown in the comparison of Vandale sediment concentrations to 95% UCL background concentrations. In every case where metals exceed the calculated sediment criteria, they also exceed site background concentrations by a factor of at least 1.12. Lead is nearly 3 times its 95% UCL background concentration in the marsh sediments.

The uncertainties in the calculation of sediment criteria are addressed, in part, in the assumptions which are reported in Appendix III. Although any individual method for assessing sediment contamination has numerous uncertainties, the use of additional methods and sources provides mounting evidence of sediment quality. Because of such uncertainties, this is the approach which was used in assessing site sediments.

The PRPs suggest calculating an upper 95% confidence limit for the sediment quality criteria. No sample calculation was provided, and the comment is unclear. The calculated sediment criteria resulted in only one value per chemical. It is not possible to calculate the 95% UCL of a single value. U.S. EPA assumes that this was not what PRPs meant, but the comment implied such an approach.

U.S. EPA did not derive Koc values from well water, as the PRPs inferred. The Koc values were taken from scientific literature, U.S. EPA guidance, or were calculated from Kow values.

The PRPs state that chemicals in sediments exist in three phases. The PRPs only list two phases (one phase is listed twice). It is assumed that the third phase is bound to AVS.

AVS was not tested for, since the guidance regarding the ability of AVS to control the availability of trace metals was only recently published (1991). Field work on this project had been completed by the date this report was published, and, therefore, this analytical parameter was never measured.

As previously stated, the EP approach is used as a tool. If calculations show that chemicals may be released to the water column at concentrations that exceed water quality standards, the need to remediate sediments is supported. The water quality standards used to calculate sediment criteria are intended to be protective of aquatic life. Therefore, the calculated sediment criteria are intended to be protective of aquatic life. This includes both benthic organisms and "water column organisms." The interim guidance on sediment criteria (U.S. EPA, 1988) states:

> For compounds where chronic water quality criteria are not available, the EP approach can still be useful. For example, using upper-bounds effects concentrations will give comparable (i.e. upper-bounds effects) sediment concentrations. The interpretation of such sediment values is analogous to the interpretations of the comparable water column values used in their derivation.

This is interpreted to mean that if water standards which are protective of aquatic life are used to calculate sediment criteria, the resulting sediment values will be protective of aquatic life.

It should be noted that the final residue values (FRV), mentioned in the consultant's quote in the above paraphrased comment (Comment 6.5.4), are intended for protecting the uses of

aquatic life (e.g. the marketability of fish and shellfish). It is the application of FRVs in calculating sediment quality criteria that is not "technically justifiable." This does not apply to the criteria which were calculated for the FS. The calculated sediment criteria are not purported to be protective of human health, wildlife, and the marketability of fish and shellfish.

9. The PRPs commented that default equations should have been utilized to calculate the remedial objectives for the site.

U.S. EPA Response: Current U.S. EPA guidance for the "Development of Risk-based Preliminary Remediation Goals" is directed toward the derivation of "initial clean-up goals that (1) are protective of human health and the environment and (2) comply with ARARs. They are developed early in the process based on readily available information and also are used during analysis of remedial alternatives in the remedial investigation/feasibility study (RI/FS)." Key to this description is the word "initial." This guidance was issued after the Remedial Investigation and Baseline Risk Assessment for the Vandale Junkyard site were completed. Therefore, initial, preliminary remedial goals were not derived for the site before development of the RI. In such a case, where the preliminary remedial goals are developed before performance of the risk assessment, default equations and parameter values are utilized in the goal calculations.

U.S. EPA believes that when a Baseline Risk Assessment has been developed to specifically address potential exposures at a site, the site-specific scenarios utilized in the Baseline Risk Assessment may then be used to develop remedial objectives. If default values are used to develop remedial objectives in the Feasibility Study, then site-specific information identified in the Baseline Risk Assessment is lost and the Remedial Investigation and Feasibility Study can become inconsistent. The Baseline Risk Assessment serves to identify, on a site-specific basis, which chemicals and exposure pathways can potentially pose a problem for a site. The remedial objectives developed to reduce unacceptable risks or hazards should be derived from the site-specific information identified in the Baseline Risk Assessment. The Baseline Risk Assessment for the site was developed from information gathered for receptors during visual observations, conversations, and models prepared specifically for the site.

10. The PRPs commented that ground water would be undrinkable at some wells where high levels of inorganics were detected.

U.S. EPA Response: It is true that high levels of some analytes in ground water may make the water unsuitable for ingestion because of poor taste, odor, or other such "organoleptic" qualities. However, where such high levels of one chemical may make the water unsuitable for ingestion, inhalation or dermal contact might occur. Further, while the water might be treated in some way to decrease the concentrations of one particular metal, the other metals may still remain at high, yet non-organoleptic concentrations. The corresponding variability of the occurrence of the different metals only allows for a conservative estimation of potential exposure concentrations, rather than following the tract of ignoring results for

samples which contain extreme concentrations for particular metals such as iron and magnesium.

11. The PRPs commented that the number of background samples collected for the site was inadequate, and as such did not conform with Ohio EPA's "How Clean is Clean Policy."

U.S. EPA Response: Prior to initiation of Phase II sampling and analysis at the site, both U.S. EPA and Ohio EPA provided significant scrutiny and input into the plan for sampling background locations. Both U.S. EPA and Ohio EPA approved the number of background samples collected during Phase II sampling. Current Ohio EPA "How Clean is Clean Policy" guidelines provide a detailed accounting of how the number of background sampling locations for soil and ground water should be derived. However, those guidelines were not developed until after the Phase II sampling was performed. The previous versions of the "How Clean is Clean Policy" in effect during the development of the sampling and analysis plan and during Phase II sampling did not provide such a format for deriving the number of background samples.

U.S. EPA "Guidance for Data Usability for Risk Assessment" (U.S. EPA, 1991) provides a description of techniques for deriving sample location numbers for background samples. Using such guidelines in conjunction with assumptions concerning the requirements for the coefficient of variation and reliability of the data, results in background sampling numbers which range between three and five samples for an environmental medium. Higher numbers of background samples are typically required where suspected contaminants of concern are expected to be difficult to distinguish from background levels. Remediation for metals concentrations will be based upon achieving site-specific chemical concentrations which are consistent with background levels. Additional background sampling and analysis of environmental media will be performed during the Remedial Design (RD) phase of activities at the Vandale site. While metals were a consideration at the site, organic chemicals were the primary chemicals of concern suspected to exist on-site. Such chemicals would not be expected to occur naturally on-site, and therefore a large number of samples would not be required to distinguish site-related contamination from background locations (i.e., any concentration above detection limits would be expected to be site-related).

12. The PRPs commented that the influence of background levels on risk should be subtracted from the overall site risks when developing remedial objectives.

U.S. EPA Response: U.S. EPA disagrees. The contribution of background levels of chemicals were first eliminated from development of site remedial objectives in the initial screening of chemicals of concern in the Baseline Risk Assessment section of the Remedial Investigation. Chemicals carried through the risk assessment from that point on were selected because they occurred at levels which exceeded background levels in particular environmental media. For the most part, such exceedances of background concentrations occurred in soil. For some chemicals, such as arsenic, corresponding exceedances of

background did not occur in both ground water and soil. However, the potential for inter-media migration, must also be accounted for, such that remedial objectives for media which may be influenced by the future migration of chemicals (such as ground water contaminated by leachate for soils) must also be determined.

Remedial objectives are derived to protect against unacceptable "excess" risk. When chemical concentrations are higher than background levels in a particular media, such chemical levels are contributing to excess risk, over and above background levels. Remedial objectives for metals for the site were set at background levels for all metals but antimony and nickel. However, to determine whether the chemical concentrations for all chemicals will result in an acceptable risk, the total concentrations for all of the chemicals of concern must be included in the analysis, rather than subtracting out background levels.

13. The PRPs and their consultants commented that short-term risk of remedy implementation should be evaluated.

U.S. EPA Response: U.S. EPA acknowledges that a quantitative evaluation of the short- and long-term risks associated with remedy implementation and post-remedial conditions was not included in the Feasibility Study. In accordance with U.S. EPA Guidelines for the "Risk Evaluation of Remedial Alternatives", such an evaluation would likely be qualitative in nature because data associated with remediation of the site environmental media will not become available until remediation begins (U.S. EPA Risk Assessment Guidance for Superfund, Part C, OSWER Publication 9285.7-01C, December 1991).

The only background information which can be evaluated for potential risks associated with remediation would be that of the results of the future scenarios of the Baseline Risk Assessment which assumed that soils would be disturbed for future site development. Short-term exposures would be expected to follow the pattern of short-term or subchronic exposures, hazards, and risks determined in the future scenarios of the Baseline Risk Assessment. As such, the short-term hazards and risks would likely be lower than the long-term risks. However, in the case of emissions related to remedial activities, the associated air concentrations of the chemicals of concern would likely be higher than the concentrations modeled in the Baseline Risk Assessment (based on fugitive dust emissions). The exposures relative to emissions generated during remediation may result in higher risks and/or hazards for receptors. Workers performing remedial work would likely be subjected to the highest exposures.

But it should be noted that ARARs will have to be complied with during remediation (i.e., air and water quality standards and criteria, ambient and occupational air quality/exposure standards and criteria, etc.). Compliance with such ARARs will require that appropriate techniques are followed to prevent or mitigate additional contamination and exposure of environmental media or human or environmental receptors. In addition, a Health and Safety Plan will be developed to ensure that unacceptable exposures to site workers will not occur during remedial activities. In both the short- and long-term remediation scenarios, potential

exposures, risks, and hazards for the receptors would be expected to decrease with time if remediation is successful in decreasing chemical concentrations. As for the potential effects on ecological receptors, care would be required to protect potentially vulnerable species and to rebuild vegetation and species once remediation has been achieved. Finally, U.S. EPA's selected remedy has the lowest short-term effects of all action remedies evaluated in the FS.

14. The PRPs commented that cleanup levels are calculated such that the chemicals of concern have an interdependent relationship.

U.S. EPA Response: The cleanup levels were developed to encompass the total site risk from all of the chemicals of concern contributing to unacceptable hazards and risks. The approach took into account both the relative contribution of the chemicals to the overall risk as well as the relative toxic potential of each of the chemicals/exposure pathways. While this approach limits the relative percentage of allowable risk for each of the chemicals of concern, this interdependence is based on the results of the Baseline Risk Assessment. The PRPs contend that media-specific and independent chemical-specific cleanup levels should be developed for the site. However, the site risks and hazards are comprised of potentially concurrent contributions from both soil and ground water exposures. If each of the chemicals are allowed a total risk of $1x10^{-6}$, for each of the two environmental media, it is not possible for the point of departure for developing a site remedial goal of $1x10^{-06}$ to be achieved.

