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RECORD OF DECISION
SITE 14 OF THE MISCELLANEOUS AREAS OPERABLE UNIT

Crab Orchard National Wildlife Refuge
Superfund Site
Marion, Illinois

U.S. Fish & Wildlife Service
Crab Orchard National Wildlife Refuge
Marion, Illinois

July 2001

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DECLARATION FOR THE RECORD OF DECISION
SANGAMO ELECTRIC DUMP/CRAB ORCHARD NATIONAL WILDLIFE REFUGE (USDOI)
CARTERVILLE, ILLINOIS
MISCELLANEOUS AREAS OPERABLE UNIT – SITE 14

A. SITE NAME AND LOCATION

This National Priority List (NPL) site is known as the Sangamo Electric Dump/Crab Orchard National Wildlife Refuge (USDOI)[1], Carterville, Illinois (Refuge). The subject of this Record of Decision (ROD) is Site 14 of the Miscellaneous Areas Operable Unit (MISCA OU), part of this NPL site. The United States Environmental Protection Agency (USEPA) Identification Project Number for this NPL site is IL8143609487.

B. STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedy for Site 14 of the MISCA OU at the Refuge. The Selected Remedy was chosen 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, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record file for this site.

The State of Illinois concurs with the Selected Remedy.

C. ASSESSMENT OF THE SITE

The response action selected in this Record of Decision is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances, and pollutants or contaminants from this site that may present an imminent and substantial endangerment to the health or welfare.

D. DESCRIPTION OF THE SELECTED REMEDY

Overall Site Cleanup Strategy

The Refuge is currently divided into seven Operable Units (OUs). These OUs are:

- Metals Areas
- PCB Areas
- Explosives/Munitions Manufacturing Areas (EMMA)
- Miscellaneous Areas
- Water Tower
- Additional and Uncharacterized Sites
- Lake Monitoring

[1] The USDOI in the NPL listing stands for the U.S. Department of Interior.

The OUs are in various phases of cleanup: investigation, remediation, and long term monitoring. Separate Records of Decision were signed for the Metals Areas OU, PCB Areas OU, and the EMMA OU on March 30, 1990, August 1, 1990, and February 19, 1997, respectively. Separate Explanations of Significant Differences were signed for the EMMA OU and the PCB OU on January 11, 2000 and June 23, 2000, respectively. Separate Action Memoranda for removal actions were signed for the Water Towers OU, MISCA OU, and EMMA OU.

Site 14 is one of thirteen sites investigated as part of the MISCA OU. Other sites within this OU include Sites 7, 7A, 8, 9, 10, 11, 11A, 12, 16, 20, 22A, and 36. A Remedial Investigation/Baseline Risk Assessment Report for the MISCA OU concluded that conditions at ten of the MISCA OU sites (Sites 7, 7A, 8, 9, 10, 11, 11A, 12, 16, and 20) do not pose an unacceptable risk to human health and the environment. In 1996, the Department of the Interior/Fish and Wildlife Service (FWS) conducted a removal action to address dioxin and pentachlorophenol contaminated soil at Site 22A, a former post-treating facility. Soil in the vicinity of Site 36 (a wastewater treatment area) is contaminated primarily with cadmium, chromium, and PCBs. A separate decision document will be prepared to address the contamination at Site 36 and the other MISCA OU sites .

Soil and groundwater at Site 14 are contaminated primarily with toluene, ethylbenzene, xylenes, and methylene chloride[2]. In addition, soil at Site 14 is also contaminated with chromium which may pose an unacceptable risk to ecological receptors, and lead above human health risk based concentration. The groundwater at this site is a Potable Resource Groundwater (Class I groundwater standards in accordance with Title 35 of the Illinois Administrative Code, Section 620) as determined by the State of Illinois.

Addressing Principal Threat

The soil contamination at Site 14 is determined to be the source of groundwater contamination at levels above Maximum Concentration Limits (MCLs)/State of Illinois Class I groundwater standards. This source material is a principal threat to the further degradation of the groundwater. The remedy selected in this ROD addresses the principal threat through excavation and containment in an off-site permitted solid waste landfill.

Major Components of the Remedy

The major components of the remedy include:

- Pre-design investigation. Sampling will be done to fill data gaps identified in the Feasibility Study Report; the investigation will also include obtaining site-specific information related to monitored natural attenuation. A site-specific risk assessment will be done to identify the levels of residual VOC soil contamination for which risks would be unacceptable for site workers and construction workers. If these unacceptable risk levels are below the cleanup levels for any of the VOCs at this site, institutional controls will be implemented which will require special worker protection for site related activities.

[2] Methylene chloride and dichloromethane are synonyms for each other.

- Demolition and removal of a structure referred to as the "Repour Building," a small building which is part of the existing facility at the site.
- Excavation, removal, and off-site disposal of chromium and lead-contaminated soil.
- Excavation, removal, and off-site disposal of soil contaminated with VOCs.
- Pumping of seepage water from the excavation, treatment of the water to meet Illinois State surface water quality standards, and on-site discharge of the treated water.
- Site restoration including backfilling of the excavated area with clean soil and establishment of vegetation.
- Institutional controls to prohibit installation of potable water wells until the groundwater is restored to MCLs/State of Illinois Class I groundwater standards for all contaminants of concern.
- Groundwater monitoring until groundwater at Site 14 is restored to MCLs/State of Illinois Class I groundwater standards for all contaminants of concern.

E. STATUTORY DETERMINATION

Statutory Requirement

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. The Selected Remedy attains the mandates of CERCLA §121, and, to the extent practicable, the NCP.

Statutory Preference for Treatment

The remedy in this OU does not satisfy the statutory preference for treatment as a principal element of the remedy for the following reason: The selected alternative is the most reliable (implementability criterion), achieves soil remediation objectives in the shortest period of time, and the cost is reasonable compared to other alternatives. The remedies selected in the previous Records of Decision for the Refuge, including Metals Areas OU, PCB Areas OU, and EMMA OU, however, satisfied the statutory preference for treatment as principal element of the remedy (i.e., reduced the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment).

Five-year Review

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

F. DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary Section of this Record of Decision. Additional information can be found in the Administrative Record file for this site.

- Chemicals of concern and their respective concentrations. (Section E).
- Baseline risk represented by the chemicals of concern. (Section G).
- Cleanup levels established for chemicals of concern and the basis for these levels. (Section L).
- How source materials constituting principal threats will be addressed. (Section K).
- Current and reasonable anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD. (Section F).
- Potential land and groundwater use that will be available at the site as a result of the Selected Remedy. (Section L).
- Estimated capital, annual operation and maintenance (O&M), total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected. (Section I).
- Key factors that led to selecting the remedy. (Section L).

G. AUTHORIZING SIGNATURES

Assistant Secretary for Policy, Management and Budget
Department of the Interior

10/30/01
Date

Superfund Division Director
United States Environmental Protection Agency
Region 5

9/27/01
Date

A. SITE NAME, LOCATION, AND DESCRIPTION

Name and Location

This National Priority List (NPL) site is known as the Sangamo Electric Dump/Crab Orchard National Wildlife Refuge (USDOI), Carterville, Illinois (Refuge). The subject of this Record of Decision (ROD) is Site 14 of the Miscellaneous Areas Operable Unit (MISCA OU), part of this NPL site.

CERCLIS ID Number

The United States Environmental Protection Agency (USEPA) Identification Project (CERCLIS) Number for this NPL site is IL8143609487.

Lead and Support Agencies

The Department of the Interior (DOI) is the lead agency and the USEPA, Region 5 and the Illinois EPA (IEPA) are the support agencies for this project.

Source of Cleanup Monies

DOI will seek response costs, including costs of implementing the remedy, from one or more potentially responsible parties.

Site Type

Site 14 is an industrial facility within a National Wildlife Refuge.

Site Description

The Refuge, which was established in 1947, consists of 43,500 acres located primarily in Williamson County in Southern Illinois.

Site 14 is located in the southeast part of the Refuge within Area 8, which is an industrial area (Figures A-1 and A-2). The site covers about 3.5 acres at a current tenant's active manufacturing and warehouse facilities. These facilities include areas where solvents, inks, lubricants, and other liquid manufacturing supplies are manufactured and/or stored, and areas where liquid manufacturing supplies were stored in the past. These facilities were used during World War II for painting and cleaning bombshells. The media of concern at Site 14 are soils and groundwater.

B. SITE HISTORY

History of Site Industrial Activities

During World War II, a portion of what is now the Refuge was the site of the Illinois Ordnance Plant (IOP), a bomb and munitions manufacturing facility operated by Sherwin Williams Defense Corporation. When the war ended in 1945, the site was transferred to the War Assets Administration, and many former IOP buildings were leased to industrial tenants. The Refuge was created in 1947, with a multiple mission, including wildlife management, recreational and agricultural use and industrial operations.

The Sherwin Williams Defense Corporation, under contract with the U.S. War Department, used these facilities from 1942 to 1945 for painting and cleaning bombshells. Diagraph has used the Site 14 facilities since 1947 for ink and stencil manufacturing. Both the Sherwin Williams Defense Corporation and Diagraph used solvents.

History of Investigations

The Refuge has been divided into several operable units, based on geography, contaminant sources, and contaminant types. The development of these OUs is discussed below.

A Refuge-wide Remedial Investigation (1988) and a Feasibility Study (1989) (O' Brien & Gere) (RI/FS) were completed shortly after the NPL listing[3]. The 1988 RI identified seven sites that required remediation. Four of these were contaminated primarily with PCBs and were formed into the PCB OU. Three were contaminated primarily with heavy metals and comprised the Metals Areas OU. The Records of Decision (RODs) for both of these OUs were signed in 1990. Remediation at both OUs is complete, except for the TCE contamination at Sites 32/33 of the PCB OU.

In addition to the sites requiring remediation, the 1988 RI identified twenty-two sites as requiring no further work or needing further investigation, monitoring, or maintenance. A Federal Facility Agreement (FFA) for the Refuge[4] designated these twenty-two sites, plus Site 36 as the MISCA OU. The DOI added another site, Site 22A to the MISCA OU. DOI completed a Remedial Investigation/Baseline Risk Assessment (RI) of these 24 sites in two phases from 1993 to 1995[5]. This RI investigated thirteen sites (Sites 7, 7A, 8, 9, 10, 11, 11A, 12, 14, 16, 20, 22A and 36). The remaining eleven sites (13, 18, 21, 24, 25, 26, 27, 30, 31, 34, and 35) were excluded from the RI during the work planning process. In October 1999, DOI completed an RI Addendum[6] to

[3] O'Brien and Gere Engineers, Inc. 1988/1989. Remedial Investigation Report/Feasibility Study Report, Crab Orchard National Wildlife Refuge. Completed for U.S. Fish and Wildlife Service, Marion, Illinois, and Sangamo Weston, Inc., Atlanta, Georgia.

[4] In 1991, the USEPA Region V, IEPA , DOI, and the Department of the Army entered into a Federal Facilities Agreement for the Management of the Refuge Cleanup.

[5] Woodward-Clyde (W-C). 1996. Final RI Report, Remedial Investigation Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge, Marion, Illinois (Williamson County).

[6] URS Greiner Woodward-Clyde (URS). 1999. Draft Final RI Addendum Report, Sites 14 and 36 Investigations. Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County).

further delineate the contamination at Sites 14 and 36. In August 2000 and December 2000, DOI completed Feasibility Study Reports for Sites 14[7] and 36[8], respectively.

The MISCA OU sites investigated are described below.

Site 7

Site 7 is within an industrial area known as Area 2 D. The site consists of a drainage channel on the southeast portion of Area 2 D, which drains to Crab Orchard Lake. Mercury was detected during the 1988 RI (O'Brien and Gere) in a composite sample and its duplicate (0.040 milligrams per kilogram [mg/kg] and 0.3 mg/kg, respectively).

Samples collected during the 1996 RI were analyzed for explosives and for the CERCLA target analyte list (TAL) of inorganic constituents and the target compound list (TCL) of organic constituents. The TCL list includes volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and PCBs. The TAL list includes inorganic compounds such as metals and cyanide. No preliminary levels of concern (PLCs) were exceeded for any constituents. The Preliminary Ecological Risk Assessment determined that there is little likelihood of potential ecological risk at this site. The 1996 RI recommended no further investigations at this site.

Site 7A

Site 7A is a 3-acre grassy plot located in the northwest corner of Area 2 D. The 1988 RI stated that barrels of chemicals were reportedly dumped in the area. Magnetometer and electromagnetic surveys did not detect anomalies suggestive of buried metallic objects; however, mercury was detected in six composite soil samples at concentrations ranging from 0.022 mg/kg to 0.029 mg/kg.

Samples collected during the 1996 RI were analyzed for explosives and for the CERCLA TAL inorganics and TCL organics. No PLCs were exceeded for any constituents. The Preliminary Ecological Risk Assessment determined that there is little likelihood of potential ecological risk at this site. The 1996 RI recommended no further investigations at this site.

Site 8

Site 8 is a drainage way that receives surface runoff from the active industrial facility within Area 2 and discharges into Crab Orchard Lake. No contaminants of concern were detected in the samples taken during the 1988 RI.

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[7] URS Corporation (URS). 2000. Final Feasibility Study. Miscellaneous Areas Operable Unit, Crab Orchard National Wildlife Refuge Superfund Site, Marion, Illinois (Williamson County). Volume I, Site 14.

[8] URS Corporation (URS). 2000. Final Feasibility Study. Miscellaneous Areas Operable Unit. Crab Orchard National Wildlife Refuge Superfund Site. Marion, Illinois (Williamson County). Volume II, Site 36.

Samples collected during the 1996 RI were analyzed for explosives and for the CERCLA TAL inorganics and TCL organics. No PLCs were exceeded for any constituents. The Preliminary Ecological Risk Assessment determined that there is little likelihood of potential ecological risk at this site. The 1996 RI recommended no further investigations at this site.

Site 9

Site 9 is a stream which carries runoff from a watershed area which includes munitions manufacturing facilities in the area known as Areas 2 D and 2 P. The stream discharges to Crab Orchard Lake. Low levels of PCBs and mercury were detected during the 1988 RI .

Samples collected during the 1996 RI were analyzed for explosives and for the CERCLA TAL inorganics and TCL organics. No PLCs were exceeded for any constituents. The 1996 RI recommended no further investigations at this site.

Site 10

Site 10 includes a downstream segment of the same stream as Site 9, and a tributary which received runoff from an active industrial facility within Area 2.

In the 1996 RI, trichloroethene and 1,2 dichloroethene were detected, but the concentrations were well below their PLCs, and were not evaluated further. During the 1996 RI, benzo(a)anthracene and benzo(b)fluoranthene were detected above their PLCs. Based on further evaluation, these constituents were judged to not represent unacceptable risk to human health or the environment. A human health risk assessment was not done; the site is in a restricted area and the exposure pathway was judged to be incomplete. The 1996 RI recommended no further action at this site.

Site 11

Site 11 is a drainage way which receives runoff from parts of the active industrial facility at Area 2 P. The drainage way discharges to Crab Orchard Lake.

Samples collected during the 1996 RI were analyzed for explosives and for the CERCLA TAL inorganics and TCL organics. No PLCs were exceeded for any constituents. The 1996 RI recommended no further investigations at this site.

Site 11A

Site 11A includes an abandoned L-shaped walkway which contains areas reportedly used to store production materials for explosives (O'Brien and Gere, 1988). According to the 1988 RI, chemicals may have been dumped on the ground in this area.

Samples collected during the 1996 RI were analyzed for explosives and for the CERCLA TAL inorganics and TCL organics. No PLCs were exceeded for any constituents. The 1996 RI recommended no further investigations at this site.

Site 12

Site 12 is within the area known as Area 8. The site consists of a circular impoundment approximately 100 feet in diameter which, in the past, surrounded an above-ground storage tank. The tank was reportedly used to store oil for a boiler previously located nearby. The tank was reportedly removed during the early 1960s (W-C, 1996). Several black oily pools in and around the impoundment, and bare patches of black sediment and tars located in the impoundment were reportedly visible in the mid-1980s (O'Brien and Gere, 1988). By 1992 these features were not visible (W-C, 1996). The area is now overgrown with trees and vegetation.

Samples collected during the 1996 RI were analyzed for explosives and for the CERCLA TAL inorganics and TCL organics. No PLCs were exceeded for any constituents. The 1996 RI recommended no further investigations at this site.

Site 13

Site 13 is the location of a former change house that was used by workers on the Area 8 bomb loading line to shower and change clothes after their work shift. It was demolished between 1971 and 1980 (W-C, 1996). Based on analysis of six soil samples and a electromagnetic and magnetometer survey, the 1988 RI concluded that Site 13 does not represent a chemical exposure risk to human health or to ecological receptors. No investigations of this site were done as part of the MISCA OU.