15. The PRPs commented that the method of developing soil cleanup levels for the protection of ground water is overly simplistic because it does not allow for attenuation or dilution of contaminants leached from soils.

U.S. EPA Response: U.S. EPA concedes that a conservative approach was used to develop ground water protection cleanup levels in soils. U.S. EPA believes that in the absence of site-specific soil leaching tests, this methodology is appropriate for the circumstances at the site. This is especially true for areas where soils are not very deep and fractured bedrock is close to the surface, since this provides for a direct conduit from soil contamination to ground water contamination. However, U.S. EPA has agreed to allow for the development of refined soil cleanup levels for the protection of ground water in the selected remedy. These refined cleanup levels may be pursued during remedial design based on site-specific leaching tests and modeling of contaminant transfer from soils to the ground water.

l6. The PRPs commented that site-wide average concentrations of contaminants in soils, as related to the required cleanup levels, should be used to determine whether or where remediation is necessary.

U.S. EPA Response: U.S. EPA disagrees. The site has been found to have highly variable contaminant distributions with "hot spots" of contamination from waste disposal, especially in association with drum fragments. Clearly, it is not appropriate to measure site-wide averages prior to removal of contaminant hot spots. These hot spots may be the primary source of

ground water contaminants. The use of statistically derived site-wide averages to show compliance with cleanup levels after remediation is recommended by U.S. EPA, and will be necessary at the site.

17. The PRPs commented that an uncertainty analysis was not performed for the cleanup levels developed for the site.

U.S. EPA Response: U.S. EPA acknowledges that a formal uncertainty analysis was not performed for the development of remedial objectives for the site. However, from a qualitative standpoint, all of the uncertainties discussed in the Baseline Risk Assessment, including the assumption that chemical concentrations will remain constant over time; the lack of site-specific activity pattern information; and uncertainties associated with toxicity data, also apply to the calculation of the remedial objectives.

REFERENCES FOR COMMENTS ON THE DEVELOPMENT OF REMEDIAL OBJECTIVES

U.S. EPA. 1979. Water-related Environmental Fate of 129 Priority Pollutants. Volume I: Introduction and Technical Background, Metals and Inorganics, Pesticides and PCBs. EPA-440/4-79-029a. December 1979.

U.S. EPA. 1988. Interim Sediment Criteria Values for Nonpolar Hydrophobic Organic Contaminants. SCD #17. May 1988.

U.S. EPA. 1989. Determining Soil Response Action Levels Based on Potential Contaminant Migration to Ground Water: A Compendium of Examples. EPA/540/2-89-057 October 1989.

COMMENTS ON THE DEVELOPMENT AND EVALUATION OF REMEDIAL ALTERNATIVES IN THE FEASIBILITY STUDY

1. The PRPs commented that the FS failed to properly develop a combined remedy for the site, because it does not differentiate between the various areas of contamination at the site and should have considered separate remedial approaches for Active Area A, Active Area B, and the North Slope.

U.S. EPA Response: U.S. EPA disagrees. A review of Figure 2-1 in the FS clearly shows that in Active Area A, only a portion of the entire area (approximately 16%) is expected to include both organic and inorganic contaminants. The remainder of this area is expected to include only inorganic contaminants. The soil volume estimates in Appendix VI, the cost estimates in Section 4.0, and supporting information in Appendix VII (page VII-4) of the FS further document and support this differentiation of contaminated areas.

The FS does, in fact, provide for "combined remedies" by separately addressing treatment technologies/remedial approaches for inorganic and organic contaminants in soil, seep sediments, ground water, surface/seep water, and solid wastes separately and then developing a combined remedy which will fully address the variety of contaminants and contaminated media along the North Slope and interactive areas of the Vandale Junkyard site.

2. The PRPs commented that Table 2-7 in the FS report indicates the contaminants of concern in Active Area A are metals and chlorinated volatile organic compounds; the contaminants of concern in Active Area B are metals and non-chlorinated semi-volatile organic compounds; and the contaminants of concern in the North Slope Area are metals, chlorinated volatile organic compounds, and bis (2-ethylhexyl) phthalate. Based on this information, the PRPs claim that the FS should have considered separate remedial approaches for each of these areas and the FS inappropriately screened remedial technologies as if all of the contaminants were found in each of these three areas.

U.S. EPA Response: U.S. EPA did attempt to provide for separate remedial approaches for the various areas on-site. As discussed in the response to the preceding comment, Active Area A was clearly noted in Figure 2-1 to include a small area of inorganic and organic contamination and a much larger area of inorganic contamination only. Furthermore, the estimates in the FS indicate that the North Slope Area is expected to account for over 50% of the site soils which will require treatment for organic contaminants. The organic contaminants detected above cleanup levels along the North Slope include chlorinated organic compounds and non-chlorinated organics. Furthermore, both chlorinated and non-chlorinated organic compounds have been detected in soil samples from Active Areas A and B.

Although not all of these compounds were detected above cleanup levels, historical disposal practices at the Vandale Junkyard (as discussed in the FS report) are considered too ill-defined to conclude that the Active Area A soils will not include non-chlorinated organic compounds above cleanup levels and Active Area B soils will not include chlorinated organic compounds above cleanup levels. Selection of flexible treatment remedies that can effectively treat a wide variety of organic contaminants is therefore a justifiable approach for the Vandale Junkyard technology screening process. However, U.S. EPA has provided additional flexibility in the selected remedy to investigate the utility of other technologies to remediate distinct areas of the site during remedial design. This determination will depend on the results of additional soil sampling, soil treatability studies, and other site-specific information.

3. The PRPs commented that in-situ bioremediation was inappropriately eliminated as a potential treatment technology for the site soils.

U.S. EPA Response: U.S. EPA eliminated in-situ bioremediation as a potential treatment technology for organic contaminants in soils during the FS for the following reasons:

- The high clay content and low-permeability of the site soils will, as stated in the FS report, limit the ability of nutrients to migrate through the soils and make contact with contaminants. The inability of nutrients to make contact with contaminants may prevent them from promoting biological degradation of the organic contaminants. The PRPs performed a sieve analysis on five site soil samples during the RI. Four of the five samples classified as clay and one sample classified as silt. The PRPs determined the coefficient of permeability (k) for each of the soil samples to be less than $1x10^{-7}$ cm/sec.

- The U.S. EPA Publication, Innovative Treatment Technologies, Overview and Guide to Information Sources, October 1991 (EPA/540/9-91/002), indicates that applications for in-situ bioremediation are limited to favorable site conditions which require soils that are sandy and highly permeable (K greater than $1x10^{-1}$ cm/sec).

- An article entitled "Performance of In-situ Soil Decontamination Technologies: An Air Force Perspective" in the August 1990 issue of Environmental Progress (Volume 9, Number 3) stated the following:

  > "Our experiences at Kelly AFB and Eglin AFB test sites have shown that enhanced biodegradation cannot be applied at sites with poor permeability and that contaminant accessibility can be a problem even in more permeable, sandy soils. This technology seems best suited for sandy or gravel aquifers where the majority of contamination is in the saturated zone."

- The U.S. EPA Handbook, "Stabilization Technologies for RCRA Corrective Actions", August 1991 (EPA/625/6-91/026) states the following:

  > "Many chlorinated solvents, such as tetrachloroethene (PCE), trichloroethene (TCE), and 1,1,1-trichloroethane (TCA) can be resistant to aerobic biodegradation. These compounds may, however, be degraded under anaerobic conditions. The degradation of these compounds involves reductive dehalogenation, where chlorine is replaced with hydrogen to form new compounds that may be more mobile and toxic than the original compound before being mineralized."

- Several of the project managers listed in Attachment 1 of the PRP's comments (Field Applications of Bioremediation) were contacted to determine the types of soils that were effectively treated in-situ. None of the project managers indicated that their project had successfully treated soils characterized by the low-permeability of the Vandale Junkyard site soils. Most of the sites where in-situ bioremediation was being performed were characterized by highly permeable sandy soils. Several of the project managers were very skeptical

regarding the ability of nutrients to migrate through the low-permeability clays and provide effective treatment.

Since the selected remedy does not require on-site treatment of soils, this question is no longer relevant.

4. The PRPs commented that ex-situ bioremediation was inappropriately eliminated as a potential treatment technology for site soils.

U.S. EPA Response: U.S. EPA eliminated ex-situ bioremediation as a potential treatment technology for organic contaminants in soils during the FS based on the following reasons:

- As stated in the FS and supported in the response to the preceding comment, the high clay content of the site soils is expected to limit the effectiveness of this technology.

- As stated in the FS and supported in the response to the preceding comments, the presence of both chlorinated and non-chlorinated organic compounds are expected to complicate the bioremediation process.

Since the selected remedy does not require on-site treatment of soils, this question is no longer relevant.

5. The PRPs commented that the FS failed to identify and evaluate in-situ stabilization/solidification as a treatment alternative for site soils.

U.S. EPA Response: Tables 2-8 and 2-9 in the FS include a discussion and evaluation of treatment technologies for site soils. In-situ vitrification is an in-situ stabilization technology.

In-situ stabilization/solidification involves mixing soils with a chemical reagent using a backhoe, auger, or rotary filling device to provide stabilization/solidification of soil contaminants. This technology was not addressed in the FS report. U.S. EPA believes that implementation of this technology may be limited at the site for the following reasons:

- In-situ mixing operations will be very difficult to implement and control along the north slope.

- The high clay content of the site soils will complicate the mixing process and volatilization of some organic compounds is likely to occur during mixing.

- In-situ mixing operations are typically limited to the treatment of lagoon sludge.

Since the selected remedy does not require on-site treatment of soils, this question is no

longer relevant.

6. The PRPs commented that the FS inappropriately restricted potential use of stabilization/solidification to the treatment of inorganic contaminants in the site soils. This technology may also be used to treat organic contaminants in soil.

U.S. EPA Response: The use of stabilization/solidification technologies to treat organic contaminants in soil has some potential drawbacks or limitations which include:

- Impediment or retardation of mixture setting/curing, particularly at high concentrations of organic contaminants.

- Volatilization of volatile organic compounds during mixing.

Since the selected remedy does not require on-site treatment of soils, this question is no longer relevant.

7. The PRPs commented that low temperature thermal desorption (LTTD) is not effective for treatment of PAHs and will not be effective for volatile organic compounds (VOCs) in the soils at the Vandale Junkyard. The high clay content of the site soils will limit the effectiveness of LTTD.