Site 14

Site 14 is the subject of this ROD. It is an approximately 3.5-acre site located in the northern part of Area 8. Soil and groundwater are contaminated primarily with toluene, ethylbenzene, xylenes, and methylene chloride. The groundwater contamination exceeds MCLs and State of Illinois Class I groundwater standards for these constituents. Remediation will be done to prevent further degradation of the groundwater and to restore the groundwater to its State designated beneficial use (State of Illinois Class I groundwater standards or MCLs). In addition, soil at this site is also contaminated with chromium (representing a potential risk to the American Robin) and with lead (representing a potential human health risk). This ROD addresses clean up action to be taken at Site 14.

Site 16

Site 16 is located within Area 7, which was designated as the IOP Inert Storage Area. In the mid-1980s, black residues were reported near five of the large buildings (O'Brien and Gere, 1988) in this area. Three of these buildings were reportedly used to recover and recycle waste oil, and one was reportedly used to refurbish mining equipment (O'Brien and Gere, 1988). The 1988 RI detected SVOCs, primarily phthalates and polyaromatic hydrocarbons (PAHs); and PCBs in the soils and sediments near these buildings.

By the time of the 1996 RI, four of the five buildings had been removed, and there was no black residue observed in the area.

Detections of PCBs and some metals during the 1996 RI exceeded PLCs. The baseline ecological risk assessment concluded that metals and PCBs are compounds of concern for small terrestrial predators, and that small herbivores may be at risk due to metals in soils (W-C, 1996). Although the Ecological Risk Assessment determined that there were slight potential risks to mice, robin, and quail due to cadmium, potential risks to mice and robins due to PCB Aroclors, and potential ecological risk to robins due to lead, there were no significant potential risks to higher-level predators. A human health risk assessment was not done; the site is in a restricted area and the exposure pathway was judged to be incomplete. The 1996 RI recommended no further action at this site.

Site 18

Site 18 is located in Area 13, which consists of approximately 85 igloos that were used for explosives storage as part of the IOP. Industrial tenants have used the igloos since the 1950s. Site 18 consists of a concrete railroad loading dock. Site 18 was not investigated as part of the 1996 MISCA OU RI.

Site 20

Site 20 is a drainage way that receives runoff from a nearby abandoned building that was reportedly used to dump chemicals (O'Brien and Gere, 1988). A composite sediment sample collected from the drainage way during the 1988 RI detected two SVOCs: bis(2-ethylhexyl)phthalate at an estimated concentration of 2,320 micrograms per kilogram (ug/kg) and n-nitrosodimethylamine at an estimated concentration of 336 ug/kg. These compounds were not detected in samples taken during the 1996 RI.

Samples collected during the 1996 RI were analyzed for explosives and for the CERCLA TAL inorganics and TCL organics. No PLCs were exceeded for any constituents. The 1996 RI recommended no further investigations at this site.

Site 21

Site 21 is a pasture about 150 feet by 400 feet in size, located southeast of Area 7. A pile of concrete debris was observed here. During the 1988 RI, several samples were analyzed and magnetometer and electromagnetic surveys were conducted. The 1988 RI reported that no metallic objects were buried at the site, and no detected contaminants exceeded any levels of concern. Historic and aerial photo review done as part of the 1996 RI indicated that the debris may have been from demolition of a church. No evidence of industrial usage was found. The Preliminary Ecological Risk Assessment determined that there is little likelihood of potential ecological risk at this site. The 1996 RI recommended no further investigation at this site.

Site 22A

Site 22A is near the IOP Shop Area located near Area 4 and was used during the 1960s for treating wood posts with pentachlorophenol (W-C, 1996). The significant contaminants detected in soils were pentachlorophenol, dioxins and other contaminants including 4,4,-DDT, 4,4-DDE, 4,4-DDD, selenium, mercury, and zinc. The ecological risk assessment determined there is risk

to robins and aquatic biota. In 1996, DOI conducted a removal action to address pentachlorophenol and dioxin contaminated soil at Site 22A.

Site 24

Site 24 consists of a west drainage ditch adjacent to a soft drink bottling plant located outside of the Refuge property boundary. Runoff from the ditch drains through tributaries to Crab Orchard Lake. O'Brien and Gere (1988) investigated the site. Although slightly elevated levels of mercury were detected in ditch sediments, it was concluded that Site 24 was not a potential source of contamination and did not contribute mercury to Crab Orchard Lake (O'Brien and Gere, 1988). The FFA states that no further work is required for Site 24. No additional investigations were conducted at this site.

Site 25

Site 25 is the old municipal landfill for the City of Marion and is located next to Crab Orchard Creek. Crab Orchard Creek was dammed during the 1930s to form Crab Orchard Lake. Site 25 consists of portions of Crab Orchard Creek located upstream and downstream of the inactive landfill, and a pond adjacent to the landfill. The site is not located on the Refuge.

Cyanide was detected in two of several sediment samples obtained during the 1988 RI. The 1988 RI concluded that the site was not contributing cyanide to Crab Orchard Lake, and that Site 25 did not pose an unacceptable exposure risk to human health or the environment. The FFA states that no further work is required for Site 25. No additional investigations were conducted at this site.

Site 26

Site 26 is the City of Marion sewage treatment plant that discharges to Crab Orchard Creek. Site 26 consists of portions of the creek downstream of the treatment plant. It is located outside the Refuge boundaries. Based on the results of several sediment samples, the 1988 RI concluded that Site 26 does not pose unacceptable risk to human health or the environment. The FFA states that no further work is required at this site. No additional investigations were conducted at this site.

Site 27

Site 27 is a section of Crab Orchard Creek just west of a section of the creek that was straightened by dredging. O'Brien and Gere (1988) investigated the site to evaluate whether discharges from the Marion sewage treatment plant may be impacting Crab Orchard Lake. Cyanide was detected in a sediment sample from the creek at levels high enough that the 1988 RI recommended monitoring of the stream. Later field observations and review of historic aerial photos did not show any evidence of industrial activity in this area (W-C, 1996). The Preliminary Ecological Risk Assessment determined that there is little likelihood of potential ecological risk at this site. The 1996 RI did not include investigation of this site.

Site 30

Site 30 is located near Area 13 and was selected to represent an uncontaminated control site for the 1988 RI (O'Brien and Gere). Since it was a control site and the samples collected did not indicate contamination, the 1996 RI did not include further investigation.

Site 31

Like Site 30, Site 31 was a control site used for the 1988 RI. Since it was a control site and the samples collected did not indicate contamination, the 1996 RI did not include further investigation.

Site 34

Site 34, Crab Orchard Lake, was investigated as part of the 1988 RI. DOI created a separate operable unit, the Lake Monitoring Operable Unit, to investigate Crab Orchard Lake.

Site 35

Site 35 is a low-lying area east of the industrial facilities at Area 9. One soil sample was collected and analyzed from a "bare" spot within the depression (O'Brien and Gere, 1988). A trace of PCBs and an unusually high specific conductance were reported (O'Brien and Gere 1988). A risk assessment performed by O'Brien and Gere (1988) concluded that the site posed no risk to human or wildlife receptors. Refuge records show that the field containing Site 35 has been leased as agricultural land since at least 1962. The Preliminary Ecological Risk Assessment determined that there is little likelihood of potential ecological risk at this site. No further investigation was conducted as part of the 1996 RI.

Site 36

Site 36 is the Wastewater Treatment Plant located north of Area 3. Soil in the vicinity of Site 36 is contaminated primarily with cadmium, chromium, and PCBs. A Proposed Plan to address the contamination at this site was made available to the public for comments on December 15, 2000. The public comment period ended on January 16, 2001. A separate Record of Decision will address the soil contamination at Site 36.

The sites comprising the MISCA OU and the action related to each of these sites are summarized in Table B-1.

C. COMMUNITY PARTICIPATION

Public Participation Requirements of CERCLA and the NCP

A Community Relations Plan was developed in 1989 and revised in 1992 to document community concern and to plan public involvement activities. Interviews of the community were conducted in 1994 to re-assess community concerns. A number of public meetings were

held to keep the public informed of activities at the site. DOI has also sent out fact sheets at various times during the RI/FS process.

The Proposed Plan for Site 14 of the MISCA OU at the Crab Orchard National Wildlife Refuge, was made available to the public on September 25, 2000. Copies of the Proposed Plan were sent to 400 people on the Refuge CERCLA mailing list, and copies were placed in the information repositories. The notice of the availability of the proposed plan, and the notice of the public meeting were published in the Marion Daily Republican and the Southern Illinoisian, the two local newspapers of widest circulation, on September 22, 2000. A public comment period, originally set for September 25, 2000 to October 25, 2000, was extended to November 24, 2000 in response to a public request. A public meeting was held on October 5, 2000 to present the Proposed Plan to a broader community audience than those that had already been involved at the site. At this meeting representatives from USEPA, IEPA, and DOI answered questions about problems at the site and the remedial alternatives. DOI's response to the comments received during this period is included in the Responsiveness Summary, which is Appendix A of this ROD.

The Proposed Plan and other CERCLA-related documents for the MISCA OU and the other Refuge OUs are available for public review at the following repositories:

U.S. Fish and Wildlife Service
Refuge Headquarters
8588 Route 148
Marion, IL 62959
(618) 997-3344 Ext. 361

Morris Library
Southern Illinois University-Carbondale
Carbondale, IL 62901
(618) 453-2818

The Administrative Record file is located at the FWS Refuge Headquarters listed above.

Views on Future Land Use and Future Beneficial Use of Water

DOI solicited public views on land and water use on the Refuge and is in the process of developing a Comprehensive Conservation Plan (CCP) for the Refuge. Several public meetings have been held as part of that process. The public comment period for the draft CCP ended December 31, 2000.

Comments on future beneficial use of water were made at the public meeting held October 5, 2000 to present the Proposed Plan (See Responsiveness Summary in Appendix A).

D. SCOPE AND ROLE OF OPERABLE UNIT

The scope and role of the operable unit was discussed in Section B, above. The MISCA OU is one of seven OUs on the Refuge.

E. SUMMARY OF SITE CHARACTERISTICS

E.1 Conceptual Site Model

The following sections present a conceptual site model of the site, which is a three-dimensional "picture" of site conditions that illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors.

Human Health Risk

Potential human receptors identified in the baseline risk assessment done for Site 14 as part of the 1996 MISCA OU RI include site workers, hypothetical construction workers, and hypothetical recreational receptors/trespassers. Potentially complete exposure pathways for these receptors include ingestion and dermal contact with surface and/or subsurface soils, ingestion and dermal contact with surface water, and inhalation of volatile emissions and particulate matter from surface and/or subsurface soils. For recreational receptors, potentially complete pathways also include ingestion of fish from Crab Orchard Lake, if groundwater contaminants are transported to the lake; and ingestion of deer that may be exposed to contaminants from foraging at the site. The site conceptual exposure model (SCEM) that details the contaminant source area, chemical release mechanisms, environmental transport media, potential human intake routes, and potential human receptors is presented in Figure E-1.

Ingestion of contaminated groundwater was considered to be an incomplete pathway, in the SCEM, which was developed for the baseline risk assessment. However, hypothetical future groundwater users will be at risk if they ingested groundwater with current levels of contaminants. The groundwater at this site is classified as Potable Resource groundwater (35 IAC 620). In order to comply with State and Federal applicable or relevant and appropriate requirements, the aquifer needs to be restored to beneficial use. In addition, while the present vertical extent of contamination at the site has been defined, no empirical evidence has been generated at Site 14 to demonstrate that the shallow aquifer does not pose an actual or potential risk to the bedrock aquifer below. The bedrock aquifer is actively used in the vicinity of the Refuge. The Selected Remedy will provide long-term protection from future potential vertical contaminant migration into the actively used bedrock aquifer.

Ecological Risk Discussion

Site 14 consists primarily of grass-lined stormwater drainage ditches, some lawn area, as well as a small section of forest edge. The habitat afforded by the limited areas of grass and forest edge is being sustained by and ultimately controlled through human activities within the site. This site is also expected to remain as an industrial area within the Refuge. As such, the site contains little to no "natural" habitat and provides little value (through biomass production, genetic diversity, etc.) to the overall landscape scale ecosystem within the Refuge. In essence, no self-sustaining ecosystem *per se* was identified within the boundaries of Site 14. It was recognized, however, that certain more transient wildlife would at least at times forage within the site boundaries. Coupled with a characterization of the environmental fate and effects associated with the contaminants of potential ecological concern, this led to the single assessment endpoint for Site 14, protection of:

Terrestrial omnivorous[9] and carnivorous[10] birds and mammals that may occasionally forage at Site 14 and consume invertebrates containing arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, selenium, silver, or thallium.

A conceptual exposure model was developed for Site 14 that employed the concept of ecological guilds (see Figure E-2). In the context of the risk assessment, an ecological guild is a grouping of species by ecologically relevant functional groups (e.g., herbivores[11], omnivores, insectivores, etc.) and by feeding behaviors (ground-gleaning, aerial hawking, etc.). Through this categorization, those guilds with the greatest potential for exposure to the chemicals of potential ecological concern were identified, from which specific species were selected to represent the ecological guild. The species are referred to as receptors of concern.

E.2 Site Overview

Size of Site

Site 14 covers approximately 3.5 acres and consists of a drainage network that receives runoff from the current manufacturing tenant.

Geographical and Topographical Features

Site 14 is a relatively flat, poorly drained site. It is located at an existing manufacturing facility in the industrial part of the Refuge. The buildings shown in Figure A-2 are part of the operating facility. The site consists primarily of the grassy area partially surrounded by three buildings (the former Repour Building, Building 3 [including Annex 3], and Annex 3A), and the soil beneath the former Repour Building.

Elevations at Site 14 range from a high of 440 feet just south of Annex 3, to a low of 433 feet, in the drainage channel north of the former Repour Building.

There are no designated wetlands or floodplains on the site.

Surface and Subsurface Features

Two 10,000-gallon aboveground storage tanks (ASTs) were previously located north of Annex 3A, at the location shown in Figure A-2. The date of installation and contents of the tanks are not known. These tanks were removed in about 1985. Three ASTs were installed at the south side of Annex 3A during 1980 to 1982 to support the ink production operation of the current manufacturing tenant (Figure A-2). The tanks included an 8,500-gallon AST that contained diacetone alcohol, an 8,500-gallon AST that contained diethylene glycol, and a 2,000-gallon AST that contained xylene. These tanks were removed in 1998.

[9] Plant and meat eating.

[10] Meat eating.

[11] Plant eating.

The 1988 RI reported two drum storage areas with 50 to 100 drums. Drum storage areas were located northeast of the former Repour Building and along the northwest side of Annex 3A. The 1988 RI report states that "Linseed oil and various solvents are handled in bulk and in drums." Some of the bulk solvents noted were: T25 Xylene, T8 Diacetone Alcohol, T9 Diethylene Glycol, and T18 Methyl Cellosolve. The date of removal is not known, however at the time of the 1999 RI Addendum the drums had been removed.

Areas of Archaeological or Historical Importance

No areas of known archaeological or historical importance are located at Site 14.

E.3 Sampling Strategy

The previous investigations at Site 14 included the 1988 RI, the 1996 RI, the 1996 verification sampling[12], and the 1999 RI Addendum. The following sections present the sampling strategy for each investigation. This includes the media sampled, the sampling approach, and when and where the sampling was performed.

1988 RI

Sampling Strategy

The sampling strategy was based on the presence of two drum storage areas and the active ink and stencil manufacturing operations at Site 14. The first of two phases of sampling included soil and water composite samples (one each) from the drainage ditch and the second phase included water and soil composite samples (one each) from the drum storage area. The Phase I soil sample was analyzed for full priority pollutant analysis. The Phase II samples were analyzed SVOCs.

SVOCs were detected in the drainage ditch samples, but at concentrations below levels of concern. The 1988 RI report recommended a monitoring plan for volatiles and semivolatiles in water. Site 14 was included in the 1996 MISCA RI.

1996 RI

Sampling Strategy

The sampling strategy was based on previous investigations and historical information. The objectives of the investigation were to define the nature and extent of contamination and potential for migration. During the first of two phases, two soil samples (1 to 2 foot depth) were analyzed for the TCL organic constituents and the TAL inorganics. The samples were also analyzed for explosives. Each sample was a composite of five discrete samples (one of the discrete samples was analyzed for VOCs).

[12] Results of the 1996 verification sampling were included in the 1999 RI Addendum.

During the Phase II RI, a shallow soil survey using a grid system was conducted to delineate the general extent of VOCs in the areas of potential contaminant sources. Soil samples were collected at grid points from depths varying from 20 to 24 inches below ground surface (bgs), then placed in a closed container with open air space (called a headspace) into which the samples could "de-gas". The concentrations of VOCs in that headspace were qualitatively analyzed using a photoionization detector. Two shallow soil samples were collected at the two locations where the headspace measurements were detected above background levels. These samples were analyzed for TCL VOCs.