U.S. EPA Response: References more recent than those used by the PRPs to support this comment indicate that LTTD is effective for treatment of PAHs. A U.S. EPA Engineering Bulletin, "Thermal Desorption Treatment," from May 1991 (EPA/540/2-91/008) indicates that removal efficiencies for PAHs are typically greater than 97% . More specifically, for constituents of concern at the Vandale Junkyard site, the following removal efficiencies were noted:

PAH Compound	**Removal Efficiency (%)**
Benzo(b)anthracene	> 97 to > 99.99
Chrysene	93.6 to > 99.8
Benzo(b)fluoranthene	82.3 to 97.9
Benzo(a)pyrene	98 to > 99.9

Results are provided for benzo(b)anthracene because tests were not performed for benzo(a)anthracene. These removal efficiencies compare very favorably with removal efficiencies for other technologies, including bioremediation (which had an average removal rate of 87% according to the document referenced by the PRPs).

To further support the effectiveness of LTTD for treatment of PAHs, a pilot scale test performed by IT Environmental Programs, Inc. and IT Corporation in February 1991 (On-site Engineering Report for the Low-Temperature Thermal Desorption Pilot Scale Test

on Contaminated Soil, Volume I, Contract No. 68-C9-0036, August 1991), indicated that PAHs were effectively treated using LTTD. The results from this pilot scale test are presented below:

PAH Compound	Pre-Treatment Concentrations (mg/kg)	Post-Treatment Concentrations (mg/kg)
Benzo(a)anthracene	160;150;210;160;160;190	all < 0.23
Chrysene	150;140;200;140;150;170	all < 0.120
Benzo(b,k)fluoranthene	180;130;220;130;130;160	all < 0.047
Benzo(a)pyrene	73;62;120;64;65;76	all < 0.110

Benzo(b)- and Benzo(k)fluoranthene were found to co-elute; therefore, a total amount is given.

With respect to treatment of VOCs, the table used in the PRP comments to demonstrate LTTD's ineffectiveness shows an average soil bed temperature between 90°F and 115°F. It is not surprising that treatment of VOCs was not achieved with these low temperatures. As noted in the U.S. EPA Engineering Bulletin referenced above, LTTD technology "heats contaminated media between 200-1,000°F, driving off water and volatile contaminants". At the higher temperatures, LTTD has proven very effective in removing volatile organic constituents (including halogenated compounds) from soil.

There is documented evidence that LTTD can effectively treat soils with a high clay content. The U.S. EPA Engineering Bulletin referenced above indicated that PAH removal efficiencies in excess of 99% were typical for creosote contaminated clay soils. In addition, LTTD units operated by Chemical Waste Management have been demonstrated to successfully treat very cohesive clays.

Since the selected remedy does not require on-site treatment of soils, this question is no longer relevant.

8. The PRPs commented that U.S. EPA has not properly developed the concept of operable units and combined technologies at the Vandale Junkyard site, which has resulted in the improper elimination of potential cost-effective remedies.

U.S. EPA Response: The FS report divided the site into three distinct areas which include: the North Slope, Active Area A, and Active Area B. The North Slope and the Active Areas were evaluated for potential remedial actions separately in the FS report, consistent with the "operable unit" approach. The applicable portions of the responses to Comments 1 and 2 also support this response.

9. The PRPs commented that the rationale used to eliminate in-situ bioremediation of site soils as a treatment alternative (high clay content and limited access to contaminants)

should also have been used to eliminate in-situ bioremediation as a treatment option for site seep sediments. Furthermore, the FS did not consider the adverse environmental effects of the proposed sediment remediation activities.

U.S. EPA Response: U.S. EPA believes that the contaminated sediment particles are not present in a tightly bound soil matrix, as with the contaminated soil particles. The contaminants in the sediment are therefore expected to be more accessible and amenable to in-situ bioremediation. The proposed use of nutrients and aeration pumps are not expected to adversely effect human health or the environment. The implementation of this treatment approach would be carefully monitored and could be performed when the seep collection areas have little or no standing water in them, thereby limiting the potential for suspension of fine particles and eutrophication. It is important to note that only the seep sediments are proposed for remediation, not the stream or tributary sediments.

10. The PRPs commented that the short- and long-term impacts were not identified in the evaluation of alternatives in the FS report. Furthermore, no specific short- or long-term problems are identified and no specific control measures described.

U.S. EPA Response: The FS report does identify short- and long-term impacts for all of the action alternatives as presented on pages 4-11, 4-12, 4-13, 4-24, 4-25, 4-32, 4-33, 441, 4A2, 443, 4-50, and 4-51. The long-term impacts discussed in the FS include the anticipated magnitude of residual risks following treatment and the anticipated adequacy and reliability of controls, including the potential for future contaminant migration and attainment of site cleanup goals. These issues are addressed and considered separately for each alternative. The short-term impacts discussed in the FS include the need for protection of site workers and nearby residents from exposure to contaminants during remedial activities, collection of surface water runoff, control of sediment transport, and the need for North Slope restoration. A specific plan, including the use of engineering controls (i.e., spraying work areas to limit dust generation and sediment control barriers to limit contaminant migration), personal protective equipment for site workers, and restoration along the north slope are described for each alternative as controls for anticipated short-term impacts.

11. The PRPs expressed concern about several issues related to compliance with ARARs for the remedial alternatives in the FS. These issues are as follows:

- There is no assurance that the delisting of listed hazardous wastes found on site (as proposed for Alternatives 3A, 3B, 4A, and 4B) will be successful.

- There is no indication that remedial alternatives 3A or 4A will achieve MCLs for groundwater.

- Ohio's regulations regarding lead in particulate matter are not identified or addressed.

U.S. EPA Response: The FS report clearly presents delisting as one viable option for ensuring compliance with land disposal restrictions (LDRs) if treatment of soils is desired. The other option is to obtain a treatability variance. Pages 4-22 and 4-23 of the FS report present a detailed discussion and explanation of these options. At no point do these discussions claim that delisting will definitely be successful, as the difficulty of achieving delisting requirements for all contaminants was recognized. This is why the treatability variance was included as another option. However, U.S. EPA has determined that the selected remedy will not require soils treatment. This decision was made after further consideration of site-specific information and the comments from the PRPs.

The discussions regarding achieving ground water MCLs under each alternative in the FS report state that the proposed remedies will promote compliance with MCLS. Removal of the contaminant source is the mechanism for reducing contaminant concentrations in ground water. This is expected to be accomplished in conjunction with capping, whereby limiting the infiltration of water through impacted soils is expected to reduce contaminant concentrations in the ground water. By removing or containing the source of ground water contamination, it logically follows that (as stated in the FS report), the naturally-occurring processes of adsorption, dilution, and biodegradation will reduce the concentrations of contaminants in ground water over time, thereby promoting compliance with MCLs. Ultimate compliance with MCLs or the more stringent health-based cleanup levels specified in the ROD is not assured, and the ROD clearly acknowledges this.

With respect to lead in particulate matter issue, the PRPs provide no regulatory citation for the Ohio regulations concerning lead in particulate matter. However, the FS report states that work areas will be sprayed to limit fugitive emissions during excavation activities. Furthermore, the FS indicates that the necessary air pollution control devices will be used to control emissions on the incineration and/or thermal treatment units.

12. The PRPs commented that a U.S. EPA demonstration of an incinerator unit treating lead-containing soils encountered “extreme difficulty in meeting particulate emissions requirements”.

U.S. EPA Response: The referenced U.S. EPA document used to support this comment (EPA/540/5-88/002a, September 1980) is a report on the results of a single demonstration test performed for a specific type of incinerator (the Shirco Infrared Incineration System) over the course of three days of testing. Based on the results from this test, it is certainly not prudent or technically sound to conclude that the same problems will be encountered at the Vandale Junkyard. The FS report does not suggest that the Shirco Infrared Incineration System will be used to treat site soils. The discussion of incineration treatment on pages 2-33 and 2-34 of the FS indicate that rotary kiln incineration is likely to be the most suitable incineration system for the organic contaminants at the Vandale Junkyard. Furthermore, the test results in the referenced U.S. EPA document indicated that particulate emission requirements were achieved with the Shirco System following system maintenance and modifications. The document also included suggestions for providing more effective

treatment of emission gases (pages 94 and 94) using the Shirco System. These suggestions included:

- The reorientation of spray and distribution nozzles/headers and the introduction of additional or new scrubber internals to effect increased scrubber efficiency.

- The replacement of the scrubber system with a more efficient vertical or wet electrostatic precipitator design.

Another important factor to consider in response to this comment is that the lead concentrations in the Vandale Junkyard site soils are substantially lower than the lead concentrations in the soils treated in the referenced demonstration test. The highest detected concentration of lead in the Vandale Junkyard soils was 720 mg/kg whereas the demonstration test soils had lead concentrations between 4,400 and 5,900 mg/kg.

Finally, since the selected remedy does not require treatment of soils, this issue is no longer relevant.

13. The PRPs commented that the FS report does not adequately address the implementability issues associated with proposed alternatives 3A and 4A.

U.S. EPA Response: The selected remedy does not require treatment of soils. However, U.S. EPA has prepared the following responses for comments related to the implementability issues associated with Alternatives 3A and 4A and the PRPs' proposed bioremediation alternative.

Alternative 3A

One of the many advantages to the use of a rotary kiln to treat contaminated materials is its capability of burning waste in any physical form and accept waste feed with little or no preparation, thereby limiting the potential complications associated with materials handling and feed preparation.

The BTU content is not a relevant factor in treating contaminated soil via thermal treatment unless there are plans to use the contaminated soil as a fuel. There are no plans to burn the Vandale site soils as a fuel.

Siting requirements and the community's reaction to the use of an on-site incinerator were not addressed in the FS because, as stated in the Community Acceptance section (page 4-31), community comments on site remediation issues were expected to be received during the public comment period. This public comment period is now complete and based on the comments received, there does not appear to be any public opposition specifically directed towards incineration. The public has raised concerns and questions concerning why any type of remediation needs to be performed at the Vandale Junkyard; and partly in response to this

concern, U.S. EPA has selected a remedy which does not require treatment of soils.

Incineration was selected in the ROD as an alternative treatment technology for the site only in the event that LTTD treatment was determined to be ineffective. As noted in the response to comment 7 above, LTTD was expected to be an effective treatment technology.

The implementation of excavation activities along the north slope, as discussed in the FS report, is expected to be difficult. However, there is no evidence to support suggestions that excavation cannot be accomplished. The FS report discusses the possible need for retaining walls along the north slope to ensure slope stability during excavation activities (refer to the response to Comment 14 below for more information).

Alternative 4A

The potential for high particulate loadings was only one factor used to eliminate LTTD as a treatment approach for site sediments. There is no conclusion drawn in the FS to indicate the particulate loading will be an insurmountable problem. Another factor used to eliminate LTTD as a potential treatment option is the anticipated high moisture content of the sediment.

With respect to excavation activities along the north slope, the response under Alternative 3A above and the response to Comment 14 below should be referenced.

Bioremediation (PRP's Proposed Alternative)

The PRPs contend that a tractor with a disk and fertilizer attachment can be driven up and down the north slope to provide for in-situ bioremediation of organic contaminants in the soils. The steep grades along the north slope will simply make this impossible in some locations. The PRPs have not indicated how this problem will be addressed. Furthermore, as discussed in the response to comment 3 above, the breakdown products associated with the treatment of chlorinated organics in the site soils may be more toxic and mobile than the contaminants being treated, and the low-permeability of the site soils may make in-situ bioremediation infeasible.

The PRPs contend that excavation of the upper 18 inches of soil along the North Slope will not present the excavation implementation problems associated with Alternatives 3A and 4A. U.S. EPA believes that the steep grades along the north slope will complicate the maneuvering of heavy equipment along the north slope, regardless of the depth of excavation.

14. The PRPs commented that the FS fails to fully assess the technical feasibility of excavation along the North Slope and the risk posed by excavation activities.

U.S. EPA Response: The FS report is not intended to present detailed design requirements

for implementation of excavation activities along the North Slope. As stated in the FS, detailed review of slope conditions during the remedial design phase of the project will be performed to establish the most appropriate approach for North Slope excavation. Consideration of shoring to promote slope stability during excavation is discussed in the FS report. Excavation along steep slopes is a proven engineering practice and the North Slope of the Vandale Junkyard is not expected to present any limitations which will prevent excavation.

The FS presents a discussion of the short-term risks posed by excavation and how these risks can be controlled. As noted in the FS report, controlling the short-term health risks and the potential cross-media impacts during excavation activities will be accomplished by:

- Constructing a drainage trench along the top of the North Slope and a surface water collection pond downgradient of the excavation area to collect runoff. The drainage trench atop the slope will divert runoff away for the excavation area, thereby reducing the amount of surface water runoff collected downgradient of the excavation. The level bench area along the north slope provides a good location for collection pond construction.

- Wetting the soils to limit dust generation during excavation activities and employing sediment control barriers to control the migration of sediments and associated contaminants.

- Ensuring that site workers don appropriate PPE and are properly trained to perform work which requires excavation and handling of potentially contaminated soils.

15. The PRPs commented that soil washing and soil vapor extraction (SVE) were not given proper consideration as a treatment technology for site soils.

U.S. EPA Response: The FS report considered soil washing as a treatment technology and eliminated the technology from further consideration during the initial screening process (see Section 2.5) based on the high clay content of the site soils. A recent U.S. EPA publication (Innovative Treatment Technologies, EPA/540/9-91/002, October 1991) supports the elimination of soil washing as a treatment technology based on the clay in the site soils. The reference document states: “this process (soil washing) is relatively ineffective on soils with high silt and clay content.”

The FS report also considered SVE for treatment of site soils but eliminated this technology from consideration based on the low permeability of the site soils (high clay content) and the technology’s inability to treat heavy metal contaminants in soil. The EPA publication referenced above states that soils exhibiting low air permeability are difficult to treat with SVE. SVE generally works best in well-drained soils and is only effective for treatment of volatile organic compounds.

Since the selected remedy does not require treatment of soils, concerns regarding the effectiveness of these technologies are no longer relevant.

16. The PRPs commented that excavated material from the North Slope area will be a mixture of roots, rocks, and moist plastic soil, and stated that these materials cannot be treated with the thermal desorption unit without pretreating the soils.

U.S. EPA Response: The FS report includes a discussion of the need to segregate excavated materials into separate piles of clean soils, contaminated soils, salvageable solid wastes, unsalvageable solid wastes, and contaminated solid wastes under all alternative descriptions. It was understood that the segregation process may be an expensive undertaking, which is why the cost estimates for each alternative include several line items for segregation and handling of excavated materials. Since the selected remedy does not require treatment of soils, this concern is no longer relevant.

17. The PRPs commented that site constraints, especially with respect to the North Slope, would require that areas of contamination must be more accurately defined prior to initiating excavation activities.

U.S. EPA Response: As discussed repeatedly in the FS report, the remedial design stage of this project will include additional investigations which will more accurately define areas of site contamination.

18. The PRPs commented that the discussion on reducing toxicity, mobility, or volume through treatment on page 4-42 of the FS does not note that the stabilization/ solidification process will result in an increase in the volume of the material being treated. The PRPs also noted that the discussion of Alternative 2 on page 4-56 incorrectly states that Alternative 2 does not provide for treatment of contaminated materials.

U.S. EPA Response: U.S. EPA agrees. Page 4-42 of the FS should state that the stabilization/solidification process will result in an increase in the volume of the material being treated (as was stated on page 4-24 of the FS and also noted on page VII-5 of eAppendix VII). The discussion of Alternative 2 on page 4-56 should note that off-site treatment and disposal of drummed materials and other wastes which are unsuitable for on-site containment and bioremediation of sediments are proposed under Alternative 2. Natural degradation and attenuation of constituents of concern is not considered a treatment technology.

COMMENTS ON THE COST AND VOLUME ESTIMATES PRESENTED IN THE FEASIBILITY STUDY

1. The PRPs commented that the FS is flawed in the estimation of the areal extent and

volume of contaminated soils at the site.

U.S. EPA Response: U.S. EPA has conceded that available site information is not sufficient for accurate delineation of the areal extent and volume of contaminated soils at the site. The FS report repeatedly states that the estimates are not expected to be highly accurate, and describes how additional sampling is proposed during the remedial design phase of the project to better delineate areas which will require remediation. The FS report states that the estimates provided are conservative and will require further refinement. All available information was used to develop the estimates in the FS report, including available analytical results, historical disposal practices, and visual observations of disposed waste materials. U.S. EPA believes that this approach is reasonable because it did not hinder the selection of a remedial action for the site.

With respect to the north slope area, it is important to note that although Figure 2-1 shows the entire north slope as potentially contaminated (9,000 square yards), the figure also notes that only 30% of the north slope is expected to require excavation. Furthermore, as noted in Appendix VI of the FS report, only 50% of the excavated material from the north slope is expected to be contaminated soil.

The PRPs have expressed disagreement with the area of contamination delineated in the FS and state that "a more valid area of contamination is approximately 71,000 square feet ... only 26% of the area" identified in the FS. A close review of the contaminated soil areas in the FS report indicates that the FS has estimated an area of soil contamination of approximately 163,300 square feet, which indicates that the PRP's estimate is actually 43% of the area identified in the FS.

The response to Remedial Investigation Report Comment 1 should also be referenced for additional information related to the estimation of the areal extent and volume of contaminated soils at the site.

2. The PRPs commented that the estimated time required to implement Alternative 3A is too short to be realistic.

U.S. EPA Response: U.S. EPA believes that this statement stems from the PRP's apparent miscalculation of the volume of soils contaminated with organic constituents. Appendix VI indicated the total volume of contaminated soils at the site is estimated to be 33,600 cubic yards. However, as shown in Figure 2-1 and clearly noted on page VII-4 of Appendix VII, only 17,600 cubic yards of soil are expected to require treatment for organic contaminants (i.e., incineration under the Alternative 3A scenario). In addition to the organic-contaminated soils, an estimated additional 1,400 cubic yards of contaminated solid waste material and liquid waste (i.e., runoff) may require treatment, resulting in a total estimated volume of 19,000 cubic yards of organic-contaminated materials to be treated via incineration under Alternative 3A. Item IV-B in Table 4-2 indicates that the 19,000 cubic yards will consist of organic-contaminated soils, contaminated solid waste, and liquid waste.

Based on the assumptions made on page 7-21 of the PRPs comment document, the time required to design and implement Alternative 3A would be approximately 22 months, consistent with the FS estimate of 18 to 24 months.

3. The PRPs commented that the cost estimates in the FS used incorrect volumes for soil treatment.

U.S. EPA Response: As discussed in the response to Comment 2 above, the volumes used in the FS cost tables are correct. It appears that the PRPs incorrectly determined that all of the impacted soils at the site will require treatment for organic contaminants.

4. The PRPs commented that the FS report does not include a sensitivity analysis. Given the limited site information regarding the areal extent and volume of impacted site soils, a cost sensitivity analysis is considered appropriate.

U.S. EPA Response: The information provided by the cost sensitivity analysis performed by the PRPs is interesting but not persuasive. If the volume of contaminated soil at the site were to decrease substantially below the estimates presented in the FS, it logically follows that the differences in the costs between all alternatives (including on-site and off-site disposal alternatives) will decrease. The lack of soils treatment in the selected remedy makes this question irrelevant, as U.S. EPA has concluded that containment of soils is most cost-effective.

5. The PRPs commented that the cost associated with the delisting of treated soils and waste was apparently overlooked in the cost estimates for Alternatives 3B and 4B.

U.S. EPA Response: U.S. EPA believes that the 20 percent contingency cost incorporated into these cost estimates would be more than adequate to cover the delisting expenses and other cost elements which were not itemized in the cost estimate. The itemized cost elements in FS Tables 4-1 through 4-5 are expected to include the significant cost items associated with the remedial alternatives but are not intended to represent a detailed list of every cost item which may be associated with the implementation of each alternative. The 20 percent contingency is included with each cost estimate to account for these additional costs.

6. The PRPs commented that a simplified approach may have been used in evaluating the available capacity of the site for placement of soils and waste, stating that approximately one-fourth of the Cap “A” area is unavailable due to the severe slopes and that variations in elevation at the Cap “B” location make capping impractical.

U.S. EPA Response: The FS report provides a preliminary evaluation of a theoretical cap design in order to “provide some insight concerning the relationship between the depth of contaminated soils placed in the active site areas prior to capping and the slope of the cap and cover system”. The preliminary calculations in the FS provide this “insight”. The FS report explicitly states that cap construction would require clearing and grading of the

proposed cap areas (to eliminate variations in elevation) prior to placement of contaminated materials and that the optimum specifications of the cap system will be established during remedial design. The FS report repeatedly indicates that the proposed areas of excavation and impacted soils will require further delineation during remedial design. Since the selected remedy does not require excavation in the active areas of the site or treatment of soils, it is unlikely that, based on further delineation of contaminated areas during remedial design, the proposed cap areas will not be able to accommodate the actual quantity of excavated soil and waste materials. Obviously, if the on-site areas cannot accommodate placement of treated soils, other options will require consideration.