During the Phase II RI, shallow and subsurface soil samples were collected from three monitoring wells and analyzed for TCL VOCs. Three soil samples were analyzed for TCL VOCs. One soil sample was analyzed for the full TCL/TAL. One surface water sample was analyzed for TCL/TAL.

1996 Verification Sampling

During the 1996 verification sampling, five soil samples were collected from one to two feet bgs from the drainage ditch and analyzed for chromium and mercury, in an attempt to delineate the extent of these contaminants.

1998-1999 RI Addendum

Sampling Strategy

The purpose of this investigation was to further delineate contamination identified in the 1996 RI. Both organic and inorganic contamination had been found in the drainage ditches. In addition, concentrations of ethylbenzene, toluene, xylenes and antimony exceeding both MCLs and State of Illinois Class I groundwater standards had been found in the groundwater, but the contamination extent had not been delineated.

Soils were sampled for VOCs and inorganics during the August 1998 and February 1999 sampling events. The VOCs samples included: one sample for the full VOC list, eight for TCL VOCs and 41 for VOCs-benzene, toluene, ethylbenzene, and xylenes (BTEX) only. The inorganic samples included: six samples for the full TAL list of inorganics; thirty-five samples for chromium, lead, mercury, nickel, selenium, and silver only, and fifteen samples for chromium, lead, mercury, nickel, and selenium only.

Antimony was the only metal analyzed for groundwater samples during the August 1998 and February 1999 sampling events.

One sample of surface water from a drainage ditch was analyzed for total and dissolved TAL metals and cyanide.

E.4 Suspected Sources of Contamination

The contamination is a result of past industrial activity at this site. The Sherwin Williams Defense Corporation, under contract with the War Department, used the facility for cleaning and painting bombshells from 1942 to 1945. Since 1947, Diagraph has used the facility for the manufacture of stenciling and ink products. The contaminants detected are consistent with what would be expected from an ink and stenciling facility. They could also potentially be associated with solvents used for painting and cleaning.

E.5 Types of Contamination and the Affected Media

This section discusses the characteristics of the contaminants of concerns (COCs), the quantity/ volume of waste, concentrations of COCs in each medium, and RCRA[13] hazardous waste and affected media. Benzene and chromium are known carcinogens, while the other COCs are non-carcinogenic.

Types and Characteristics of COCs

Detailed information is presented in the 1996 RI and the 2000 FS (Volume III).

Chromium

The majority of chromium in soil is typically in Cr^{+3} form, but it may be present in oxidation states ranging from Cr^{+2} to Cr^{+6}. Chromium will adsorb to clay particles, but this is pH dependent. Values reported in the literature for the distribution coefficient, K_d, which is a measure of a chemical's tendency to adsorb to soil, range widely (by three orders of magnitude) for chromium, which may reflect measurement of mixed Cr^{+6}/Cr^{+3} systems. Cr^{+3} has a higher affinity for soil adsorption than does Cr^{+6}. Volatilization of chromium does not occur at typical atmospheric temperatures. Chromium is inorganic and therefore does not biodegrade.

Health effects of chromium:

- Exposure can occur through inhalation or ingestion.
- Certain types of chromium can affect the kidneys, liver, respiratory tissue, and the gastrointestinal tract.
- Cr^{+6} is a known carcinogen through inhalation.

Lead

Lead adsorbs to soil particles and tends to remain in the soil and groundwater for a long time. It does not biodegrade.

[13] RCRA hazardous waste as defined by the Resource Conservation and Recovery Act.

Health effects of lead:

- Exposure can occur through inhalation or ingestion.
- Lead damages the central nervous system, the kidneys, and most bodily organs.
- Lead can cause reproductive disorders.

Benzene, Ethylbenzene, Methylene Chloride, Toluene, and Xylenes

These constituents are VOCs and are slightly soluble in water, have a moderate affinity for organic sediments, and do not appreciably bioconcentrate in animal or plant tissue. Decay rates are rapid in air and moderately fast in aerobic surface waters. The pathways of concern include leaching into groundwater, sediment transport, tracking, dust transport and volatilization. Leaching is an important mechanism because VOCs have moderate water solubility and can therefore migrate into groundwater or surface water. The area of groundwater that could potentially be impacted will be controlled by local groundwater conditions. Sediment transport, tracking and fugitive dust emissions are pathways of concern because xylenes and ethylbenzene have a strong affinity for soil/sediment particles. Volatilization is also a pathway of concern because the vapor pressure of the compounds is moderate.

Benzene, ethylbenzene, toluene, and xylenes (total), along with other nonhalogenated VOCs, degrade readily under aerobic conditions. Methylene chloride is slightly more mobile than ethylbenzene, toluene, or xylenes. Methylene chloride is a halogenated VOC, which will degrade more slowly than the nonhalogenated VOCs under aerobic conditions.

Health effects of benzene:

- Exposure generally occurs through ingestion or breathing vapors.
- Benzene can affect the central nervous and skeletal system.
- Benzene is a known carcinogen.

Health effects of ethylbenzene:

- Exposure generally occurs through breathing vapors.
- Inhalation of ethylbenzene can affect pulmonary function and the central nervous system.

Health effects of methylene chloride:

- Exposure can occur through inhalation, ingestion, or skin contact.
- Methylene chloride can affect the skin, respiratory system, and the nervous system.

Health effects of toluene:

- Exposure generally occurs through inhalation, but can occur through ingestion or skin contact.
- Toluene primarily affects the central nervous system.

Health effects of xylenes:

- Exposures generally occur through inhalation.
- Xylenes can affect the eyes, nose, throat, and the gastrointestinal and central nervous systems. Kidney and liver function can be affected by exposure to high levels of xylenes.

Quantity/Volume of Waste

The following table summarizes the calculated average depths and soil volumes above cleanup goals at Site 14.

Media of Concern–Soil	Estimated Maximum Depth (feet)	Average Depth (feet)	Estimated Soil Volume (yd^3)	Average Depth Under Repour Building (yd^3)	Estimated Soil Volume Under Repour Building (yd^3)
Soil exceeding 100 mg/kg for ethylbenzene	17	11	7300	6	200
Soil associated with chromium hot spot	1	1	10	–	–

Concentrations of COCs in Each Media

Soil

The following table presents the maximum concentration of the contaminants of concern detected in soil at the site. In this and subsequent tables, "J" indicates a value that has been qualified as estimated based on data validation and "E" indicates a result that exceeded the upper range of the analytical equipment.

Contaminants of Concern	Maximum Soil Detection at Site
VOCs (µg/kg)	
Benzene	11 J
Ethylbenzene	990,000 J
Methylene Chloride	29,000
Toluene	80,000 J
Xylenes (total)	3,100,000
Metals (mg/kg)	
Chromium	5,560
Lead	25,300

Groundwater

The detected constituents that exceeded federal MCL and State of Illinois Class I groundwater standards at Site 14 are as listed in the following table. The table presents the maximum detected concentrations including data from both the 1996 and 1999 RI.

Constituent	Maximum Groundwater Detection (ug/L)	MCL (ug/L)	Class I Groundwater Standard (ug/L)
Benzene	31 J	5	5
Ethylbenzene	98,000 E	700	700
Methylene Chloride	520	5	5

Constituent	Maximum Groundwater Detection (ug/L)	MCL (ug/L)	Class I Groundwater Standard (ug/L)
Toluene	6,000 J	1,000	1,000
Xylenes (total)	300,000 E	10,000	10,000
Antimony	71	6	6
Thallium	12 J	2	2

Thallium was detected above MCLs and Class I standards, during the 1996 RI. As shown in the above table, the MCLs and Class I standards for the COCs at Site 14 are identical.

Surface Water

Maximum detected concentrations were compared to Illinois General Use Water Quality Standards [14], see Table E-1. Note that only iron exceeded the General Use Water Quality Standards established by the State of Illinois.

RCRA Hazardous Wastes and Affected Media

None of the contaminants on-site are considered to be listed RCRA hazardous wastes because the specific industrial source has not been identified. The chromium and lead contaminated soil will be tested to determine if it is considered a RCRA characteristic hazardous waste at the time of remediation. If it is found to be a RCRA hazardous waste by characteristic, it will be treated and disposed in accordance with RCRA requirements.

E.6 Location of Contamination and Potential Routes of Migration and Volume of Affected Media

Lateral and Vertical Extent of Contamination

Figure E-3 shows the estimated extent of soils at Site 14 that exceed the cleanup goal of 100 mg/kg ethylbenzene for VOC contamination in soil. The extent of groundwater contamination above MCLs/State of Illinois Class I groundwater standards generally corresponds to soils with contamination in excess of 100 mg/kg ethylbenzene, see Figure E-4. The area was calculated to be about 18,000 ft^2.

Figure E-3 depicts the estimated extent of soil at Site 14 associated with the hot spot of chromium contamination.

Current and Potential Future Surface and Subsurface Routes of Human Or Environmental Exposure

There are no current users of groundwater at this site. The primary potential future exposure route for human health is through drinking contaminated groundwater. Ingestion of water extracted from this aquifer poses a potential risk to human health because USEPA's acceptable risk range is exceeded and concentrations of contaminant are greater than MCLs for drinking

[14] These General Use Water Quality Standards for Site 14 were furnished by IEPA as part of their comments on the Draft RI Addendum Report, August 1999.

water (as specified in the Safe Drinking Water Act) and the State of Illinois Class I groundwater standards.

There is one small area where chromium contamination is dramatically higher than the other locations. For this reason, hot spot removal of chromium is necessary for protection of ecological resources. Removal of chromium contaminated soil in this location will reduce the average concentration over the site to a level that does not pose an unacceptable risk to wildlife (American robin) at Site 14.

Likelihood for Migration of COCs

If the contamination present at Site 14 is not remediated, the contamination will continue to migrate in groundwater. There is a bedrock aquifer, which is currently a drinking water source, that is directly below the affected aquifer. There is the possibility that without remediation the contamination could migrate to the bedrock aquifer. In addition, there will be movement of contamination in soil through runoff and surface transport and the soil will likely be a source for increased groundwater contamination.

Human and Ecological Populations That Could Be Affected

Humans could potentially be affected by ingestion of contaminated groundwater or by dermal absorption, or inhalation, or ingestion of ethylbenzene from contaminated soils (site workers and construction workers).

There is potential risk to the American robin from a chromium hotspot at Site 14.

E.7 Groundwater Contamination

Description of Affected Aquifer

Based on the site investigation conducted at the Refuge, the groundwater at Site 14 is a Potable Resource Groundwater (State of Illinois Class I groundwater standards) in accordance with Title 35 of the Illinois Administrative Code, Section 620 as determined by the State of Illinois.

The affected aquifer consists of sand layers in the silty clay glacial till that underlies the site. It is unconfined. Groundwater depths in the six wells at the site ranged from about one to 11 feet bgs. The affected aquifer appears to be separated from the underlying sandstone aquifer by a clay layer.

Hydraulic conductivity values, based on slug tests performed in the six monitoring wells, ranged from 4.1×10^{-4} cm/s to 4.2×10^{-3} cm/s, with an average of 1.75×10^{-3} cm/s.

Groundwater Flow Directions and Discharge Locations

Groundwater elevation contours for February 1999 and June 1999 are shown on Figures E-5 and E-6, respectively. As shown on the figures, the area encompassing monitoring wells COMW214-2, COMW214-3, and COMW514-4, appears to overlie a groundwater ridge or

mound. The groundwater mound is in the general area of the grassy area which is partially surrounded by the three buildings on site. The mound could be due to greater surface water infiltration in the grassy area compared to the surrounding area of buildings, and to runoff from the buildings.

Based on data from the monitoring wells, the horizontal hydraulic gradient appears to be steepest to the east, in the general direction of COMW514-6, and flattest to the south-southwest. The maximum calculated hydraulic gradient, 0.0179, is based on the February 1999 groundwater elevation data presented on Figure E-5. The hydraulic gradient is a measure of the steepness of the groundwater surface.

Interconnection between Surface Contamination

Because of the shallow depth of the groundwater, the VOC-contaminated soil is in direct contact with the groundwater.

Presence and Location of Non-Aqueous Phase Liquids (NAPLs)

VOC contamination in soil appears to be present in sorbed, dissolved, and possibly residual free phase forms. Detected concentrations in groundwater exceed solubility limits; however, free phase contamination has not been observed on site (e.g., free product has not been detected or measured in monitoring wells). In addition, detected concentrations in soil are elevated indicating that contamination may be trapped as free phase product in soil pores in addition to being sorbed to soil particles.

Groundwater Models

Modeling was used for the purpose of estimating the time required to restore the groundwater to concentrations below MCLs/State of Illinois Class I groundwater standards. The model used was BIOSCREEN (Version 1.4), which was developed by USEPA and the Air Force. BIOSCREEN is a screening model that simulates remediation through natural attenuation of hydrocarbons at petroleum fuel release sites. Natural attenuation is a general term for the naturally occurring processes that gradually reduce contaminant levels in the groundwater.

Model assumptions:

- Contaminant mass is concentrated at the center of the original source area.
- The model assumes that subsurface material is homogeneous with respect to hydraulic conductivity. The hydraulic conductivity value used was based on the average value calculated from the slug test data from monitoring wells at the site.
- The model uses a constant hydraulic gradient value. This was based on field data.
- For effective porosity, the model default value of 0.25 for silt and sand was used.
- Contaminant mass was estimated from samples collected at the site.
- Plume lengths for each constituent were estimated based on field data.
- For soil bulk density, the model default value was used.
- The following values for partition coefficient were used:
  - Benzene—58.9 liters per kilogram (L/kg)

- Toluene—182 L/kg
- Ethylbenzene—363 L/kg
- Xylene—260 L/kg

Summary of BIOSCREEN Results

In summary, the monitoring times that correspond to the first order decay, indicate that without source removal or treatment the aquifer will not restore to below MCLs and State of Illinois Class I groundwater standards within 600+ years. However, with source removal or treatment to the cleanup goals identified in this ROD (100 mg/kg ethylbenzene) based on the assumptions used, the modeling indicates that the groundwater would be restored to levels below MCLs/State of Illinois Class I groundwater standards for contaminants of concern by natural attenuation within 6 years.

F. CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

F.1 Land Uses

Current Land Use. Site 14 is currently an industrial facility within the Crab Orchard National Wildlife Refuge.

Current Adjacent Land Use. The Refuge has multiple uses, including wildlife management, industry, recreation, and agriculture. Site 14 is located in the industrial or closed part of the Refuge, which covers about 20,000 acres in the eastern part of the Refuge. This part of the Refuge is generally closed to the public except for the roadways. It was previously part of the Illinois Ordnance Plant that produced weapons during World War II. After the war, the former ordnance plant buildings, which are widely spaced throughout the area, were leased to industrial tenants. The closed part of the Refuge serves as a wildlife sanctuary and is mostly wooded and grass-covered, with some areas used for agricultural crops. The current tenant at Site 14 occupies several buildings. The nearest active industrial area to Site 14 is Area 7 located about a half-mile northeast of the site. There is a federal penitentiary located to the east of Site 14, just outside the Refuge boundary. The closest urban area, Marion, Illinois, is approximately 5 miles northeast of the site, the nearest residential property is approximately 3 miles east of the site, and the closest Refuge property boundary is approximately 1 mile to the east. Crab Orchard Lake is located about 6,000 feet to the north of Site 14.

Anticipated Future Use. The reasonably anticipated future use of Site 14 is industrial property. The current use of Site 14 is designated as industrial, as part of Area 8, in the Industrial Policy for Crab Orchard Refuge dated December 1, 1981, which is the most recent policy in effect. This policy is expected to be replaced soon by the Comprehensive Conservation Plan for the Refuge which is currently under development by DOI.

F.2 Groundwater and Surface Water Uses

Current Surface Water and Groundwater Use. Groundwater and surface water in the area are not currently being used for drinking water. Groundwater on the Refuge is not currently used for any purpose. Crab Orchard Lake was previously used as the Refuge drinking water source, but its use was discontinued several years ago. All surface water on the Refuge is used by the wildlife for whom the Refuge was established. Crab Orchard Lake is also used for recreational boating, fishing, and swimming.

Potential Beneficial Future Use of Surface Water and Groundwater. Based on the site investigation conducted at the Refuge, the groundwater at Site 14 is a Potable Resource Groundwater (State of Illinois Class I groundwater standards) in accordance with Title 35 of the Illinois Administrative Code, Section 620 as determined by the State of Illinois.

Although the affected upper till aquifer is not currently being used as a drinking water source, it overlies a bedrock aquifer that is a regional drinking water source. While these two aquifers did not appear to be hydraulically connected at Site 14, they may be connected at other locations. While there are no permanent streams on the site, runoff from the site does contribute to permanent water bodies on the Refuge, which are used by wildlife. Crab Orchard Lake will continue to be used for recreational activities.