APPENDIX B

ADMINISTRATIVE RECORD INDEX

U.S. EPA ADMINISTRATIVE RECORD INDEX

ORIGINAL

VANDALE JUNKYARD SITE

MARIETTA, OHIO

08/25/92

DOC#	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	03/17/81	Gorman, P., OEPA	U.S. EPA	Preliminary Assessment	4
2	07/01/81	Scnornstheimer, R., B.F. Goodrich	Gorman, P., OEPA	EP Toxicity Test Results & Description of BFG Drums on Site	5
3	09/09/82	Ecology & Environment	U.S. EPA	Site Inspection Report	14
4	01/26/83	Cekus, G., Ecology & Environment	U.S. EPA	Cover & Preliminary Assessment	4
5	07/20/83	Gorman, P., OEPA	U.S. EPA	Site Inspection Report	14
6	07/28/83	Dettmann, E., Ecology & Environment	Holoska, A., U.S. EPA	Inspection of Van Dale Junkyard	21
7	04/01/84	Gorman, P., OEPA	U.S. EPA	Site Inspection Report	15
8	05/14/84	CH2M Hill	U.S. EPA	Final Remedial Action Master Plan (RAMP)	127
9	06/03/84	Gorman, P., OEPA	U.S. EPA	Site Inspection Report	14
10	01/15/85	Gorman, P., or Starkey, M., OEPA	U.S. EPA	Preliminary Assessment	5
11	05/01/87	Meierer, R., CompuChem		CompuChem Laboratories' Quality Assurance Plan	89
12	07/29/87	Lupton J., U.S. EPA	Addressees	Cover Letter & Administrative Order on Consent for RI/FS	39
13	08/06/87	U.S. EPA	Public	NEWS RELEASE: U.S. EPA, Ohio Seek Comment on Vandale Junkyard Investigation	2
14	08/31/87	ERM Group	The Vandale PRP Group	Health & Safety Plan	73
15	09/00/87	ERM Group	The Vandale PRP Group	Remedial Investigation Work Plan	82
16	09/01/87	ERM Group	The Vandale PRP Group	Remedial Investigation: Quality Assurance Project Plan	165

DOC#	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
17	09/25/87	Barriball, T., U.S. EPA & Enrle, G., OEPA	Bodamer, J., Amer. Cyanamid & Hoadley, G., UNISYS	Effective Date of Consent Order	6
18	10/07/87	Johe, D., ERM-Midwest	Barriball, T., U.S. EPA	Modification to RI Workplan	2
19	05/00/88	Jacobs Engineering Group	U.S. EPA	Final Community Relations Plan	29
20	05/05/88	Kleinrath, A., U.S. EPA	Bodamer, J., American Cyanamid	Approval of Amended RI Workplan	2
21	08/25/88	Jirka, A., U.S. EPA	Bruce, D., U.S. EPA	Partial Approval of Quality Assurance Project Plan for RI/FS (all activities approved except sampling & analysis of domestic well samples)	1
22	08/30/88	Alcamo, T., U.S. EPA	Bodamer, J., American Cyanamid	Notice of RI, Phase I Work Plan Approval	1
23	09/00/88	U.S. EPA	Public	FACT SHEET: Vandale Junkyard Site	6
24	11/18/88	U.S. Public Health Service		Preliminary Health Assessment	4
25	04/00/89	U.S. EPA	Public	Progress Report on the Vandale Junkyard Superfund Site	2
26	04/11/89	Jones, V., U.S. EPA	Niedergang, N., U.S. EPA	Approval of QAPP, Addendum #1 for Sampling & Analysis of Residential Well Water Samples (QAPP attached)	223
27	10/31/90	Metcalf & Eddy	U.S. EPA	RI Work Plan Documents Package	418
28	12/22/90	Morris, K., Metcalf & Eddy	Karobka, L., U.S. EPA	CRL Sample Data Reports, Traffic Reports & Chain of Custody Reports for water, sediment & soil	95
29	01/23/91	Morris, K., Metcalf & Eddy	Karobka, L., U.S. EPA	Revised CRL Sample Data Reports & Corrected Original Traffic Reports & Chain of Custody Records	148
30	01/31/91	Morris, K., Metcalf & Eddy	Minnich, L., Sample Management Office	Sample Data Reports, Original Traffic Reports & Corrected Chain of Custody Records	21
31	04/25/91	Hunkler, P., OEPA	Schmitt, L., U.S. EPA	List of Ohio ARARs for Site	31
32	11/19/91	Schmitt, L., U.S. EPA	Hunkler, L., OEPA-DERR	Letter Providing Copies of Draft RI Report dated 11/18/91	1

DOC#	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
33	02/18/92	Metcalf & Eddy	U.S. EPA	Final RI Report	430
34	02/18/92	Metcalf & Eddy	U.S. EPA	Final RI Report: Appendices	750
35	02/27/92	Blair, B., OEPA	Schmitt, L.,	Ohio EPA Approval of Final Report	1
36	05/06/92	Schmitt. L., U.S. EPA	Stello, M., OEPA-DERR	Cover Letter to Draft FS dated 5/4/92	1
37	06/00/92	U.S. EPA	Public	FACT SHEET: Results of Remedial Investigation	6
38	08/00/92	U.S. EPA	Public	FACT SHEET: EPA Recommends Cleanup Plan	12
39	08/12/92	Metcalf & Eddy	U.S. EPA	Final FS Report	342
40	08/21/92	Stello, M, OEPA	Schmitt, L, U.S. EPA	Concurrance with Final Proposed Plan & Final FS	1
41	08/27/92	U.S. EPA		Proposed Plan	24

U.S. EPA ADMINISTRATIVE RECORD
VANDALE JUNKYARD SITE
MARIETTA, OHIO
UPDATE #1
09/23/93

DOC#	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
1	08/26/92	Schmitt, L., U.S. EPA	Clark, R., Environmental Mitigation Group	Letter w/Copies of the FS and Proposed Plan for Review for the Public Comment Period	1
2	08/26/92	Marietta A.M.	Public	Public Notice Announcing the Public Comment Period on the Feasibility Study and Proposed Plan	1
3	09/03/92	Clark, R., Environmental Mitigation Group	Schmitt, L., U.S. EPA	Letter re: September 11, 1992 Meeting and Request for an Extension of the Public Comment Period	1
4	09/09/92	Schmitt, L., U.S. EPA	Clark, R., Environmental Mitigation Group	Letter re: Approval for Extension of the Public Comment Period to October 29, 1992	2
5	09/09/92	Marietta A.M.	Public	Public Notice Announcing an Extension of the Public Comment Period on the Feasibility Study and Proposed Plan	1
6	09/10/92	Booth-Bennett, S.	U.S. EPA	Transcript of Public Meeting Held September 10, 1992 re: the Proposed Plan	85
7	09/13/92	Barnes, T. and Barnes, P.	Allen, C., U.S. EPA	Citizen's Comments of the Proposed Plan	2
8	09/16/92	Burke, H., Rockingham Inc.	Schmitt, L., U.S. EPA	Letter and Information re: Use of In Situ Vitrification Technology	7
9	10/09/92	Hoadley, G., Wise & Marsac	Schmitt, L., U.S. EPA	Letter Requesting an Additional 30 Days to Prepare Written Comments for the Public Comment Period	1
10	10/09/92	Brant, T., Cromer, Eaglesfield & Maher	Allen, C., U.S. EPA	Letter Requesting an Extension of the Public Comment Period for the Proposed Remedial Action Plan	1
11	10/10/92	Hardy, M., Thompson, Hine and Flory	Schmitt, L., U.S. EPA	Letter Requesting an Extension of the Public Comment Period	2
12	10/14/92	Clark, R., Environmental Mitigation Group	Schmitt, L., U.S. EPA	Letter Requesting an Additional 30 Day Extension of the Public Comment Period	1
13	10/20/92	Clark, R., Environmental Mitigation Group	Schmitt, L., U.S. EPA and Stello, M., OhioEPA	Letter Clarifying Reasons for Requesting an Additional Extension of the Public Comment Period	2

DOC#	DATE	AUTHOR	RECIPIENT	TITLE/DESCRIPTION	PAGES
14	10/21/92	Clark, R., Environmental Mitigation Group	Schmitt, L., U.S. EPA and Stello, M., OhioEPA	Follow-up Letter to the October 14, 1992 Letter Requesting an Additional 30 Day Extension of the Public Comment Period	1
15	10/22/92	Schmitt, L., U.S. EPA	Clark, R., Environmental Mitigation Group	Letter Approving an Additional 15 Days for the Public Comment Period Extending It to November 13, 1992	2
16	10/29/92	Marietta A.M.	Public	Public Notice Announcing the Second Extension of the Public Comment Period on the Feasibility Study and Proposed Plan	1
17	11/10/92	Hardy, M., Thompson, Hine and Flory	Allen, C., U.S. EPA	Vandale Junkyard Steering Committee's Requested Supplement to the Administrative Record	7
18	11/12/92	Ellis, M., Cromer, Eaglesfield & Maher	Schmitt, L., U.S. EPA, et al.	B.F. Goodrich Company's Comments on the RI/FS and the Proposed Remedial Action Plan	153
19	11/12/92	Clark, R., Environmental Mitigation Group	Schmitt, L., U.S. EPA	Vandale Junkyard Steering Committee's Comments on the RI/FS and the Proposed Plan	502
20	11/13/92	Hardy, M., Thompson, Hine and Flory	Allen, C., U.S. EPA	Letter w/Copies of Items Mentioned in the Vandale Junkyard Steering Committee's November 10, 1992 Request to Supplement the Administrative Record	1202
21	12/03/92	Carpenter, E., Cromer, Eaglesfield & Maher	Allen, C., U.S. EPA	Replacement Copy of B.F. Goodrich Company's November 13, 1993 Public Comments	163
22	01/28/93	Metcalf & Eddy	Schmitt, L., U.S. EPA	Errata Sheet for the Final Feasibility Study	2

APPENDIX C

STATE CONCURRENCE LETTER

State of Ohio Environmental Protection Agency

P.O. Box 1049, 1800 WaterMark Dr.
Columbus, Ohio 43266-0149
(614) 644-3020
FAX (614) 644-2329

George V. Voinovich
Governor

March 31, 1994

Mr. Valdas V. Adamkus
Regional Administrator
United States Environmental Protection Agency
Region V
77 West Jackson Boulevard
Chicago, IL 60604-3590

Dear Mr. Adamkus:

The Ohio Environmental Protection Agency has reviewed the Record of Decision (ROD) for the Vandale Junkyard Superfund site near Marietta, Washington County, Ohio. Ohio EPA concurs with the selected remedial alternative for this site, Alternative 2. The selected remedy includes the following major components:

* Ground water restoration by source control, removal, and containment, and natural attenuation.