Beneficial Use Timeframe. There is currently no planned future use of the groundwater at this site, except to the extent that it may migrate to the bedrock aquifer, which is used as a potable water source off-Refuge. Modeling done as part of the FS for Site 14 predicted that with remediation as planned, the groundwater would be restored to levels below MCLs/State of Illinois Class I groundwater standards for contaminants of concern within 6 years.

Location of Anticipated Use. As discussed in the potential beneficial use discussion above, there are currently no plans for the use of the contaminated aquifer. However, without remediation, contamination from this aquifer may migrate into the bedrock aquifer that is used as a drinking water source off-Refuge.

G. SUMMARY OF SITE RISKS

This section summarizes site risks, which plays a role in the need to protect human health and the environment.

G.1 Contaminants of Concern

The groundwater at Site 14 is contaminated primarily with toluene, ethylbenzene, xylenes, and methylene chloride above their respective MCLs and State of Illinois Class I groundwater standards. Two concerns drive the need for cleanup. First, there is the need to prevent further degradation of the groundwater. Secondly, there is the need to return the groundwater at Site 14 to its State designated beneficial use (i.e. return the to State of Illinois State Class I groundwater standards or MCLs).

While the baseline human health risk assessment conducted as part of the 1996 RI found no unacceptable human health risk for Site 14, the RI Addendum found higher concentrations of some contaminants, which required a re-evaluation of risk. The unacceptable site risks based on the RI Addendum re-evaluation are summarized below.

A hot spot in the soil contains elevated levels of chromium (maximum concentration of 5,560 mg/kg) and lead (maximum concentration of 25,300 mg/kg). The chromium levels pose potential unacceptable risk to ecological receptors. Remediating the soil to a chromium level of 52 mg/kg as discussed below in the risk characterization section will eliminate the potential unacceptable risk to ecological receptors from chromium. Potential risks to human receptors were also evaluated. The acceptable level of lead for residential land use based on the USEPA's Integrated Exposure Uptake/Biokinetic (IEUBK) Lead Model[15] is 400 mg/kg. This is the basis for the USEPA Region 9 preliminary remediation goal (PRG) for residential soil exposure. Removal of this hot spot would reduce chromium and lead levels to below ecological and human health risk based concentrations, respectively.

G.2 Summary of Risk Characterization—Human Health Risk Assessment

The 1996 RI concluded that contaminants at this site represented no unacceptable risk to human or ecological receptors. As noted above, higher contaminant concentrations found during the RI Addendum investigation resulted in some unacceptable human health and ecological risk. The results of the risk assessment/evaluation are summarized below.

Soil

In the 1996 RI baseline risk assessment, the maximum detected concentrations of COCs in soil were compared to USEPA Region III Risk Based Concentrations (RBCs) for industrial/commercial soils. The RBCs for soils are based on a 25-year exposure of an adult worker to soil through ingestion. The comparison demonstrated that the maximum concentration of each COC detected in soil was below the RBC.

Groundwater

The 1996 baseline risk assessment concluded that since there is no current domestic use of groundwater on the Refuge, the groundwater ingestion pathway was incomplete.

Surface Water

The 1996 RI baseline risk assessment for detected COCs in this medium assumed exposure to site workers, construction workers, and recreational receptors through surface water ingestion and dermal contact. Both carcinogenic and non-carcinogenic risks were within USEPA acceptable levels. The total hazard index (HI) for these exposure pathways is 0.04, which is below the threshold comparison value of 1 and indicates that no unacceptable adverse health

[15] United States Environmental Protection Agency (USEPA). 1994. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. EPA/540/F-94/043.

effects are expected as a result of exposure. The estimated lifetime excess cancer risk is $4x10^{-7}$. This is below the USEPA target risk range of $1x10^{-6}$ to $1x10^{-4}$ and is, therefore, acceptable.

Summary of Risk Characterization—RI Addendum

The following paragraphs summarize the results of the evaluation of additional data collected after the 1996 RI. After completion of the MISCA OU baseline risk assessment[16], additional samples were collected at Site 14 (August 1996, August 1998, and February 1999) to further delineate the extent of contamination. Some contaminant levels detected during these investigations were greater than the levels detected during the original RI. Therefore risks were re-evaluated.

Soil

Values of chromium, lead, and mercury are considerably higher than detected in previous investigations. The updated maximum concentrations of contaminants were compared to the most recent list of USEPA Region III RBCs for commercial/industrial soil[17]to be consistent with the screening-level risk assessment in the RI. The maximum detected value of chromium is still well below its RBC. No RBCs for lead or mercury are provided in the 1999 USEPA Region III update; however, values from the 1995 RBC table are 400 mg/kg and 610 mg/kg, respectively. The maximum detected value of mercury (7.44 mg/kg) is below its 1995 RBC value. The maximum detected value of lead (25,300 mg/kg) is above the IEUBK-based value of 400 mg/kg. Only arsenic exceeds its RBC for commercial/industrial soil; however, the maximum detected concentration (10.6 mg/kg) is below its background value of 19.4 mg/kg.

Groundwater

MCLs/State of Illinois Class I groundwater standards are applicable or relevant and appropriate requirements (ARARs) for this site. The constituents that exceeded MCLs/State of Illinois Class I Standards are presented in Table G-1.

Note that ingestion of contaminated groundwater is considered to be an incomplete pathway, in the SCEM, which was developed for the baseline risk assessment. However, hypothetical future groundwater users would be at risk if they ingested groundwater with current levels of contaminants. The groundwater at this site is classified as Potable Resource groundwater (35 IAC 620). In order to comply with State and Federal ARARs the aquifer needs to be restored to beneficial use. In addition, no empirical evidence has been generated at Site 14 to demonstrate that the shallow aquifer does not pose an actual or potential risk to the bedrock aquifer below. The bedrock aquifer is actively used in the vicinity of the Refuge.

[16] Woodward-Clyde (W-C). 1996. Final RI Report, Remedial Investigation Miscellaneous Areas Operable Unit. Crab Orchard National Wildlife Refuge. Marion, Illinois.

[17] United States Environmental Protection Agency (USEPA). 1999. Region III Risk-Based Concentration Table.

Surface Water

Barium, lead, and manganese were detected in surface water at levels slightly above previous maximum concentrations. Carcinogenic and non-carcinogenic health risks are still within acceptable levels.

G.3 Ecological Risk Summary

A baseline ecological risk assessment was conducted as part of the RI for the MISCA OU in February 1996. The MISCA OU is comprised of several sites, including Site 14. The purpose of the baseline ecological risk assessment is to determine the potential for adverse ecological effects to occur as a result of exposure to existing conditions at the MISCA OU sites. The risk assessment concluded that Site 14 did not pose unacceptable ecological risks. To incorporate updated methodologies for ecological risk assessment, and provide for additional consideration of resource management goals at Crab Orchard National Wildlife Refuge, the DOI decided to re-evaluate the ecological risk assessment for Site 14 to support the FS.

The FS ecological risk evaluation consists of three components that, in combination, comprise USEPA's general approach as outlined in *Guidelines for Ecological Risk Assessment*[18].

Site 14 consists primarily of grass-lined stormwater drainage ditches, some lawn area, as well as a small section of forest edge. The habitat afforded by the limited areas of grass and forest edge is being sustained by and ultimately controlled through human activities within the site. Soils were identified as the primary exposure media at Site 14. Though water can be present in ditches following rainfall, no significant standing water is anticipated. As such, aquatic organisms (e.g., invertebrates and amphibians) were not considered ecologically relevant to Site 14, nor will aquatic organisms contribute significant forage to other receptors. The potential for offsite transport of contaminants from Site 14 was evaluated, and was not considered significant based on the concentrations detected in surface water, and fate and transport mechanisms associated with the chemicals.

Site 14 is expected to remain as an industrial area within the Refuge. The site contains little to no "natural" habitat and provides little value (through biomass production, genetic diversity, etc.) to the overall landscape scale ecosystem within the Refuge. It was recognized, however, that certain transient wildlife would at least at times forage within the site boundaries.

Detailed results of the ecological risk characterization are presented in Volume 3 of the Sites 14 and 36 FS Report. Among the chemicals of potential ecological concern evaluated at Site 14, only chromium, lead, mercury and thallium exceeded their respective RBCs (i.e., exceeded a hazard quotient [HQ] of 1). An HQ is the ratio of a single substance exposure level over a specified time period to a reference dose for that substance derived from a similar exposure period. An HQ of less than one for a single substance and a given exposure pathway indicates an acceptable risk level for that substance/exposure pathway. With one exception, the only receptor potentially at risk was the American robin. For chromium, the HQ_{NOAEL} (the HQ based on the

[18] USEPA. 1998. *Guidelines for Ecological Risk Assessment.* United States Environmental Protection Agency, Risk Assessment Form. Washington, D.C. EPA/630/R-95/002F (see also 63FR93:26845-26924).

No Observable Adverse Effects Level [NOAEL]) also slightly exceeded 1 for the American kestrel (1.4), but the HQ for the American robin was substantially higher (14.1). Thallium was detected in only one sample and exceeded a RBC_{NOAEL} (HQ_{NOAEL} = 1.8). The RBC_{LOAEL} (RBC based on the Lowest Observable Adverse Effects Level [LOAEL]) for thallium was not exceeded (HQ_{LOAEL} = 0.2). This suggests that the predicted risk is uncertain, but not sufficiently elevated to recommend any remedial action. Similar to thallium, though lead and mercury concentrations exceeded $RBCs_{NOAEL}$ (HQs of 1.05 and 2.1, respectively), these are not considered significant risks to ecological receptors at Site 14 because the HQs_{LOAEL} were less than 1 for each constituent (0.5 and 0.05, respectively).

Examination of the chromium data in a spatial context indicated that only two individual sample locations influenced the projected risks to the American robin, for which the RBC_{LOAEL} is 52 mg/kg for chromium. When these samples were censored, which would reflect a potential "hot-spot" removal action (to 52 mg/kg chromium) of estimated ten cubic yards, the potential ecological risks associated with chromium were essentially eliminated.

Conclusion

The response action selected in this ROD is necessary to protect human health or welfare or the environment from actual or threatened release of hazardous substances, pollutants or contaminants from this site that may present an imminent and substantial endangerment to public health or welfare.

H. REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) for Site 14, based on existing knowledge of the site and potential risks, are:

- Protect groundwater resources at Site 14 by reducing levels of benzene, ethylbenzene, methylene chloride, toluene, and xylenes in soil such that groundwater will be restored to levels below MCLs and State of Illinois Class I groundwater standards for those contaminants within a reasonable amount of time. Studies at the site showed that ethylbenzene is the most predominant and widespread contaminant. If ethylbenzene concentrations in the soil are reduced to acceptable levels, the other contaminants will also be reduced to acceptable levels. Studies showed that the lateral boundary of soil with a maximum level of ethylbenzene contamination at 100 mg/kg approximately coincides with the limits of groundwater contamination at or below MCLs/State of Illinois Class I groundwater standards for ethylbenzene and all other contaminants of concern. Reducing ethylbenzene contamination to 100 mg/kg, would achieve this RAO. Therefore, the cleanup level for ethylbenzene in soil is 100 mg/kg. Cleanup levels for the other VOCs in soil are interim and are based on the field-observed ratios of those constituents to ethylbenzene. Those interim cleanup goals are: benzene, 0.09 mg/kg; toluene, 11 mg/kg; total xylenes, 292 mg/kg; and methylene chloride, 4.4 mg/kg. Additional field investigation will occur in the Remedial Design (RD) phase (design for the implementation of the preferred alternative) to verify the ethylbenzene contour, which is defined as the limits of groundwater contamination at MCLs/State of Illinois Class I groundwater standards for ethylbenzene, and concentrations of all contaminants of concern (COCs) in soil at that contour. For contaminants with interim

cleanup goals, if RD sampling reveals levels in groundwater above MCLs/State of Illinois Class I groundwater standards at locations where the soil concentrations are below these interim cleanup goals, then these interim cleanup goals may be adjusted.

- Conduct site specific risk assessment to identify the levels of residual soil contamination above which risk would be unacceptable for site workers and construction workers. If these unacceptable risk levels are below the cleanup levels for any of the contaminants at this site, institutional controls will be implemented which will require special worker protection for site related activities.

- Reduce levels of chromium and lead in surface soil, targeting a localized hot spot, to minimize the risk to humans (for lead); and to animals that may occasionally forage at Site 14. This would be done by reducing chromium levels in soil to 52 mg/kg, and lead levels to 400 mg/kg. These are the cleanup goals for these constituents.

- Using site specific information, conduct monitored natural attenuation calculations to verify if groundwater would be restored to MCLs/State of Illinois Class I groundwater standards within a reasonable amount of time for all COCs, including methylene chloride.

- Wastes and contaminated media, which exhibit a characteristic of a RCRA hazardous waste, will be removed and treated and disposed off-site in accordance with RCRA requirements.

I. DESCRIPTION OF ALTERNATIVES

Five alternatives were developed and evaluated including the No-Action Alternative.

The costs presented for each alternative include capital costs (such as equipment, labor and other construction expenses to put the remedy in place) and operation and maintenance (O&M) costs (such as monitoring the groundwater).

A list of Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) which apply to the site are listed and described in the Statutory Determinations Section of this ROD.

I.1 Alternative 1 – No Action

Alternative 1 assumes that no remedial action would be implemented. This alternative is required by the National Contingency Plan, and it serves as a baseline against which other alternatives are compared.

I.2 Alternative 2 – In-Situ ORC® / Excavation of Metals-Contaminated Soil / Off-Site Disposal / Institutional Controls / Groundwater Monitoring

Treatment Components for Soil and Groundwater

- In-situ injection of oxygen release compound (ORC®) into VOC-contaminated soil. ORC® is a commercially available formulation of magnesium peroxide that enhances aerobic bioremediation by slowly releasing oxygen into the soil and groundwater.
- Treats an estimated 7,300 cubic yards of VOC-contaminated soil. Remediation through ORC® is expected to achieve cleanup goals.
- Treats VOC-contaminated groundwater.

Containment (or Storage) Components for Soil and Groundwater

- Estimated 10 cubic yards of metals-contaminated soils will be excavated and disposed of in an off-site RCRA Subtitle D landfill.
- No on-site containment components are included.

Institutional Control Components for Soil and Groundwater

- Institutional controls to prohibit installation of potable water wells until the groundwater is restored to MCLs/State of Illinois Class I groundwater standards for all contaminants of concern.
- Groundwater monitoring until groundwater at Site 14 is restored to MCLs/State of Illinois Class I groundwater standards for all contaminants of concern.

I.3 Alternative 3 – Ex-situ Biopile / In-Situ ORC® / Excavation of Metals-Contaminated Soil / Off-Site Disposal / Institutional Controls / Groundwater Monitoring

Alternative 3 is similar to Alternative 2 except that ORC® is used only to treat VOC-contaminated soil beneath the Repour Building; the remainder of the VOC-contaminated soil is excavated and treated in a biopile.

Treatment Components for Soil and Groundwater

- Ex-situ biopile treatment of VOC-contaminated soil. Excavated soils are mixed with nutrients to form a compost which is placed in aboveground enclosures and aerated with blowers or vacuum pumps.
- In-situ injection of ORC® into VOC-contaminated soil under the Repour Building.

- Ex-situ biopile treats approximately 7,100 cubic yards of VOC-contaminated soil and in-situ ORC® treats approximately 200 cubic yards of VOC-contaminated soil under the Repour Building. Remediation through the biopile and ORC® is expected achieve cleanup goals.

- Treats groundwater that seeps into the excavation resulting from the removal of the VOC-contaminated soils for the biopile.

Containment (or Storage) Components for Soil and Groundwater

- Estimated 10 cubic yards of metals-contaminated soils will be excavated and disposed of in an off-site RCRA Subtitle D landfill.

- No on-site containment components are included.

Institutional Control Components for Soil and Groundwater

- Institutional controls to prohibit installation of potable water wells until the groundwater is restored to State of Illinois Class I groundwater standards for all contaminants of concern.

- Groundwater monitoring until groundwater at Site 14 is restored to MCLs/State of Illinois Class I groundwater standards for all contaminants of concern.

I.4 Alternative 4 – In-Situ ORC® / Excavation / Off-Site Disposal / Institutional Controls / Groundwater Monitoring

Alternative 4 is the same as Alternative 3 except that the VOC-contaminated soil that is treated in the biopile in Alternative 3 is instead excavated and disposed of off-site.

Treatment Components

- In-situ injection of oxygen release compound (ORC®) into VOC-contaminated soil under the Repour Building (approximately 200 cubic yards of VOC-contaminated soil).

- Treats groundwater that seeps into excavation resulting from the removal of the bulk of the VOC-contaminated soil.

Containment (or Storage) Components for Soil and Groundwater

- Approximately 10 cubic yards of metals-contaminated soil and 7,100 cubic yards of VOC-contaminated soil will be excavated and disposed of in an off-site RCRA Subtitle D landfill.

- No on-site containment components are included.