* Consolidation of contaminated site soils and unsalvageable solid wastes, followed by construction of a RCRA Subtitle C cap.

* Off-site treatment and/or disposal of drummed materials, including liquid and solid industrial wastes and sludges and other wastes, especially hazardous wastes. Soils visibly contaminated with industrial wastes will also be taken off-site for treatment and/or disposal.

* In-situ bioremediation of organic contaminants in north slope seep sediments.

* Ground water, surface water, and sediment monitoring to confirm the expeditious attainment of cleanup levels.

* Institutional controls, including deed restrictions and fencing, to prevent installation of drinking water wells in contaminated ground water while cleanup levels are being achieved, and to prevent disturbance of capped areas.

* Operation and maintenance requirements including cap mowing, inspection and repair.

The estimated total net present worth cost for the selected remedy is $4,564,880, which includes $3,709,650 for capital costs and $855,230 for operation and maintenance costs.

The ROD specifies that if monitoring indicates that contaminant levels in ground water, surface water, and sediment are not diminishing sufficiently to achieve cleanup levels in a reasonable timeframe, additional work may be required. Further, if the selected remedy fails to demonstrate expeditious progress toward meeting ground water cleanup levels at any or all of the monitoring points, contingency measures such as additional source removal activities or limited ground water extraction and treatment will be considered, where feasible.

The ROD does not set forth clear criteria by which to make the determination of what is a reasonable timeframe to achieve cleanup levels. However, the ROD does indicate that information to be obtained in remedial design and remedial action will affect this determination. The ROD further indicates that reasonable timeframes for assessing expeditious ground water attenuation will be developed during remedial design, based in part on additional ground water information to be collected. The effectiveness of the selected ground water remedy will be further evaluated at the required 5-year review period.

Ohio EPA believes that it is very important that remedial design include development of clear criteria and procedures for assessing whether cleanup levels are being expeditiously achieved. Methods for interpreting data collected over time and supporting rationale, and actions based on those interpretations, should be fully defined in the remedial design. Ohio EPA believes that the selected remedy provides the best balance among the alternatives and that, in combination with the criteria and procedures to be defined in remedial design, provides the best response to the conditions at the Vandale Junkyard site.

Sincerely,

Donald R. Schregardus, Director
Ohio Environmental Protection Agency

Distribution:

Jan Carlson, Acting Chief, DERR
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Larry Schmitt, U.S. EPA

APPENDIX D

FEDERAL ARARS

TABLE IV-A

SELECTED CHEMICAL-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS - - FEDERAL GOVERNMENT

Chemical Name	SDWA Maximum Contaminant Levels a/ (mg/l)
Arsenic	5.0 x 10-02
Barium	2.0
Beryllium	1.0 x 10-03
Cadmium	5.0 x 10-03
Chromium	1.0 x 10-01
Lead	1.5 x 10-02
Nickel	1.0 x 10-01
Thallium	2.0 x 10-03/1.0 x 10-03
1,1-Dichloroethene	7.0 10-03
(Cis)1,2-Dichloroethene	7.0 x 10-02
(trans)1,2-Dichloroethene	1.0 x 10-01
1,1,1-Trichloroethane	2.0 x 10-01
Trichloroethene	5.0 x 10-03
Tetrachloroethene	5.0 x 10-03
Vinyl Chloride	2.0 x 10-03

a/ For water that is to be used for drinking, the MCLs set under the SDWA are generally the applicable or relevant and appropriate standard. A standard for drinking water more stringent than an MCL may be needed in special circumstances, such as where multiple contaminants in ground water or multiple pathways of exposure present extraordinary risks. In setting a level more stringent than the MCL in such cases, a site-specific determination should be made by considering MCLGs, the Agency's policy on the use of appropriate risk ranges for carcinogens (10^{-4} to 10^{-7} individual lifetime risk), levels of quantification, and other pertinent guidelines. Prior consultation with Headquarters is encouraged in such cases.

TABLE IV-A (continued)

SELECTED CHEMICAL-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS -- FEDERAL GOVERNMENT

	CWA Water Quality Criteria for Protection of Human Health		CWA Ambient Water Quality Criteria for Protection of Aquatic Life b/	
	Water and Fish Ingestion (mg/l)	Fish Consumption Only (mg/l)	Freshwater Acute/Chronic (mg/l)	Federal Sediment Standard (calculated)** (mg/kg)
Antimony	1.4 x 10-02	4.3	9.0*/1.6*	8.0 x 10+04
Arsenic	2.2 x 10-06	1.8 x 10-05	0.85*/4.8 x 10-02*	0.24
Beryllium	7.7 x 10-06	1.3 x 10-04	0.13*/5.3 x 10-03*	
Bis(2-ethylhexyl)phthalate	1.8 x 10-03	5.9 x 10-03	- -	
Cadmium	1.6 x 10-02	0.17	3.9 x 10-03+/1.1 x 10-03+	
Chromium	3.3 x 10+01	6.7 x 10+02	1.7+/0.210+	1.035+
Copper	1.3		1.8 x 10-02+/1.2 x 10-02+	5.91 x 10-02+
Cyanide	0.70	2.2 x 10+02	2.2 x 10-02/5.2 x 10-03	2.6 x 10-02
Chloroform	5.7 x 10-03	0.47	/1.24	5.45 x 10+01
1,1-Dichloroethene	5.7 x 10-05	3.2 x 10-03	11.6*/ - -	
1,2-Dichloroethene	0.70	1.4 x 10+02	11.6*/ - -	
Iron	- -	- -	- -	
Lead	5.0 x 10-02	- -	8.2 x 10-02+/3.2 x 10-03+	1.59 x 10+01+
Mercury	1.4 x 10-04	1.5 x 10-04	2.4 x 10-03/1.2 x 10-05	6.0 x 10-03
Nickel	0.61	4.6	1.4+/0.16+	
Selenium	0.10	6.8	2.0 x 10-02/5.0 x 10-03	
Silver	0.105	65	4.1 x 10-03+/1.2 x 10-04+	
Tetrachloroethene	8.0 x 10-04	8.85 x 10-03	5.28*/0.84*	3.06 x 10+02
Thallium	1.7 x 10-03	6.3 x 10-03	1.4/0.04	
1,1,1-Trichloroethane	3.1	1.7 x 10+02	- -	
Vanadium	- -	- -	- -	
Vinyl Chloride	2.0 x 10-03	.525	- -	
Zinc	- -	- -	0.12+/0.11+	5.3 x 10+01+

b/ Federal water quality criteria (FWQC) are not legally enforceable standards, but are potentially relevant and appropriate to CERCLA actions. CERCLA §121(d)(2)(B)(I) requires consideration of four factors when determining whether FWQC are relevant and appropriate: 1) the designated or potential use of the surface or ground water, 2) the environmental media affected, 3) the purposes for which such criteria were developed, and 4) the latest information available.

* Lowest Observed Effect Level

* Calculation of sediment standard is provided in Appendix III of this report.

* Hardness dependent criteria (100 mg/l used); refer to specific criteria documents for equations to calculate criteria based on other water hardness values

Source: U.S. EPA, Office of Water, Drinking Water Regulations and Health Advisories, November, 1991, and U.S. EPA, Quality Criteria for Water 1986, EPA 440/5-86-001, May, 1986 (51 Federal Register 43665), and U.S. EPA Amendment to the Water Quality Standards Regulation to Establish the Numeric Criteria for Priority Toxic Pollutants Necessary to Bring All States into Compliance with Section 303(C)(2)(B), Proposed Rules, November, 1991 (56 Federal Register 58420).

TABLE IV - B

SELECTED LOCATION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Location	Requirement	Prerequisite	Citation
Within 100-year floodplain	Facility must be designed constructed, operated and maintained to avoid washout	RCRA hazardous waste; treatment storage, or disposal	40 CFR 264.18(b)
Within floodplain b/	Action to avoid adverse effects, minimize potential harm, restore and preserve natural and beneficial values	Action that will occur in a floodplain, i.e. lowlands and relatively flat areas adjoining inland and coastal waters and other flood prone areas	Protection of floodplains b/ (40 CFR 6, Appendix A); Fish and Wildlife Coordination Act (16 USC 661 et seq.); 40 CFR 6.302

TABLE IV - C

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Capping (See also Closure with Waste in Place for additional associated requirements)	Placement of a cap over (e.g., closing a landfill, or closing a surface impoundment or waste pile as a landfill, or similar action) requires a cover designed and constructed to: * Provide long-term minimization of migration of liquids through the capped area; * Function with minimum maintenance; * Promote drainage and minimize erosion or abrasion of the cover; * Accommodate settling and subsidence so that the cover's integrity is maintained; and * Have a permeability less than or equal to the permeability of any bottom liner system or natural sub-soils present.	RCRA hazardous waste placed at site after the effective date of the requirements, or placement of hazardous waste into another unit will make requirements applicable when the waste is being covered with a cap for the purpose of leaving it behind after the remedy is completed. Capping without such placement will not make requirements applicable. d/	40 CFR 264.228(a) (Surface Impoundments) 40 CFR 264.258(b) (Waste Piles) 40 CFR 264.310(a) (Landfills)

a/ Currently only RCRA, CWA, and SDWA requirements are included. Additional action-specific requirements will be added as additional statutes are analyzed.

b/ Action alternatives from RCD keyword index, FY1986 Record of Decision Annual Report, January 1987, Hazardous Site Control Division, EPA.

c/ Requirements have been proposed but not promulgated for air stripping, hybrid closure, gas collection and miscellaneous unit treatment. When these regulations are promulgated, they will be included in the matrix.

d/ Some action-specific requirements listed may be relevant and appropriate even if RCRA definitions of storage, disposal, or hazardous waste are not met, or if the waste at the site is similar to but not identifiable as a RCRA hazardous waste. See Chapter 2 for information on relevant and appropriate RCRA requirements.

TABLE IV - C

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Capping (continued)	Eliminate free liquids, stabilize wastes before capping (surface impoundments).		40 CFR 264.228(a)
	Restrict post-closure use of property as necessary to prevent damage to the cover.		40 CFR 264.117(c)
	Prevent run-on and run-off from damaging cover.		40 CFR 264.228(b) 40 CFR 264.310(b)
	Protect and maintain surveyed benchmarks used to locate waste cells (landfills, waste piles.		40 CFR 264.310(b)
Closure with No Post-Closure Care (e.g., Clean Closure)	General performance standard requires elimination of need for further maintenance and control; elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products.	Applicable to land-based unit containing hazardous waste. d/ Applicable to RCRA hazardous waste (listed or characteristic) placed at site after the effective date of the requirements, or placed into another unit. Not applicable to material treated, stored, or disposed only before the effective date of the requirements, or if treated in-situ, or consolidated within area of contamination. Designed for cleanup that will not require long-term management. Designed for cleanup to health based standards.	40 CFR 264.111
	Disposal or decontamination of equipment, structures, and soils. Removal or decontamination of all residues, contaminated containment system components (e.g., liners, dikes), contaminated subsoils, and structures and equipment contaminated with waste and	May apply to surface impoundments and container or tank liners and hazardous waste residues, and to contaminated soil, including soil from dredging or soil disturbed in the course of drilling or excavation, and returned to land.	40 CFR 264.111 40 CFR 264.178 40 CFR 264.197 40 CFR 264.288(o)(1) and 40 CFR 264.258

d/ Some action-specific requirements listed may be relevant and appropriate even if RCRA definitions of storage, disposal, or hazardous waste are not met, or if the waste at the site is similar to but not identifiable as a RCRA hazardous waste. See Chapter 2 for information on relevant and appropriate RCRA requirements.

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Closure with No Post-Closure (continued)	leachate, and management of them as hazardous waste.		
	Meet health-based levels at unit.		40 CFR 244.111
Closure with Waste in Place	Eliminate free liquids by removal or solidification. Stabilization of remaining waste and waste residues to support cover	Applicable to land disposal of hazardous waste. d/ Applicable to RCRA hazardous waste (listed or characteristic) placed at site after the effective date of the requirements, or placed into another unit. Not applicable to material treated, stored, or disposed only before the effective date of the requirements, or if treated in-situ or consolidated within area of contamination	40 CFR 264.228(a)(2) 40 CFR 264.228(a)(2) 40 CFR 264.258(b)
	Installation of final cover to provide long-term minimization of infiltration (see Capping).		40 CFR 264.310
	30-year post-closure care and ground water monitoring. g/		40 CRF 264.310

f/ In many cases, there are no defined “units” at a CERCLA site. Instead, there are areas of contamination with differing concentration levels (including hot spots) of hazardous substances, pollutants, or contaminants. When RCRA hazardous wastes are moved into or out of an area of contamination, RCRA disposal requirements are applicable to the waste being managed and certain treatment, storage, or disposal requirements (such as for closure) are applicable to the area where the waste is received.

g/ Regional administrator may revise length of post-closure care period (40 CFR 264.117).

h/ Landfill units meeting the requirements of 40 CFR 264.301(f) are not subject to RCRA minimum technology requirements.

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE ON RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Consolidation between Units	With respect to the waste that is moved, see requirements in the following sections: Capping, Closure with Waste in Place, Container Storage, Construction of a New Landfill On-Site, Construction of a New Surface Impoundment On-Site, Incineration (On-Site), Land Treatment, Operation and Maintenance, Tank Storage, and Treatment.	Movement of hazardous waste and placement into another unit.	See Capping, Closure with Waste in Place, Container Storage, Construction of a New Landfill On-Site, Construction of a New Surface Impoundment On-Site, Incineration (On-Site), Land Treatment, Operation and Maintenance, Tank Storage, and Treatment in this exhibit.
Container Storage	Containers of RCRA hazardous waste must be:	Storage of RCRA hazardous waste (listed or characteristic) not meeting small quantity generator criteria held for a temporary period greater than 90 days before treatment, disposal, or storage elsewhere (40 CFR 264.10), in a container (i.e., any portable device in which a material is stored, transported, disposed of, or handled). A generator who accumulates or stores hazardous waste on-site for 90 days or less in compliance with 40 CFR 262.34(a)(1-4) is not subject to full RCRA storage requirements. Small quantity generators are not subject to the 90 day limit (40 CFR 262.34(c), (d), and (e)).	
	o Maintained in good condition;		40 CFR 264.171
	o Compatible with hazardous waste to be stored; and		40 CFR 264.172
	o Closed during storage (except to add or remove waste).		40 CFR 264.173
	Inspect container storage areas weekly for deterioration.		40 CFR 264.174

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Container Storage (continued)	Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.		40 CFR 264.175
	Keep containers of ignitable or reactive waste at least 50 feet from the facility's property line.		40 CFR 264.176
	Keep incompatible materials separate. Separate incompatible materials stored near each other by a dike or other barrier.		40 CFR 264.177
	At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers, liners.		40 CFR 264.178
	Storage of banned wastes must be in accordance with 40 CFR 268. When such storage occurs beyond one year, the owner/operator bears the burden of proving that such storage is solely for the purpose of accumulating sufficient quantities to allow for proper recovery, treatment, and disposal.		40 CFR 268.50

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Construction of New Landfill On-Site (see Closure with Waste in Place)	Minimum Technology Requirements:	RCRA hazardous waste (listed or characteristic) currently being placed in a new, replacement, or	40 CFR 264.301
	Install two liners or more, a top liner that prevents waste migration into the liner, and a bottom liner that prevents waste migration through the liner. h/	expanded landfill.	
	Install leachate collection systems above and between the liners.		40 CFR 264.301
	Construct run-on and run-off control systems capable of handling the peak discharge of a 25-year storm.		40 CFR 264.301
	Control wind dispersal of particulates.		40 CFR 264.301
	Operation and maintenance.		40 CFR 264.303-304
	Close each cell with a final cover after the last waste has been received.		40 CFR 264.310
	Ground Water Monitoring		
	Establish a detection monitoring (264.98). Establish a compliance monitoring program (264.99) and (264.100) when required by 40 CFR 264.91. All monitoring programs must meet RCRA general ground water monitoring requirements (264.97).	Creation of a new landfill unit to treat, store, or dispose of RCRA hazardous wastes as part of a response action.	40 CFR 264.91-264.100

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Discharge of Treatment System Effluent	Best Available Technology:		
	Use of best available technology (BAT) economically achievable is required to control toxic and non-conventional pollutants. Use of best conventional pollutant control technology (BCT) is required to control conventional pollutants. Technology-based limitations may be determined on a case-by-case basis.	Point Source discharge to waters of the United States. i/ j/	40 CFR 122.44(a)
	Water Quality Standards:		
	Applicable Federally approved State water quality standards must be complied with, These standards may be in addition to or more stringent than other Federal standards under the CWA. k/		40 CFR 122.44 and State regulations approved under 40 CFR 131
	Discharge limitations must be established at more stringent levels than technology-based standards for toxic pollutants.		40 CFR 122.44(e)

i/ "Waters of the U.S." is defined broadly in 40 CFR 122.2 and includes essentially any water body and wetland.

j/ Section 121 of SARA exempts on-site CERCLA activities from obtaining permits. However, the substantive requirements of a law or regulation must be met. In particular, on-site discharges to surface waters are exempt from procedural NPDES permit regulations. Off-site discharges would be required to apply for an obtain an NPDES permit.

k/ Federal Water Quality Criteria may be relevant and appropriate depending on the designated or potential use of the water, the media affected, the purposes of the criteria, and current information. (CERLA §121(d)(2)(B)(i)) Federal Water Quality Criteria for the protection of aquatic life will be relevant and appropriate when environmental factors (e.g., protection of aquatic organisms) are being considered. (50 FR 30784 [July 29, 1985]).

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Discharge of Treatment System Effluent (continued)	Best Management Practices:		
	Develop and implement a Best Management Practice program to prevent the release of toxic constituents to surface waters.		40 CFR 125.100
	The Best Management Practices program must: • Establish specific procedures for the control of toxic and hazardous pollutant spills • Include a prediction of direction, rate of flow, and total quantity of toxic pollutants where experience indicates a reasonable potential for equipment failure. • Assure proper management of solid and hazardous waste in accordance with Regulations promulgated under RCRA.	Discharge to waters of the U.S. j/	40 CFR 125.104
	Monitoring Requirements:		
	Discharge must be monitored to assure compliance. Discharge will monitor: • The mass of each pollutant • The volume of effluent • Frequency of discharge and other measurements as appropriate.		40 CFR 122.41(i)

j/ Section 121 of SARA exempts on-site CERCLA activities from obtaining permits. However, the substantive requirements of a law or regulation must be met. In particular, on-site discharges to surface waters are exempt from procedural NPDES permit regulations. Off-site discharges would be required to apply for and obtain an NPDES permit.

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Discharge of Treatment System Effluent (continued)	Approved test methods for waste constituent to be monitored must be followed. Detailed requirements for analytical procedures and quality controls are provided.		40 CFR 136.1-136.4
	Sample preservation procedures, container materials, and maximum allowable holding times are prescribed.		
	Comply with additional substantive conditions such as: • Duty to mitigate any adverse effects of any discharge; and • Proper operation and maintenance of treatment system.		40 CFR 122.41(i)
Dredging	Remove all contaminated soil	RCRA hazardous waste placed at site after the effective date of the requirements, or placed into another unit.	See Closure in this Exhibit.
	Dredging must comply with Section 10 of the Rivers and Harbors Act and U.S. Army Corps of Engineers regulations.	Dredging in navigable waters of the United States.	33 U.S.C. 403 33 CFR 320-330

l/ CWA §403 requires that an NPDES permit be issued for discharge into marine waters, including territorial seas, the contiguous zone, and the oceans. (40 CFR 122.2). a Permit is not requred if point of discharge is on-site.

m/ Discharge to POTWs is considered an off-site activity (see p, 3-21 for discussion of requirements); therefore, requirements related to discharge to a POTW are not ARARs, but are included in this exhibit for reference. Off-site sections must comply with all legally applicable requirements, both substantive and administrative. The concept of “relevant and appropriate” is not available for off-site actions.