Institutional Control Components for Soil and Groundwater

- Institutional controls to prohibit installation of potable water wells until the groundwater is restored to MCLs/State of Illinois Class I groundwater standards for all contaminants of concern.
- Groundwater monitoring until groundwater at Site 14 is restored to MCLs/State of Illinois Class I groundwater standards for all contaminants of concern.

I.5 Alternative 5 – Excavation / Off-Site Disposal / Institutional Controls / Groundwater Monitoring

Alternative 5 is the same as Alternative 4 except that all the VOC-contaminated soil is excavated and disposed of off-site. In Alternative 5, the Repour Building overlying VOC contaminated soil will be removed to gain access to the contaminated soil.

Treatment Components

- On-site treatment of water that seeps into excavation resulting from removal of the VOC-contaminated soil.

Containment (or Storage) Components

- Approximately 10 cubic yards of metal-contaminated soil and 7,300 cubic yards of VOC-contaminated soil will be excavated and disposed of in an off-site RCRA Subtitle D landfill.

- There are no on-site containment or storage components.

Institutional Control Components for Soil and Groundwater

- Institutional controls to prohibit installation of potable water wells until the groundwater is restored to MCLs/State of Illinois Class I groundwater standards for all contaminants of concern.

- Groundwater monitoring until groundwater at Site 14 is restored to MCLs/State of Illinois Class I groundwater standards for all contaminants of concern.

I.6 Common Elements and Distinguishing Features of Each Alternative

This section addresses the action alternatives only.

Key ARARs Associated with Alternatives. For all the action alternatives the main ARARs are MCLs and State of Illinois Class I groundwater standards (35 IAC 620). Groundwater at the site exceeds MCLs and State of Illinois Class I groundwater standards. All action alternatives, to varying degrees, use off-site disposal in a RCRA Subtitle D landfill.

Long-term Reliability of Alternatives. Alternatives 2, 3, and 4 include the use of ORC® technology. Alternative 2 uses ORC® exclusively for remediation of all the VOC-contaminated

soil (about 7,300 cubic yards). Alternatives 3 and 4 use it only for the approximately 200 cubic yards of soil beneath the Repour Building. While ORC® is considered a proven technology for some situations, its effectiveness for this site is unknown, because of the elevated concentrations of VOCs and the ratio of these compounds compared to typical hydrocarbon-contaminated sites. Alternative 5, which uses only excavation for remediation, is considered the most reliable alternative.

Quantity of Untreated and Treated Residuals to be Disposed Off-Site or Managed On-Site. All action alternatives include off-site disposal of about ten cubic yards of metals-contaminated soil. For Alternatives 2 and 3 that is the only off-site disposal. Alternatives 4 and 5 also include approximately 7,100 and 7,300 cubic yards, respectively, of VOC-contaminated soil to be disposed off-site.

All alternatives are expected to be about the same in terms of residuals to be managed on-site. For all alternatives, institutional controls will be required. For all the action alternatives, there is no expectation of any differences in the quantities of these residuals that will be left after remediation is complete. While ORC® will address a larger volume of groundwater than the on-site treatment of groundwater pumped from the excavation, the effectiveness of the ORC® treatment of groundwater is not expected to be as great. The ex-situ treatment will remove a limited amount of contaminated groundwater, while the ORC® treatment will only reduce concentrations.

Time Required for Design and Construction. Alternatives 3 through 5 would each require approximately 18 months for design and construction. Alternative 2 would require 24 months for design and construction, because this alternative would require a 6-month pilot test.

Time Required to Reach Cleanup Levels. Based on the BIOSCREEN model, for Alternative 2, the predicted time required to reach soil and groundwater cleanup goals for benzene, ethylbenzene, toluene and xylenes would be 6 years after construction. Alternative 3 would reach soil cleanup goals for these constituents within 2 years following completion of construction. Alternative 4 would require less than a year to reach cleanup goals for these constituents following construction. Alternative 5 would reach soil cleanup goals for these constituents at the completion of construction. For all action alternatives, the estimated time required to reach MCLs/State of Illinois Class I groundwater standards is 6 years.

Cost for Each Alternative. The following table presents a summary of the capital cost, annual operation and maintenance (O&M), and present worth cost for each of the alternatives.

Cost	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Capital Cost	$0	$1,051,000	$1,633,000	$1,502,000	$1,562,000
Annual O&M	$0	$16,000	$127,000 (0-2 years) $15,000 (2-6 years)	$16,000	$16,000
Present Worth	$0	$1,129,000	$1,908,000	$1,579,000	$1,639,000

The cost estimates used a discount rate of 7% and the duration of O&M was assumed to be 6 years.

Use of Presumptive Remedies and/or Innovative Technologies. Presumptive remedies are those remedies that are USEPA's preferred technologies for common categories of sites. None of the alternatives evaluated for the site are considered presumptive remedies[19].

Innovative technologies are newly invented processes that have been tested yet lack enough testing to predict the outcome at various sites. The only technology considered for this site that is an innovative technology is the ORC® treatment option. This technology would require a 6-month pilot test at the site.

I.7 Expected Outcomes of Each Alternative

Available Land Uses Upon Achieving Performance Standards. Land use at Site 14 is not expected to change after performance standards are achieved. It is expected to continue to be an industrial site during and following remediation.

Available Groundwater Uses Upon Achieving Performance Standards. For all the action alternatives, groundwater is predicted to be restored to MCLs/State of Illinois Class I groundwater standards for contaminants of concern within about 6 years following remediation.

J. COMPARATIVE ANALYSIS OF ALTERNATIVES

This section compares the alternatives in terms of the nine criteria as required by the NCP (Section 300.430(f)(5)(i)). Each of the nine criteria is first explained. The results are summarized in Table J-1. An alternative providing the "best balance" of tradeoffs with respect to the nine criteria is determined from this evaluation.

J.1 Overall Protection of Human Health and the Environment

This criterion addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls. All of the alternatives, except the No-Action Alternative, are protective of human health and the environment by eliminating, reducing, or controlling risks posed by the site through treatment of soil contaminants, engineering controls, and/or institutional controls.

Alternatives 2 through 5 mitigate human health and ecological risk posed by metal-contaminated soil (i.e., chromium/lead hot spot) through removal and off-site disposal.

Alternatives 2, 3, and 4 protect groundwater by in situ and/or ex situ treatment of VOC-contaminated soil. Alternative 5 protects groundwater by removing VOC-contaminated soil that

[19] USEPA. 1993. Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites With Volatile Organic Compounds in Soils. Office of Solid Waste and Emergency Response, Directive 9355.0-48FS; EPA 540-F-93-048; PB 93-963346.

corresponds to groundwater that exceeds MCLs and State of Illinois Class I standards from the site. Alternatives 3, 4, and 5 also include removal and treatment of the majority of the groundwater with contamination above MCLs/State of Illinois Class I groundwater standards. All action alternatives provide protection through institutional controls for any residual groundwater contamination.

All action alternatives provide comparable protection of human health and the environment. Alternative 1, the No Action Alternative, would not provide protection of human health and the environment.

J.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria and limitations which are collectively referred to as "ARARs", unless such ARARs are waived under CERCLA Section 121(d)(4). ARARs applying to the site are listed and described in the Statutory Determinations Section of this ROD.

Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under Federal environmental or State environmental or facility citing laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those State standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility citing laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking waiver.

All alternatives, except the No-Action Alternative, had common ARARs associated with off-site disposal and MCLs/State of Illinois Class I groundwater standards. The use of a biopile (Alternative 3) requires control of emissions. Alternatives 3 through 5 will require compliance with Illinois surface water quality standards for the discharge of treated groundwater.

All the action alternatives provide comparable attainment of State and Federal ARARs. For all action alternatives, computer models predict that MCLs/State of Illinois Class I groundwater standards will be attained within about six years.

J.3 Long-term Effectiveness and Permanence

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 clean-up levels have been met. This criterion includes the consideration of residual risk that will remain onsite following remediation and the adequacy and reliability of controls.

All alternatives except the No-Action Alternative provide long-term effectiveness. All the action alternatives result in some residual contamination left on-site that would be managed by institutional controls. Groundwater is expected to be restored to MCLs/State of Illinois Class I groundwater standards for contaminants of concern within 6 years for all action alternatives.

All action alternatives provide comparable long-term effectiveness.

J.4 Reduction of Mobility, Toxicity, and Volume through Treatment

Reduction of mobility, toxicity, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy. This criterion evaluates an alternative's use of treatment to reduce the harmful nature of contaminants, their ability to move in the environment and the amount of contamination present.

Alternative 1 would not reduce the toxicity, mobility, or volume of VOC-contaminated soil or groundwater.

Alternative 2 would significantly reduce the toxicity of VOC-contaminated soil through in-situ treatment, but will not reduce the volume or mobility.

Alternative 3 would significantly reduce toxicity, mobility, and volume of VOC-contaminated soil through ex-situ treatment and spreading the treated soil as fill in selected parts of the Refuge.

Alternative 4 would reduce toxicity of a small portion of VOC-contaminated soil underneath the Repour Building through in-situ treatment, but will not reduce the volume or mobility.

Alternative 5 would not reduce the toxicity, mobility, or volume of VOC-contaminated soil through treatment.

All alternatives (with the exception of the No-Action Alternative) would reduce the toxicity of contaminated groundwater through treatment.
In summary, Alternative 3 would provide the greatest degree of reduction in toxicity, volume, and mobility of VOC-contaminated soil through treatment. Alternative 2 would provide the greatest reduction in toxicity of VOC-contaminated soil, but no reduction in either the mobility or the volume through treatment. Alternative 4 would provide a lesser degree of reduction in toxicity of VOC-contaminated soil with no reduction in mobility or the volume through treatment. Alternative 5 would not provide any reduction in toxicity, mobility, or volume through treatment of VOC-contaminated soil. All action alternatives (2 through 5) would reduce the toxicity through treatment of contaminated groundwater.

J.5 Short-term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

Alternative 1 (No-Action) does not provide any short-term effectiveness during the remedial action because no action is taken.

In-situ treatment (Alternative 2) will reduce on-site soil contaminant concentrations over a period of years while excavation (Alternative 5) removes the source immediately. Other alternatives are between Alternatives 2 and 5 in terms of time requirements.

Alternatives 2 through 5 would pose little or no risk to the community. Installation of ORC® boreholes for Alternatives 2, 3, and 4 may present some limited physical hazards for workers at the operating manufacturing facility at Site 14. Excavation of VOC-contaminated soil for Alternatives 3, 4, and 5 would present a greater degree of short-term physical hazards for on-site workers. Work zone access restrictions would be required for Alternatives 2 through 5 during remedial action. Because of the longer time requirements for Alternative 3, work zone access restrictions would need to be in effect for a longer time. While industrial and site/construction worker risks associated with source materials are reduced during implementation of Alternative 2, greater short-term risks for these receptors will exist than the risk associated with residual contamination left after excavation (Alternatives 4 and 5) over the same time period.

Alternative 2 would present minimal risk to the environment. Alternatives 3, 4, and 5 would present slightly higher risks to the environment due to potential spill hazards associated with handling of contaminated materials.

In summary, because Alternative 2 does not involve excavation and handling of the VOC-contaminated material, it poses the least potential adverse impacts to workers, community, and the environment. All other alternatives involve excavation and handling of most of the VOC-contaminated soil. However, air monitoring on-site and at the site boundaries and engineering controls would control the potential for exposure. Workers would be required to wear appropriate levels of protection to avoid exposure during excavation and treatment activities.

J.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other government entities are also considered.

Regarding technical feasibility: Alternatives 2, 3, and 4 use a technology (ORC®) that has been demonstrated to be effective in some cases. This technology is considered experimental for this site, because it has not been demonstrated to be effective for soils with VOC contamination of the magnitude and mix found at this site. Alternative 2 uses ORC® exclusively for the remediation of the VOC contaminated soils, and Alternatives 3 and 4 use it for the soil beneath

the Repour Building. Alternative 3, which includes the biopile, is technically more feasible than Alternative 2.

Regarding administrative feasibility: Because the ORC® is considered experimental for this site, and would require pilot testing, contingencies would need to be built into the ROD, the design, and the contracting in the event the pilot testing is unsuccessful.

Alternative 5, which involves excavation and offsite disposal, is the most technically feasible, followed by Alternative 4 (excavation of most of the VOC-contaminated soil, with ORC® under the Repour Building) then Alternative 3 (biopile with ORC®), and finally Alternative 2.

J.7 Cost

The estimated present work costs for the action alternatives ranged from $1,129,000 for Alternative 2 to $1,908,000 for Alternative 3. Cost summaries can be found in Table J-1.

J.8 State Acceptance

This State has expressed its support for Alternatives 2 through 5. The State does not believe that Alternative 1 provides adequate protection of human health and the environment.

J.9 Community Acceptance

During the public comment period, some employees and the industrial tenant at Site 14 expressed concern about the preferred remedy. The responses to public comments are presented in Appendix A, the Responsiveness Summary of this ROD.

K. PRINCIPAL THREAT WASTES

The NCP establishes an expectation that USEPA will use treatment to address the principal threats posed by a site wherever practicable (NCP §300.430(a)(1)(iii)(A)). Principal threat wastes include mobile source materials such as the subsurface soil containing VOCs found at Site 14. These contaminated soils are contributing to the groundwater contamination at the site.

The action alternatives address the principal threat, the VOCs source material (VOC-contaminated subsurface soil) as follows:

- *Alternative 2.* The VOC-contaminated source zone would be remediated using ORC®, a commercially available formulation of magnesium peroxide that enhances aerobic bioremediation by slowly releasing oxygen into the soil and groundwater.

- *Alternative 3.* The soil contaminated with VOC would be excavated and composted in a biopile, as described previously. In addition, the VOC-contaminated soil under the Repour Building at the site would be addressed by ORC®.

- *Alternative 4.* The majority of the VOC-contaminated soil would be addressed through excavation and containment within a permitted off-site RCRA Subtitle D landfill. The source under the Repour Building would be remediated by ORC®.

- *Alternative 5.* All the VOC-contaminated soil above cleanup levels would be excavated and contained in a permitted off-site RCRA D landfill.

L. SELECTED REMEDY

L.1 Summary of the Rationale for the Selected Remedy

Alternative 5 was selected because it is the most reliable (implementability criterion), requires the shortest time to reach soil cleanup goals, and the cost is reasonable compared to the other alternatives.

All the alternatives are comparable with respect to the following criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Short-term effectiveness
- State/support agency acceptance
- Community acceptance

The alternatives differ with respect to these criteria:

- Reduction of toxicity, mobility, or volume through treatment
- Implementability
- Cost

The selection was then based upon a comparison of the alternatives to these three criteria. Although Alternative 3 provides the greatest reduction in toxicity, mobility, and volume of contaminated soil through treatment, it is 16% more expensive than Alternative 5 and 21% more expensive than Alternative 4. Alternative 2 was the least expensive, but it is the most difficult to implement, especially when compared with Alternatives 3 and 5 which do not include in-situ treatment. Alternative 4 is less expensive than Alternative 5, but it includes limited in-situ treatment of contaminated soil under the Repour Building and is more difficult to implement than Alternative 5. Although Alternative 5 is slightly (3.8%) more expensive than Alternative 4, it is the easiest of the alternatives to implement. Alternative 5 was chosen because it provides the best balance of tradeoffs among the alternatives, when comparing the cost, implementability, and reduction of toxicity, mobility, or volume through treatment.

L.2 Detailed Description of Selected Remedy

The Selected Remedy includes a pre-design investigation. Sampling will be done to fill data gaps identified in the Feasibility Study Report; the investigation will also include obtaining site-specific information related to monitored natural attenuation. A site-specific risk assessment will be done to identify the levels of residual VOC soil contamination above which risks would be unacceptable for unprotected future site/construction workers who may be exposed to contaminated soil at the site. If these unacceptable risk levels are below the cleanup levels for

any of the VOCs at this site, institutional controls will be implemented which will require special worker protection at the site.

The Selected Remedy includes the demolition and disposal of part of the former Repour Building (less than 1,000 square feet) and excavation and off-site disposal of VOC- and metals-contaminated soil. Figure E-3 shows the layout of Alternative 5, with the remediation goal of 100 mg/kg for ethylbenzene in soil.

The former Repour Building was built during World War II and is now part of a larger warehouse for the current tenant. The former Repour Building will be demolished to allow access to all the contaminated soil above cleanup goals. The building demolition will require oversight by a structural engineer licensed in the State of Illinois to ensure that the building to which the Repour Building is attached is structurally sound during and after demolition. The Repour Building would also need to be assessed before demolition for potential asbestos and lead-based paint abatement.

The contaminated soil will be excavated and hauled off-site for disposal. Metals-contaminated soil will be segregated from VOC-contaminated soil. Air monitoring will be conducted throughout the excavation of both metals- and VOC-contaminated soil. Confirmation sampling will be performed after excavation of the metals-contaminated soil to ensure that cleanup criteria are met. The excavated metals-contaminated soil will be tested to determine if any of it is RCRA hazardous by characteristic. If so, the soil will be disposed of in accordance with RCRA requirements. After the metals-contaminated soil is removed and disposed of, the VOC-contaminated soil will be removed and confirmation sampling done in that part of the excavation to ensure that cleanup criteria are met. Excavated soil will be stockpiled and then hauled to an off-site facility. The plan for confirmation sampling will be designed based upon EPA 230/02-89-042, *Methods for Evaluating the Attainment of Cleanup Standards and Statistical Methods for Evaluating the Attainment of Cleanup Standards, Volume 3, Reference-Based Standards for Soils and Solid Media*, EPA/230/R-94-004.

During excavation, seepage water will be pumped to an on-site holding tank. From the tank, water will be pumped through a mobile air stripper on site. Any additional treatment necessary to achieve Illinois water quality standards will be done. Pumping and treating water that seeps into the excavation will treat a significant amount of groundwater that exceeds MCLs and State of Illinois Class I groundwater standards. After treatment the groundwater will be tested and discharged in accordance with Illinois General Use Water Quality Standards established by the State of Illinois for Site 14. The treatment and discharge activities will meet the substantive ARAR requirements. Immediately after confirmation that cleanup goals for soil have been met, clean backfill material will be placed to restore site use and vegetation will be established.

Institutional controls will be implemented at Site 14 to ensure that potable water supply wells are not installed at the site in the region of exceedances of MCLs/State of Illinois Class I groundwater standards until groundwater is restored for constituents of concern. If the risk assessment that will be done as part of the pre-design investigation indicates risk to site workers or construction workers following remediation, institutional controls will be implemented for worker protection.

Groundwater in and around the region of exceedances of MCLs/State of Illinois Class I groundwater standards will be monitored until the groundwater is restored for constituents of concern. The groundwater monitoring will verify the extent of the region of exceedances, and confirm that contaminant concentrations are declining as a result of the remediation. Groundwater will be monitored quarterly, at least initially, to ensure that remediation goals are being met (i.e., concentrations are decreasing). Existing and new monitoring wells will be sampled for COCs: benzene, ethylbenzene, methylene chloride, toluene, and xylenes; and natural attenuation parameters. In addition, antimony and thallium concentrations, which exceeded MCLs/State of Illinois Class I standards at Site 14 will be monitored during the quarterly monitoring. Figure E-3 shows presumed locations of additional monitoring wells. The well locations include wells at the perimeter of the excavation area and wells at varying distances surrounding the excavation area. The assumed total monitoring period is 6 years for the 100-mg/kg ethylbenzene remediation goal.

Monitored natural attenuation (MNA) for methylene chloride will be conducted, using USEPA guidance. Verification of MNA for the other VOCs in groundwater will be done using site specific information. If at the 5-year review these standards have not been met, the groundwater monitoring will be re-evaluated according to the triggers discussion below.

Alternative 5 is shown schematically in Figure E-3. The clean up of Site 14 achieved by this remedial alternative will adequately protect human health and the environment.

Triggers During Groundwater Monitoring Period

After the active remediation is complete and during the time that groundwater is being monitored, monitoring wells will be sampled on a quarterly basis, at least initially. If any of the following occurs, all parties of the FFA will be notified, and they will determine what, if any action needs to be taken:

- Contaminant concentrations in groundwater exhibit an increasing trend,
- Near-source wells exhibit large increases in concentrations,
- Contaminants are identified in monitoring wells outside the original plume,
- Contaminant concentrations are not decreasing at a sufficiently rapid rate to meet the remedial objectives.

The action that will be taken will depend on the severity of the problem and could include, but not be limited to, additional soil removal, groundwater treatment, increased frequency of sampling, and/or installation of additional monitoring wells.

L.3 Summary of the Estimated Remedy Cost

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an explanation of significant differences (ESD) to the ROD, or a

ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to –30 percent of the actual project cost.

The detailed cost estimate for the Selected Remedy is presented in Appendix B of this ROD. The total estimated capital cost for the Selected Remedy is $1,562,000, the total estimated operation and maintenance cost is $16,000, and the total estimated present worth cost is $1,639,000.

L.4 Expected Outcomes of the Selected Remedy

The expected land use, groundwater use, anticipated socio-economic and community impacts, and anticipated environmental and ecological benefits of the Selected Remedy are as follows:

Land Use. After remediation, the site is expected to be used as an industrial site. A small portion of the building complex (the former Repour Building) will be demolished to gain access to contaminated soil. The structure will not be replaced.

Groundwater Use. Institutional controls will be implemented at Site 14 to ensure that potable water supply wells are not installed at the site until groundwater is restored. Contaminated soil, the source of groundwater contamination, will be excavated and removed. It is estimated that within 6 years after the removal of the VOC-contaminated soil to cleanup levels, the groundwater will be restored to its beneficial use as a potential potable source.

Anticipated Community Impacts and Environmental and Ecological Benefit. The Selected Remedy will restore the groundwater at the site to its beneficial use as a potential potable water source. There will be benefits to ecological receptors from the removal of the metals-contaminated soil. There will be benefits to future site and construction workers who may be exposed to ethylbenzene, toluene or xylenes in the soil.

L.5 Cleanup Levels for Selected Remedy

Cleanup levels for contaminants of concern at Site 14 are summarized as follows:

Cleanup Levels for Site 14				
Contaminant	**Cleanup Objective (mg/kg)**	**Ecological RBC (mg/kg)**	**Human Health RBC (mg/kg)**	**MCL/State of Illinois Class I Groundwater Standard (mg/L)**
Chromium	-	52	-	N/A
Lead	-	-	400	N/A
Benzene	0.09*	-	-	0.005
Ethylbenzene	100	-	-	0.7
Methylene Chloride	4.4*	-	-	0.005
Toluene	11*	-	-	1
Xylenes	292*	-	-	10

* This indicates that the cleanup level is considered interim.

Soil cleanup levels of 400 mg/kg for lead (the IEUBK-based value for residential land use screening) and 52 mg/kg for chromium (the ecological RBC_{LOAEL}) will be used for confirmation sampling purposes in the chromium/lead hotspot.

Based on data collected during site investigations, the extent of groundwater contamination above MCLs/State of Illinois Class I groundwater standards appears to coincide with soil contamination above 100 mg/kg ethylbenzene (see Figure E-4). Soil cleanup levels for VOCs other than ethylbenzene are based on the ratio of ethylbenzene to these other constituents, as determined from existing data. These cleanup levels are interim as indicated in the table and may be adjusted based on results of a pre-design investigation that will include collection of soil samples and analysis for the contaminants of concern. For the cleanup goals with interim values, if data from the pre-design sampling indicate that groundwater contamination above MCLs/State of Illinois Class I groundwater standards exists at locations where the soil concentrations are below the interim cleanup levels, the cleanup levels may be adjusted.

If the localized hot spot of chromium is addressed by remediation at Site 14, then the upper confidence limit (UCL) for chromium at the site will fall below its ecological RBC (52 mg/kg, the RBC_{LOAEL}) and the potential ecological risk posed by chromium at Site 14 will be mitigated. For this reason, the ecological RBC_{LOAEL} for chromium at Site 14 will be used as the chromium cleanup goal for the site.

M. STATUTORY DETERMINATIONS

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

M.1 Protection of Human Health and the Environment

The Selected Remedy protects groundwater by removing the principal threat wastes that are contributing to groundwater contamination. It also includes removal and treatment of the majority of the groundwater with contamination above MCLs/State of Illinois Class I groundwater standards by removal and treatment of the groundwater that seeps into the excavation. Groundwater is estimated to be restored to MCLs/State of Illinois Class I groundwater standards for contaminants of concern within six years.

Ecological risk will be mitigated by removal of metal-contaminated soil.

Institutional controls will be implemented to ensure that no potable wells are installed at the site before the groundwater is restored.

The Selected Remedy will implement groundwater monitoring to confirm treatment performance and reduction of VOC concentrations in groundwater. Five-year reviews will be required to evaluate performance.

M.2 Compliance with Applicable or Relevant and Appropriate Requirements

The Selected Remedy will meet the ARARs presented in the following sections through removal of contaminated soil that acts as the source for groundwater contamination. The Selected Remedy also includes groundwater treatment by pumping contaminated groundwater from the excavation and treating it ex-situ.

The following sections describe the chemical-specific, action-specific, and location specific ARARs/TBCs that apply to Site 14.

Chemical-Specific ARARs/TBCs

Chemical-specific ARARs/TBCs for Site 14 are listed in Table M-1, with comments explaining why each was included for consideration as an ARAR or TBC. Sources used to identify these ARARs/TBCs included standards and criteria that are typically considered as ARARs under CERCLA, as well as recently published guidance that should be regarded as TBCs. The following presents more detailed information for some of the ARARs/TBCs listed in Table M-1:

- Clean Water Act. Ambient Water Quality Criteria were established under the Federal Water Pollution Control Act Amendment of 1972, later amended in 1977 (known as the Clean Water Act). The USEPA has established federal guidelines for development of water quality criteria to protect human health and aquatic life from exposure to pollutants. These federal ambient water quality criteria (AWQC) are developed as guidelines from which states determine their water quality standards. While the AWQC themselves have no direct regulatory impact, they are used to derive regulatory requirements which can include water quality-based effluent limitations, water quality standards or toxic pollutants effluent standards. The use of the AWQC is based on the designated or potential use of surface water. These are then translated into enforceable effluent limitations in a point source National Pollutant Discharge Elimination System (NPDES) permit for direct discharge to surface waters. If there is a discharge planned during remediation activities, due to management of pond water for example, the substantive requirements of a NPDES permit will be met. In addition, remediation will comply with storm water requirements.

- Clean Air Act. National Emission Standards for Hazardous Air Pollutants (NESHAPS) (40 CFR Part 61) are relevant and appropriate for remedial action including building demolition that results in releases of regulated compounds.

- Safe Drinking Water Act – MCLs (40 CFR Part 141) are relevant and appropriate for site groundwater. The groundwater at Site 14 is not currently being used as a source of drinking water, but the aquifer at the site could potentially be used as a drinking water source in the future.

- Illinois Surface Water Standards – Surface water standards are applicable if site-related chemicals impact surface water in area creeks or lakes. Illinois surface water quality standards (35 Illinois Administrative Code [IAC] Part 302) are applicable to surface water at Site 14. Effluent standards (35 IAC Part 304) are applicable for discharges to surface water. The State of Illinois has developed site-specific General Use Water Quality Standards for Site 14 under 35 IAC 302.

- Illinois Groundwater Quality Standards –35 IAC Part 620 identifies standards for groundwater Classes I (potable resource), II (general resource), III (special resource), and IV (other). The groundwater at Site 14 was determined to be Class I according to 35 IAC 620.210 (a)(4).

- Illinois Administrative Code Title 35, Subtitle F Public Water Supplies – Part 611 Primary Drinking water Standards is included for the same reason as given for the Safe Drinking Water Act.

Action-Specific ARARs/TBCs

Action-specific ARARs/TBCs for Site 14 are listed in Table M-2, with comments explaining why each was included for consideration as an ARAR or TBC (a TBC is a criterion to be considered. It may be based on guidance or a voluntary program but it is not enforceable.) Action-specific ARARs are requirements that establish restrictions or controls on specific remedial activities. These requirements are action-specific because they are directly tied to the remedial alternative and not the specific chemical of concern at the site. The following presents more detailed information for ARARs/TBCs listed in Table M-2:

Resource Conservation and Recovery Act. The Resource Conservation and Recovery Act (RCRA) of 1976, as amended, governs hazardous waste under Subtitle C and solid waste under Subtitle D.

Under Subtitle C, for remedial actions that may involve treatment or disposal of hazardous waste (e.g., excavated soils that fail to meet Toxicity Leaching Characteristic Procedure [TCLP] requirements), several requirements will be applicable, including identification and listing (40 CFR Part 261), generator standards (40 CFR Part 262), transporter standards (40 CFR Part 263), owner and operator standards for hazardous waste treatment, storage, and disposal facilities (40 CFR Part 264), land disposal restrictions (40 CFR Part 268), and the hazardous waste permit program (40 CFR Part 270).

Under Subtitle D, Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR Part 257), and Criteria for Municipal Waste Landfills (40 CFR Part 258) are relevant and appropriate for remedial actions involving containment of contaminated media left in-place, and soils disposed of off-site.

Solid Waste Disposal Act. The Guidelines for Land Disposal of Solid Waste (40 CFR Part 241), are relevant and appropriate for remedial actions involving containment of contaminated media left in-place and soils disposed of off-site.

Illinois Solid Waste Landfill Rules – 35 IAC Part 811 is considered to be applicable if remedial actions involve on-site disposal of solid waste.

Toxic Substances Control Act (TSCA) – TSCA regulations will be applicable for management and disposal of asbestos-containing material if building to be removed contains asbestos.

Illinois Hazardous and Special Waste Rules – Applicable state regulations if hazardous waste is identified at the site will be the Illinois hazardous waste management rules (35 IAC Part 720). If any material is removed and disposed as a special waste, Illinois special waste regulations (35 IAC Parts 808, 809) will also be applicable.

Clean Water Act and Illinois Effluent Standards – For remedial actions that may involve discharge to surface water (e.g., ex-situ treatment), applicable requirements will include the NPDES and Illinois effluent standards (35 IAC Part 304), including the General Use Water Quality Standards developed for Site 14.

Clean Air Act. National Emission Standards for Hazardous Air Pollutants (NESHAPS) (40 CFR Part 61) are relevant and appropriate for remedial action includes building demolition that results in releases of regulated compounds.

Illinois Air Standards – For remedial actions that may involve air emissions (e.g., ex-situ treatment of VOCs in soil or groundwater), Illinois air quality, particulate emission, and organic emission standards (contained in 35 IAC Parts 243, 212, and 215, respectively) will be applicable. Part 215 requirements will not apply to remedial activities that do not result in emissions of organic material greater than 8 pounds per hour.

Groundwater Guidance – For remedial activities that leave groundwater contamination in place that is above MCLs/State of Illinois Class I groundwater standards monitored natural attenuation may be necessary. In this case, the USEPA OSWER Directive No. 9200.4-17P, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Site is considered a TBC. Data for monitored natural attenuation will be collected as part of the pre-design investigation.

Occupational Safety and Health Act (OSHA) – Regulations will be applicable to all on-site remedial activities.

Location-Specific ARARs/TBCs

Location-specific ARARs/TBCs for Site 14 are presented in Table M-3, with comments explaining why each was included as an ARAR or TBC. Location-specific ARARs are those requirements that establish restrictions on remedial activities based on the geographic location of the site and surrounding areas. In general, the locations involved for the proposed remedial actions at Site 14 do not include sensitive or regulated resources. Therefore, the requirements listed in Table M-3 are not expected to be triggered by remedial activities in the areas to be remediated at Site 14. However, remedial actions must be compatible with the established purposes of the Refuge, including wildlife conservation and development of agricultural,

recreational, and industrial resources. Potentially applicable requirements presented in Table M-3 include:

National Wildlife Refuge System Administration Act – 16 USC 668, this law is applicable to areas designated as part of the National Wildlife Refuge System. It requires that remedial action that take place at Site 14 be compatible with the established purposes of the Refuge.

Endangered Species Act – 16 USCA Section 1531 to 1544. This law is applicable if endangered species or critical habitat are present at Site 14.

Archaeological and Historic Preservation Act – 16 USCA Sect. 469, this law is applicable if archaeological or historical data are uncovered during remedial action at Site 14.

Native American Graves Protection and Repatriation Act – PL 101-601, is applicable if Native American or cultural items are found during remedial activities.

Land Use in the CERCLA Remedy Selection Process – OSWER Directive No. 9355.7-04, is a TBC for determination of the reasonably anticipated land use for Site 14.

M.3 Cost Effectiveness

In the lead agency's judgement, the Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (NCP§300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and were ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence this alternative represents a reasonable value for the money spent.

The total estimated capital cost for the Selected Remedy is $1,562,000, the total estimated operation and maintenance cost is $16,000, and the total estimated present worth cost is $1,639,000. Although Alternative 2 is $510,000 less expensive and Alternative 4 is $450,000 less expensive (estimated present worth costs), these alternatives include the use of ORC®. ORC® is not as well proven a technology and the high concentrations of VOCs at the site make the technology even more uncertain. Alternative 5 was selected because it is the most reliable, require a short time to reach soil cleanup levels, and is therefore considered the most cost-effective.

M.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recover Technologies) to the Maximum Extent Practicable

The USEPA has determined that the Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the

site. Of those alternatives that are protective of human health and the environmental and comply with ARARs, USEPA has determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-site treatment and disposal and considering State and community acceptance.