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Excavation	Movement of excavated materials to new location and placement in or on land will trigger land disposal restrictions for for the excavated waste or closure requirements for the unit in which the waste is being placed.	Materials containing RCRA hazardous wastes subject to land disposal restrictions are placed in another unit.	40 CFR 269 Subpart D
	Area from which materials are excavated may require cleanup to levels established by closure requirements.	RCRA hazardous waste placed at site after the effective date of the requirements.	See Closure in this Exhibit.
Incineration	Analyze the waste feed.	RCRA hazardous waste.	40 CFR 264.341
	Dispose of all hazardous waste and residues, including ash, scrubber water, and scrubber sludge.		40 CFR 264.351
	No further requirements apply to incinerators that only burn wastes that are listed as hazardous solely by virtue of combination with other wastes, and if the waste analysis demonstrates that no Appendix VII constituent is present that might reasonable be expected to be present.		40 CFR 264.340
	Performance standards for incinerators: • Achieve a destruction and removal efficiency of 99.99 percent for each principal organic hazardous constituent in the waste feed and 99.9999 percent for dioxins:	RCRA hazardous waste.	40 CFR 264.343

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Incineration (continued)	• Reduce hydrogen chloride emissions to 1.0 kg/hr or 1 percent of the HCl in the stack gases before entering any pollution control devices; and		40 CFR 264.342
	• Not release particulate in excess of 180 mg/dsom corrected for amount of oxygen in stack gas.		40 CFR 264.343
	Monitoring of various parameters during operation of the incinerator is required. These parameters include: • Combustion temperature; • Waste feed rate; • An indicator of combustion gas velocity; and • Carbon monoxide.		40 CFR 264.343
	Control fugitive emissions either by: • Keeping combustion zone sealed or • Maintaining combustion zone pressure lower than atmospheric pressure		40 CFR 264.345
	Utilize automatic cut-off system to stop waste feed when operating conditions deviate.		
	Special performance standard for incineration of PCBs: • Achieve a destruction and removal efficiency of 99.9999 percent;	Liquid and non-liquid PCBs at concentrations of 50 ppm or greater.	40 CFR 761.70

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Incineration (continued)	• Either 2 second dwell time at 1200 degrees C° (±100) and 3 percent excess oxygen in stack gas; or 1.5 second dwell time at 1600 degrees C and 2 percent excess oxygen in stack gas; and • For non-liquid PCBs, mass air emissions from the incinerator shall be no greater than 0.001 g KB per kg of the PCBs entering the incinerator.		
Placement of Waste in Land Disposal Unit	Land Disposal Restrictions:		
	Attain land disposal "treatment standards" before putting waste into landfill in order to comply with land ban restrictions. A treatment standard can be either: (1) a concentration level to be achieved (performance-based) or (2) a specified technology that must be used (technology-based. If the standard is performance-based, any technology can be used to achieve the standard. (See Treatment when Waste will be Land Disposed).	Placement of RCRA hazardous Waste in a landfill surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, or underground mine or cave.	40 CFR 268 Subpart D
Surface Water Control	Prevent run-on and control and collect run-off from a 24-hour 25-year storm (waste piles, land treatment facilities, landfills).	RCRA hazardous waste treated, stored or disposed of after the effective date of the requirements.	40 CFR 264.251(c).(d) 40 CFR 264.273(d).(d) 40 CFR 264.301(c).(d)
	Prevent over-topping of surface impoundment.		40 CFR 264.221(c)

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Tank Storage (On-Site)	Tanks must have sufficient structural strength to ensure that they do not collapse, rupture, or fall.	Storage of RCRA hazardous waste (listed or characteristic) not meeting small quantity generator criteria held for a temporary period greater than 90 days before treatment, disposal, or storage elsewhere (40 CFR 264.10), in a tank (i.e., any portable device in which a material is stored, transported, disposed of, or handled). A generator who accumulates or stores hazardous waste on-site for 90 days or less in compliance with 40 CFR 262.34(a)(1-4) is not subject to full RCRA storage requirements. Small quantity generators are not subject to the 90 day limit (40 CFR 262.34(c), (d), and (e)).	40 CFR 264.190
	Waste must not be incompatible with the tank material unless the tank is protected by a liner or by other means.		40 CFR 264.191
	Tanks must be provided with secondary containment and controls to prevent overfilling, and sufficient freeboard maintained in open tanks to prevent overtopping by wave action or precipitation.		40 CFR 264.193-194
	Inspect the following: overfilling control, control equipment, monitoring data, waste level (for uncovered tanks), tank condition, above-ground portions of tanks (to assess their structural integrity), and the area surrounding the tank (to identify signs of leakage).		40 CFR 264.195
	Repair any corrosion, crack or leak.		40 CFR 264.196
	At closure, remove all hazardous waste and hazardous waste residues from tanks, discharge control equipment, and discharge confinement structures.		40 CFR 264.197

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
	Store ignitable and reactive waste so as to prevent the waste from igniting or reacting. Ignitable or reactive wastes in covered tanks must comply with buffer zone requirements in "Flammable and Combustible Liquids Code," Tables 2-1 through 2-6 (National Fire Protection Association, 1976 or 1981).		40 CFR 264.198
	Storage Prohibitions:		
	Storage of banned wastes must be in accordance with 40 CFR 268. When such storage occurs beyond one year, the owner/operator bears the burden of proving that such storage is solely for the purpose of accumulating sufficient quantities to allow for proper recovery, treatment and disposal.		40 CFR 268.50
Treatment (in a unit)	Design and operating standards for unit in which hazardous waste is treated. (See citations at right for design and operating requirements for specific unit.)	Treatment of hazardous waste in a unit.	40 CFR 264.190-264.192 (Tanks) 40 CFR 264.221 (Surface Impoundments) 40 CFR 264.251 (Waste Piles) 40 CFR 264.273 (Land Treatment Unit) 40 CFR 264.343-345 (Incinerators) 40 CFR 264.601 (Miscellaneous Treatment Units) 40 CFR 265.373 (Thermal Treatment Units)

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Treatment (when Waste will be Land Disposed)	Treatment of waste subject to ban on land disposal must attain levels achievable by best demonstrated available treatment technologies (BDAT) for each hazardous constituent in each listed waste, if residual is to be land disposed. If residual is to be further treated, initial treatment and any subsequent treatment that produces residual to be treated need not be BDAT, if it does not exceed value in CCWE (Constituent Concentration in Waste Extract) Table for each applicable water. (See 51 FR 40642, November 6 1986.)	Disposal of contaminated soil and debris resulting from CERCLA response actions or RCRA corrective actions is not subject to land disposal prohibitions and/or treatment standards for solvents, dioxine, or California list wastes until November 8, 1990 (for certain first third wastes until August 8, 1990).	40 CFR 268.10 40 CFR 268.11 40 CFR 268.12 40 CFR 268.41 40 CFR 268 Subpart D
		All wastes listed as hazardous is 40 CFR part 261 as of November 8, 1984, except for spent solvent wastes and dioxin-containing wastes, have been ranked with respect to volume and intrinsic hazards, and are scheduled for land disposal prohibition and/or treatment standard predetermination as follows:	51 FR 40641 52 FR 25760
		Solvents and dioxine — Nov. 8, 1986 California list wastes — Jul. 8, 1987 One-third of all ranked and hazardous wastes — Aug. 8, 1988 Underground injection of solvents and dioxins and California list wastes — Aug. 8, 1988 CERCLA response action and RCRA corrective action soil and debris — Nov. 8, 1988 Two-thirds of all ranked and listed hazardous wastes — Jul. 8, 1989 All remaining ranked and listed hazardous wastes identified by characteristic under RCRA section 3001 — May 8, 1990 Any hazards waste listed or identified under RCRA section 3001 after November 8, 1984 — Within 6 mos. of the date of identification or listing.	

TABLE IV - C (continued)

SELECTED ACTION-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS a/

Actions b/	Requirement	Prerequisites for Applicability c/ d/	Citation
Treatment (when Waste will be Land Disposed) (continued)	BDAT standards for spent solvent wastes and dioxin-containing wastes are based on one of four technologies or combinations: for waste waters, (1) steam stripping, (2) biological treatment, or (3) carbon absorption [alone or in combination with (1) or (2)]; and for all other wastes, (4) incineration. Any technology may be used, however, if it will achieve the concentration levels specified.		40 CFR 268.30 RCRA Sections 3004(d)(3), (e)(3) 40 U.S.C. 6924(d)(3), (e)(3)
Waste Pile	Use a single liner and leachate collection system.	RCRA hazardous waste, non-containerized accumulation of solid, non-flammable hazardous waste that is used for treatment storage.	40 CFR 264.251
	Waste put into waste pile subject to land ban regulations		40 CFR 268.2

APPENDIX E

STATE ARARS

TABLE V-A

SELECTED CHEMICAL-SPECIFIC POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS - STATE OF OHIO

Chemical Name	Ohio EPA Water Quality Standards for Aquatic Life Habitat(1) (30 day average)(mg/l)	State of Ohio Sediment Standard (Calculated)(2) (mg/kg)
Antimony	0.19	9500
Arsenic	0.19	0.95
Beryllium	2.3 x 10 - 02 +	
Bis(2-ethylhexyl) phthalate	8.4 x 10 - 03	1.68 x 10 + 07
Di-n-butylphthalate	0.19	3.23 x 10 + 04
Butylbenzylphthalate	4.9 x 10 - 02	2.45 x 10 + 03
2-Butanone	7.1 x 10 - 03	1.28 x 10 - 02
Cadmium	1.4 x 10 - 03 +	
Chlorobenzene	2.6 x 10 - 02	8.58
Chloroform	7.9 x 10 - 02	3.48
Chromium	0.207 +	1.035 +
Copper	1.18 x 10 - 02 +	5.89 x 10 + 01 +
Cyanide	1.2 x 10 - 02	6.0 x 10 - 02
1,1-dichloroethene	7.8 x 10 - 02	
1,2-dichloroethene	0.31	
Ethylbenzene	6.2 x 10 - 02	6.82 x 10 + 01
Iron	1.0	
Lead	6.92 x 10 - 03 +	3.46 x 10 + 01 +
Mercury	2.0 x 10 - 04	0.1
4-Methylphenol	6.2 x 10 - 03	0.215
Nichel	0.17 +	
Naphthalene	4.4 x 10 - 02	
Selenium	5.0 x 10 - 03	
Silver	1.3 x 10 - 03	
Styrene	5.6 x 10 - 02	4.45 x 10 + 01
Tetrachloroethene	7.3 x 10 - 02	2.66 x 10 + 01
Toluene	1.7	4.25 x 10 + 02
Thallium	1.6 x 10 - 02	
1,1,1-Trichloroethane	8.8 x 10 - 02	
Vanadium	-	
Vinyl Chloride	-	
Zinc	0.106 +	5.30 x 10 + 01 +

+ Hardness dependent criteria were calculated with a hardness value of 100 ppm.
(1) Source: Ohio EPA Water Quality Standards, Chapter 3745-1OAC.
(2) Calculation of Sediment Standards is provided in Appendix III of this report.