The Selected Remedy removes the source materials constituting principal threats at the site, achieving significant reductions in VOC concentrations in soil and groundwater and also chromium and lead concentrations in soil. The Selected Remedy satisfies the criteria for long-term effectiveness by removing VOC-, chromium-, and lead-contaminated soil and placing it off-site in a permitted landfill. The Selected Remedy includes groundwater treatment by pumping contaminated groundwater from the excavation and treating it ex-situ. The Selected Remedy does not present short-term risks different from the other treatment alternatives. There are no special implementability issues that sets the Selected Remedy apart from any of the other alternatives evaluated.

M.5 Preference for Treatment as a Principal Element

The Selected Remedy does not include treatment as a principal element. As discussed in detail in this ROD, the Selected Remedy is the most reliable and cost-effective alternative considered. The remedies selected in the previous Records of Decision for the Refuge, including Metals OU, PCB OU, EMMA OU, however, satisfied the statutory preference for treatment as a principal element of the remedy.

M.6 Five-year Review Requirements

Because this remedy will result in contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

M.7 Change to Selected Remedy

The Proposed Plan for Site 14 was released for public comment in September 2000. The Proposed Plan identified Alternative 5, Excavation / Off-Site Disposal / Institutional Controls / Groundwater Monitoring, as the Preferred Alternative. All written and oral comments submitted during the public comment period were reviewed. No significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate, based on public comment.

During subsequent agency review, a decision was made to modify the Selected Remedy. The change involves performing additional risk assessment during the pre-design investigation to evaluate the need for institutional controls for site workers and/or construction worker protection, rather than to use To Be Considered Criteria for establishing these institutional controls. The Proposed Plan indicated that institutional controls to require construction workers to use appropriate protective equipment would be included. The need for these institutional controls was based on the 35 IAC Part 742 inhalation exposure route remediation objectives for

construction workers of 58 mg/kg, 42 mg/kg, and 410 mg/kg, respectively, for ethylbenzene, toluene, and xylenes. These are objectives established by the State of Illinois as part of its voluntary cleanup program. In the absence of applicable or relevant and appropriate requirements (ARARs), the 35 IAC 742 objectives were included in the Site 14 risk evaluation as To Be Considered criteria. The baseline risk assessment did not include the inhalation exposure route for construction workers, and these criteria were applied instead. Rather than use these criteria to establish institutional controls, as indicated in the Proposed Plan, a site-specific risk assessment of site worker and construction worker risk will be done as part of the pre-remedial design investigation. The results of the risk assessment will be used to determine if institutional controls for site worker and/or construction worker protection are needed. If, after contaminated soil is excavated, confirmation sampling indicates that residual VOC soil levels are below cleanup levels but above those levels indicating unacceptable risks for the site worker and/or construction worker scenario as determined by the risk assessment, institutional controls for site worker and/or construction worker protection will be implemented.

The lead agency decided to clarify the remedy to include a cleanup level for lead in the metals-contaminated hot spot in the soil near the former Repour Building. The Proposed Plan addressed only chromium in the hot spot. The FS identified a preliminary remedial goal for lead as 400 mg/kg, which is a IEUBK-based value for residential land use screening, for confirmation sampling purposes in the hotspot. The Proposed Plan indicated that excavation, removal, and off-site disposal of the hot spot was necessary to reduce levels of chromium in surface soil to minimize the risk to animals that may occasionally forage at Site 14. The cleanup level of 400 mg/kg in the hot spot is necessary for protection of human health and has been included in this ROD.

GLOSSARY OF TERMS

Administrative Record *– A file that contains the information used to make a decision on the selection of a response action under CERCLA. The file is established at or near a site and is available for public review.*

Applicable or relevant and appropriate requirements (ARARs) *– The Federal and State environmental laws and regulations that a selected remedy must comply with. These requirements vary among sites and alternatives.*

Aquifer *– Water-filled natural underground zone.*

Baseline Ecological Risk Assessment (BERA) *- The process whereby potential risks to plants and animals due to the presence of constituents of concern are quantitatively evaluated. This information is used to determine whether remedial actions are necessary.*

Biopile *– Excavated soils are mixed with nutrients to form compost which is placed in aboveground enclosures and aerated with blowers or vacuum pumps. This aerated compost pile is referred to as a biopile.*

Bioremediation *– The use of microorganisms to transform hazardous organic contaminants into non- hazardous substances.*

Capital Costs *– Capital costs are expenditures required to construct or install the remedial action. Capital costs can also include major predicted expenditures in future years.*

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) *– A federal law enacted in 1980 and subsequently modified by the Superfund Amendments and Reauthorization Act of 1986 (SARA). This act resulted in the creation of a trust fund, commonly known as "Superfund," which provides money to investigate and clean up abandoned or uncontrolled hazardous waste sites.*

Ex-situ Remediation *– The removal of water or soil from its original place to perform the remedial action (as compared with in-situ remediation, which is done with the soil or water remaining in its original place).*

Federal Facility Agreement (FFA) *– Binding agreement between the Department of the Interior, U.S. Environmental Protection Agency, Illinois Environmental Protection Agency, and Department of Army which designates roles for these agencies during cleanup and schedules activities.*

Groundwater *– Water that is present in the open spaces between soil particles (silt, sand, gravel) and/or rock fractures below the ground surface.*

Heavy Metals *- Metallic elements (e.g., mercury, chromium, cadmium, arsenic, and lead) that can damage living things at low concentrations; some tend to accumulate in the food chain.*

Home Range *– Habitat area frequently used by wildlife.*

Hot Spot Removal *– Isolated removal of highly contaminated material.*

State of Illinois Class I Groundwater Standards *– Maximum allowable concentrations of specific chemical constituents in groundwater which is classified as Class I: Potable Resource Groundwater in accordance with Title 35 of the Illinois Administrative Code, Section 620.210 (35 IAC 620.210). The standards are published in 35 IAC 620.410.*

In-situ Remediation *– Remedial action performed where the contaminated soil or water is not removed and is treated in place.*

Miscellaneous Areas Operable Unit (MISCA OU) *– An operable unit is a grouping of a number of sites within a larger Superfund site. The grouping may be based on contaminant types, media, similarity of cleanup actions, or potentially responsible parties. The MISCA OU is made up of those areas that were proposed in the 1988 RI (O'Brien and Gere) to require no further work or that will need further investigation, monitoring, or maintenance. The FFA added another site (36), and another was added later by DOI (22A).*

Monitoring *- Ongoing collection of information about the environment that helps gauge the effectiveness of a clean-up action.*

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) *– This regulation deals with two primary subjects. The first is the procedure for responding to oil spills that occur in U.S. waters. The second is a program for identifying and cleaning up abandoned hazardous waste sites under the Superfund (CERCLA) program.*

National Priorities List (NPL) *- USEPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under Superfund.*

Natural attenuation *- includes all naturally occurring processes involved with the reduction of contaminant concentrations over time.*

Operation and Maintenance Costs *– Those post-construction/ installation costs necessary to verify the continued effectiveness of the remedial action. They include labor, equipment and material costs associated with activities such as monitoring.*

Organic compounds including VOCs *– carbon compounds, such as solvents, oils, and pesticides. Most are not readily dissolved in water. Some organic compounds cause cancer. Volatile organics are those organic compounds that readily evaporate.*

Oxygen Release Compound® *- is a commercially available formulation of magnesium peroxide that enhances aerobic bioremediation by slowly releasing oxygen into the soil and groundwater.*

Plume *- A measurable discharge of a contaminant from a given point of origin. Can be visible or thermal in water, or visible in the air as, for example, a plume of smoke.*

Potable *– Describes water that is safe for drinking and cooking.*

Preferred Alternative *– The remedial alternative initially proposed for implementation as a result of the screening process conducted during the FS.*

Present Worth Cost *– Evaluation method for expenditures that occur over different time periods. By comparing all costs to a common base year, the costs for different remedial action alternatives can be compared on the basis of a single figure for each alternative. When calculating the present worth cost for Superfund sites, total operations & maintenance costs are to be included.*

Receptor *- Ecological entity (human, animal, or plant) exposed to the hazardous substance.*

Record of Decision (ROD) *– A legal document that describes in detail the remedy selected for an entire NPL site or a particular operable unit. The ROD summarizes the results of the RI/FS and includes a formal response to public comments.*

Remedial Design *– engineering design of the Selected Remedy.*

Remedial Investigation/Feasibility Study (RI/FS) *– An in-depth study designed to:*

- *gather data needed to determine the nature and extent of contamination at a Superfund site*
- *establish site cleanup criteria*
- *identify alternatives for remedial action*
- *and support technical and cost analyses of alternatives.*

Remediation *- Methods used to remove or contain hazardous wastes at a Superfund site.*

Resource Conservation and Recovery Act (RCRA) *– Federal act that established a regulatory system to track hazardous wastes from the time they are generated to their final disposal. RCRA also provides for safe hazardous waste management practices and imposes standards for transporting, treating, storing, and disposing of hazardous waste.*

Responsiveness Summary *- Comments presented during the public meeting and received during the public comment period that are considered and addressed by the lead agency.*

Superfund Amendments and Reauthorization Act of 1986 (SARA) *– This act modified specific provision in CERCLA.*

TABLE B-1

MISCELLANEOUS AREAS OPERABLE UNIT
CRAB ORCHARD NATIONAL WILDLIFE REFUGE, MARION, ILLINOIS

SITE NUMBER	LOCATION	SITE NAME	ACTION
7	Area 2 D	Southeast Drainage Channel	Recommended for No Further Action*
7A	Area 2 D	North Lawn	Recommended for No Further Action*
8	Area 2 D	Southwest Drainage Channel	Recommended for No Further Action*
9	Area 2 P (North)	Northwest Drainage Channel	Recommended for No Further Action*
10	Area 2 P (North)	North Drainage Channel	Recommended for No Further Action*
11	Area 2 P	Southeast Drainage Channel	Recommended for No Further Action*
11A	Area 2 P (North)	Walkway Structures	Recommended for No Further Action*
12	Area 8	Impoundment	Recommended for No Further Action*
13	Area 8	Change House	Recommended for No Further Investigation
14	Area 8	Site 14	Remedial Action Needed
16	Area 7	Industrial Park	Recommended for No Further Action*
18	Area 13	Loading Platform	Recommended for No Further Investigation
20	Area 2 D	South Drainage Channel	Recommended for No Further Action*
21	Area 7	Southeast Corner Field	Recommended for No Further Investigation
22A	Area 4	Old Refuge Shop Post Treating Facility	Removal Action Complete – No Further Action*
24		Pepsi Plant West Drainage Ditch (Site Located Outside Refuge)	Recommended for No Further Investigation
25		Crab Orchard Creek downgradient of Marion Landfill (Site Located Outside	Recommended for No Further Investigation
26		Crab Orchard Creek Marion Sewage Treatment Plant (Site Located Outside	Recommended for No Further Investigation
27		Crab Orchard Creek Dredge Area	Recommended for No Further Investigation
30	Area 13	Munitions Control Site (Background)	Recommended for No Further Investigation
31		Established Refuge Control Site (Background)	Recommended for No Further Investigation
34		Crab Orchard Lake	Lake Monitoring OU
35	Area 9	East Waterway	Recommended for No Further Investigation
36	Area 3 North	Wastewater Treatment Plant	Remedial Action Needed

*A separate decision document will be issued for Site 36 and the No Further Action Sites.

TABLE E-1

COMPARISON OF SURFACE WATER DETECTIONS TO GENERAL USE WATER QUALITY STANDARDS FOR SITE 14

Chemical	Maximum Detected Concentration (ug/L)	General Use Water Quality Standards For Site 14		Exceeds Criteria?
		Acute Aquatic Life Toxicity Criteria (ug/L)	Chronic Aquatic Life Toxicity Criteria (ug/L)	
Arsenic	4.6	360	190	No
Barium	122	5,000	no criteria	No
Chromium VI	0.0152	16	11	No
Copper	7.6	18	12	No
Iron	2,030.0	1,000	no criteria	Yes
Lead	15.5	96	20	No
Manganese	828	1,000	no criteria	No
Mercury	0.24	2.6	1.3	No
Nickel	13.5	1,000	no criteria	No
Zinc	177 J	1,000	no criteria	No

Note: Constituents not listed on this table were either non-detect or had no General Use Water Quality Standards.

J = Estimated

TABLE G-1

SUMMARY OF CHEMICALS OF CONCERN IN GROUNDWATER

Chemical of Concern	Units	Concentrations Detected		Frequency of Detection	MCL/Class I Standard
		Minimum	Maximum		
Ethylbenzene	ug/L	0.74 J	98,000 E	15/23	70
Toluene	ug/L	0.9 J	3,000	12/23	1,000
Xylenes (total)	ug/L	1.0 J	300,000 E	15/23	10,000
Benzene	ug/L	2 J	31 J	3/23	5
Methylene Chloride	ug/L	2 J	520	3/16	5
Antimony	ug/L	9	71	4/21	6
Thallium	ug/L	6	12	3/6	2

Key
E = exceeded instrument limit
J = estimated value

TABLE J-1

DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR SITE 14

EVALUATION CRITERION	ALTERNATIVE 1 No Action	ALTERNATIVE 2 In-Situ ORC® / Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 3 Ex-Situ Biopile/ In-Situ ORC®/ Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 4 In-Situ ORC®/ Excavation/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 5 Excavation / Off-Site Disposal / Institutional Controls / Groundwater Monitoring
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT					
Human Health Protection	No protection of groundwater in the short term. Over time, VOCs in soil and groundwater would be expected to degrade very slowly.	Protection of groundwater would be provided through in situ treatment of VOC-contaminated soil, groundwater monitoring, and institutional controls. ORC® treatment technology would remediate VOCs in soil to acceptable levels within a relatively short time frame (approximately 1 year). Groundwater is expected to restore to below MCLs and Class I standards within 6 years. institutional controls would prevent the installation of drinking water wells and require construction workers performing intrusive work to use appropriate protective equipment.	Protection of groundwater would be provided through excavation and treatment of VOC-contaminated soil. The biopile technology would remediate VOCs to acceptable levels within months of implementation. ORC® treatment technology would remediate remaining VOCs in soil underneath buildings to acceptable levels within a relatively short time frame (approximately 1 year). Groundwater is expected to restore to below MCLs and Class I standards within 6 years. Institutional controls would prevent the installation of drinking water wells and require construction workers performing intrusive work to use appropriate protective equipment.	Protection of groundwater would be provided through excavation of VOC-contaminated soil and in situ treatment of remaining VOC-contaminated soil. ORC® treatment technology would remediate remaining VOCs in soil underneath buildings to acceptable levels within a relatively short time frame (approximately 1 year). Groundwater is expected to restore to below MCLs and Class I standards within 6 years. Institutional controls would prevent the installation of drinking water wells and require construction workers performing intrusive work to use appropriate protective equipment.	Protection of groundwater would be provided through excavation of soils contaminated with VOCs and groundwater monitoring. Groundwater is expected to restore to below MCLs and Class I standards within 6 years. Institutional controls would prevent the installation of drinking water wells and require construction workers performing intrusive work to use appropriate protective equipment.
Environmental Protection	No protection of groundwater in the short term. Over time, VOCs in soil and groundwater would be expected to degrade very slowly. Ecological risk associated with the chromium hot spot would not be reduced.	Excavation of metal-contaminated soil (i.e., chromium hot spot) would protect ecological receptors that occasionally forage at the site.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

TABLE J-1

DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR SITE 14

EVALUATION CRITERION	ALTERNATIVE 1 No Action	ALTERNATIVE 2 In-Situ ORC® / Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 3 Ex-Situ Biopile/ In-Situ ORC®/ Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 4 In-Situ ORC®/ Excavation/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 5 Excavation / Off-Site Disposal / Institutional Controls / Groundwater Monitoring
COMPLIANCE WITH ARARs					
Compliance with ARARs	Would not meet MCLs and Class I groundwater standards.	Would meet ARARs through source treatment and groundwater monitoring.	Would meet ARARs through source treatment, removal, and groundwater monitoring.	Would meet ARARs through source treatment, removal, and groundwater monitoring.	Would meet ARARs through source removal and groundwater monitoring.
Appropriateness of Waivers	Not appropriate since equivalent standard of performance would not be attained as defined in 40 CFR 300.430(f)(i)(ii)(c)(4).	A technical impracticality waiver may be required.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
LONG-TERM EFFECTIVENESS					
Magnitude of Residual Risk	Potential for ecological risk associated with metal-contaminated soil (i.e., hot spot) would remain. VOCs above MCLs and Class I groundwater standards would not be addressed.	Ecological risk would be mitigated by removal of metal-contaminated soil (i.e., hot spot). Some residual amounts of VOCs may remain in groundwater above MCLs and Class I standards; however, concentrations would be expected to reduce below standards within a reasonable timeframe (6 years) following source removal/treatment.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
Adequacy and Reliability of Controls	Not applicable.	Groundwater monitoring would confirm treatment performance and reduction of VOC concentrations in groundwater below MCLs and Class I standards.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.

TABLE J-1

DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR SITE 14

EVALUATION CRITERION	ALTERNATIVE 1 No Action	ALTERNATIVE 2 In-Situ ORC® / Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 3 Ex-Situ Biopile/ In-Situ ORC®/ Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 4 In-Situ ORC®/ Excavation/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 5 Excavation / Off-Site Disposal / Institutional Controls / Groundwater Monitoring
Need for 5-year Review	Would be required to show that risk has not increased.	Required to assess, through groundwater monitoring, whether or not the groundwater concentrations reduce to below MCLs and Class I standards following remediation.	Same as Alternative 2.	Same as Alternative 2.	Same as Alternative 2.
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME					
Treatment Process Used	None.	ORC® remediates VOCs by enhancing aerobic biodegradation. Residual VOCs contamination in groundwater left in place after treatment will be monitored. Metal-contaminated soil is removed and disposed of.	Biopiles remediate VOCs through volatilization and aerobic biodegradation. ORC® remediates VOCs by enhancing aerobic biodegradation. Residual VOCs contamination in groundwater left in place after treatment will be monitored. Groundwater pumped out of excavation will be treated. Metal-contaminated soil is removed and disposed of.	ORC® remediates VOCs by enhancing aerobic biodegradation. VOC and metal-contaminated soil is removed and disposed of. Groundwater pumped out of excavation will be treated. Residual VOCs contamination in groundwater left in place after treatment will be monitored.	Contaminated soil is removed and disposed of. Groundwater pumped out of excavation will be treated. Residual VOCs contamination in groundwater left in place after treatment will be monitored.
Reduction of TMV	None.	ORC® treatment would permanently reduce the volume and toxicity of VOCs at the site. Mobility of metals in soil would be reduced by off-site disposal.	ORC® treatment and biopile would permanently reduce the volume and toxicity of VOCs at the site. Mobility of metals in soil would be reduced by off-site disposal.	ORC® treatment would permanently reduce the volume and toxicity of VOCs at the site. Mobility of VOCs and metals in soil would be reduced by off-site disposal.	Mobility of VOCs and metals in soil would be reduced by off-site disposal.

TABLE J-1

DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR SITE 14

EVALUATION CRITERION	ALTERNATIVE 1 No Action	ALTERNATIVE 2 In-Situ ORC® / Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 3 Ex-Situ Biopile/ In-Situ ORC®/ Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 4 In-Situ ORC®/ Excavation/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 5 Excavation / Off-Site Disposal / Institutional Controls / Groundwater Monitoring
SHORT-TERM EFFECTIVENESS					
Time Required to Achieve Remedial Action Objectives	Objectives would not be achieved.	ORC® treatment would require a pilot study that would last approximately 6 months. When proven effective the treatment could achieve remediation goals for VOCs within 1 to 2 years. Groundwater is expected to achieve RAOs within 6 years due to source treatment. Excavation and off-site disposal of metal-contaminated soil would achieve RAOs immediately.	Biopile could remediate VOCs in soil within several months of implementation. ORC® treatment could achieve remediation goals for VOCs within 1 to 2 years in areas underneath buildings. Groundwater is expected to achieve RAOs within 6 years due to source treatment. Excavation and off-site disposal of metal-contaminated soil would achieve RAOs immediately.	ORC® treatment could achieve remediation goals for VOCs within 1 to 2 years in areas underneath buildings. Groundwater is expected to achieve RAOs within 6 years due to source removal. Excavation and off-site disposal of metal-contaminated soil would achieve RAOs immediately.	Excavation and off-site disposal of metal-contaminated soil would achieve RAOs immediately. Groundwater is expected to achieve RAOs within 6 years due to source removal.
Protection of Community During Remedial Action	No action taken.	Little or no risk is posed to the community. Installation of ORC® boreholes may present some short-term physical hazards for on-site workers at the Diagraph facility; therefore, these workers would be required to attend health and safety briefings. Site access would need to be restricted. Institutional controls would be required to prohibit installation of potable water wells until groundwater is restored to levels below MCLs and Class I standards.	Little or no risk is posed to the community. Excavation and Installation of ORC® boreholes may present some short-term physical hazards for on-site workers at the Diagraph facility; therefore, these workers would be required to attend health and safety briefings. Site access would need to be restricted. Institutional controls would be required to prohibit installation of potable water wells until groundwater is restored to levels below MCLs and Class I standards.	Little or no risk is posed to the community. Excavation and Installation of ORC® boreholes may present some short-term physical hazards for on-site workers at the Diagraph facility; therefore, these workers would be required to attend health and safety briefings. Site access would need to be restricted. Institutional controls would be required to prohibit installation of potable water wells until groundwater is restored to levels below MCLs and Class I standards.	Little or no risk is posed to the community. Excavation and building demolition may present some short-term physical hazards for on-site workers at the Diagraph facility; therefore, these workers would be required to attend health and safety briefings. Site access would need to be restricted. Institutional controls would be required to prohibit installation of potable water wells until groundwater is restored to levels below MCLs and Class I standards.

TABLE J-1

DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR SITE 14

EVALUATION CRITERION	ALTERNATIVE 1 No Action	ALTERNATIVE 2 In-Situ ORC® / Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 3 Ex-Situ Biopile/ In-Situ ORC®/ Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 4 In-Situ ORC®/ Excavation/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 5 Excavation / Off-Site Disposal / Institutional Controls / Groundwater Monitoring
Protection of Workers During Remedial Action	No action taken.	Minimal risk would be posed to workers, who would need to be health and safety trained.	Slightly higher risk for workers, due to physical hazards of excavation activity and potential for more direct exposure to contaminants. Workers would need to be health and safety trained.	Same as Alternative 3.	Same as Alternative 3.
Protection of Environment During Remedial Action	No action taken.	Minimal risk would be posed to environment.	Slightly higher risk would be posed to environment due to spill hazards for handling of contaminated material.	Same as Alternative 3.	Same as Alternative 3.
IMPLEMENTABILITY					
Ability to Construct and Operate	Not applicable.	Excavation and off-site disposal are readily implemented. Installation of ORC® boreholes requires a direct push technology that should not encounter any major problems, given the site conditions (boreholes can be installed inside buildings). Installation of additional monitoring wells for groundwater monitoring requires standard technology and is easily constructed.	Excavation, off-site disposal, and biopile construction are readily implemented. Installation of ORC® boreholes requires a direct push technology that should not encounter any major problems, given the site conditions (boreholes can be installed inside buildings). Biopile will require some minimal O&M activity. Installation of additional monitoring wells for groundwater monitoring requires standard technology and is easily constructed.	Excavation and off-site disposal are readily implemented. Installation of ORC® boreholes requires a direct push technology that should not encounter any major problems, given the site conditions (boreholes can be installed inside buildings). Installation of additional monitoring wells for groundwater monitoring requires standard technology and is easily constructed.	Excavation and off-site disposal are readily implemented. Installation of additional monitoring wells for groundwater monitoring requires standard technology and is easily constructed.
Technical Feasibility	Not applicable.	The ORC® process for this alternative would require a pilot study before full-scale implementation. Additional monitoring wells are required to adequately monitor site groundwater.	Treatment technologies are reliable. Excavation activity will require the appropriate safety precautions. Additional monitoring wells are required to adequately monitor site groundwater.	Same as Alternative 3.	Same as Alternative 3.

TABLE J-1

DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES FOR SITE 14

EVALUATION CRITERION	ALTERNATIVE 1 No Action	ALTERNATIVE 2 In-Situ ORC® / Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 3 Ex-Situ Biopile/ In-Situ ORC®/ Excavation of Metals-Contaminated Soil/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 4 In-Situ ORC®/ Excavation/ Off-Site Disposal/ Institutional Controls/ Groundwater Monitoring	ALTERNATIVE 5 Excavation / Off-Site Disposal / Institutional Controls / Groundwater Monitoring
COST					
Remediation Goals are 100 mg/kg Ethylbenzene and Corresponding PRGs					
Capital Cost	$0	$1,051,000	$1,633,000	$1,502,000	$1,562,000
Annual O&M	$0	$16,000	$127,000	$16,000	$16,000
Present Worth	$0	$1,129,000	$1,908,000	$1,579,000	$1,639,000

[1] Years of O&M is 6 years for Alternatives 2 through 5 for ethylbenzene of 100 mg/kg.

TABLE M-1

CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS/ TO BE CONSIDERED CRITERIA (ARARs/TBCs) FOR SITE 14

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Federal					
Safe Drinking Water Act		**42 USC Section 300**			
National Primary Drinking Water Regulations and national Revised Primary Drinking water Regulations	Groundwater	40 CFR Part 141	Applicable because groundwater could potentially be a drinking water source in the future.	Establishes maximum contaminant levels (MCLs), health-based standards for specific contaminants. MCLs are applicable for drinking water as supplied to the end users of public water supplies.	The selected remedy will comply with these regulations through source excavation, off-site disposal and groundwater monitoring.
National Primary Drinking Water Implementation Regulations	Groundwater	40 CFR Part 142	Applicable. See above.	Establishes procedures for granting variances from MCL requirements. Specifies best technologies for treatment of various pollutants.	Same as above.
National Secondary Drinking Water Standards	Groundwater	40 CFR Part 143	Since MCLs are applicable, secondary MCLs are TBCs.	Establishes secondary MCLs which are guidelines for public drinking water systems to protect the aesthetic quality fo the water. Secondary MCLs are not Federally enforceable.	Same as above.
Maximum Contaminant Level Goals (MCLGs)	Groundwater	40 CFR Parts 141, 142 Public Law NO. 99-339, 100 Stat. 642 (1986)	TBC.	Establishes nonenforceable health goals for drinking water quality at a level at which no adverse health effects may arise with an adequate margin of safety.	Same as above.

TABLE M-1

CHEMICAL-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Clean Water Act (Federal Water Pollution Control Act), as amended		**33 USCA Sect. 1251 et seq.**			
National Pollutant Discharge Elimination System (NPDES) Regulations	Surface Water	40 CFR Part 122, 125	Applicable for discharge to surface water.	Establishes procedures for determination of effluent limitations for point source discharges of chemicals to waters of the United States, protective of beneficial uses.	The selected remedy would meet these requirements through on-site treatment of groundwater from excavation before discharge.
Ambient Water Quality Criteria	Surface Water	40 CFR Part 131 Quality Criteria for Water, 1976, 1980, 1986	Relevant and appropriate for surface water.	Requires states to establish ambient water quality criteria for surface water based on use classifications and the criteria stated under Section 304(a) of the Clean Water Act.	Same as above.
Guidelines Establishing Test Procedures for the Analysis of Pollutants	Surface Water	40 CFR Sect. 136.1-5 and Appendices A-C	Applicable for discharge to surface water.	Specific analytical procedures for NPDES applications and reports.	Same as above.
National Pretreatment Standards	Surface Water	40 CFR 403	Applicable for discharge to a POTW.	Applies to discharges of chemicals to publicly owned treatment works (POTWs). Requires that such chemicals not interfere with operation of the POTW, or pass through the POTW at concentrations which cause a violation of the POTW's NPDES permit, or contaminate sewage sludge.	Same as above.

TABLE M-1

CHEMICAL-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Resource Conservation and Recovery Act (RCRA) (Solid Waste Disposal Act) as amended		**42 USC Sect. 6901-6992K**			
Criteria for Classification of Solid Waste Disposal Facilities and Practices (Subtitle D)	Soil	40 CFR Part 257	Relevant and appropriate for remedial actions involving containment of contaminated media left in-place.	Established criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health and the environment.	The selected remedy would meet these requirements by disposing of the removed contaminated media in a RCRA Subtitle D Landfill.
Identification and Listing of Hazardous Waste	Soil	40 CFR Part 261.4	Potentially applicable to wastes generated by remedial activities, including investigation-derived wastes, excavated soil, or solid wastes generated by treatment of soil or hazardous wastes.	Defines characteristics of hazardous wastes and provides lists of hazardous wastes. Identifies solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 124, 262-265, 268, 270, and 271.	The selected remedy would meet these requirements through confirmation sampling excavated metal-contaminated soil to determine whether it is hazardous by characteristic prior to disposal.
Clean Air Act (CAA), as amended		**42 USCA Sect. 7401-7671Q**			
National Primary and Secondary Ambient Air Quality Standards (NAAQS)	Air	40 CFR Part 50	Applicable for remediation that results in release of regulated compounds to air.	Establishes ambient air quality standards for certain "criteria pollutants" to protect public health and welfare.	Concentrations and quantity of contaminated material is small enough not to require air monitoring.
National Emission Standards for Hazardous Air Pollutants (NESHAPS)	Air	40 CFR Part 61	Relevant and appropriate if remediation results in releases of regulated compounds to air.	Provides standards for emissions of designated hazardous air pollutants, including mercury, beryllium, asbestos, and inorganic arsenic, from certain activities.	The selected remedy would meet these requirements by implementing proper safety procedures during removal of asbestos.

TABLE M-1

CHEMICAL-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
State					
Illinois Environmental Protection Act		415 Illinois Compiled Statutes (ILCS) 5/1 *et seq.* Subtitle B: Air Pollution			
Air Quality Standards	Air	35 IAC Part 243: Air Quality Standards 35 IAC 243.120, .122-.126	Applicable if remedial activities result in the emission of regulated chemicals to air.	Establishes ambient air quality standards.	Concentrations and quantity of contaminated material is small enough not to require air monitoring.
		35 IAC Part 212: Visual and Particulate Matter Emission Standards 35 IAC 212.110, .123, .301.	Applicable if remedial activities result in the emission of particulate matter.	Establishes particle emission standards for various sources and processes, including fugitive particulate emission standards from storage piles and conveyors.	Same as above.
		35 IAC Part 215: Organic Material Emission Standards and Limitations 35 IAC 215.101, .122, .301, .541, .561-.563	Applicable if remedial activities result in the emission of organic material >8lbs/hr.	Specified organic chemical emission limits for various sources, including construction activities, storage, and loading operations.	Same as above.

TABLE M-1

CHEMICAL-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
		Subtitle C: Water Pollution			
General Use Water Quality Standards	Surface Water	Part 302: Water Quality Standards Subpart B: General Use Water Quality Standards 35 IAC 302.208, .210	Applicable for surface water in area creeks or lakes impacted by site-related chemicals.	Establishes numerical standards for chemical constituents in general use waters of the state, and establishes procedures for deriving criteria for other toxic substances without numerical standards.	The selected remedy would meet these requirements through on-site treatment of groundwater from excavation before discharge.
Standards for Effluent in State Waters	Surface Water	Part 304: Effluent Standards 35 IAC 304.101-.106, .120-.126, .141	Applicable for discharges to surface water.	Establishes requirements regarding effluent discharges, dilution, and maximum allowable concentrations for various chemical and physical parameters.	Same as above.
Pretreatment Program	Surface Water	35 IAC Part 310: Pretreatment Program Subpart B: Pretreatment Standards	Applicable for discharges to a POTW.	Established requirements and standards for discharges to a POTW.	Same as above.
		Subtitle F: Public Water Supplies			
Primary Drinking Water Standards	Groundwater	35 IAC Part 611: Primary Drinking Water Standards	Applicable because groundwater could potentially be a drinking water source in the future.	Establishes maximum contaminant levels (MCLs), health-based standards for specific contaminants. MCLs are applicable for drinking water as supplied to the end users of public water supplies.	The selected remedy will comply with these regulations through source excavation, off-site disposal and groundwater monitoring.

TABLE M-1

CHEMICAL-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Ground Water Quality Standards and Use Classification	Groundwater	35 IAC Part 620: Groundwater Quality	Applicable. Groundwater is classified as Class I (IAC 35 620.210(a)(4)) at Site 14 based on hydraulic conductivity. Class I standards (620.410) at Site 14 have been exceeded. Therefore, corrective action (e.g., source removal) is required or a petition to the Pollution Control Board may be filed to reclassify the groundwater (620.260). The petition procedure is outlined in 415 ILCS 5 Section 28.1. A groundwater management zone (620.250) is required for any residual contamination above standards.	Establishes groundwater classification, non-degradation provisions, numerical Objectives for groundwater quality, and procedures and protocols for management and protection of groundwater. Also provides for determination of a health advisory for other chemicals and for mixtures. Groundwater Classes: I (potable resource), II (general resource), III (special resource), and IV (other).	The selected remedy will comply with these regulations through source excavation, off-site disposal and groundwater monitoring.

TABLE M-1

CHEMICAL-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
		Subtitle G: Waste Disposal			
Illinois Hazardous Waste Management Rules	Soil	35 IAC Part 702: Resource Conservation and Recovery Act (RCRA) and Underground Injection Control (UIC) Program 35 IAC Part 703: RCRA Permit Program 35 IAC Part 720 Hazardous Waste Management System	Applicable to wastes generated by remedial activities, including investigation-derived wastes and excavated soil/sediment, if found to meet the definition of a hazardous waste.	Identifies chemicals and wastes classified as hazardous. State of Illinois rules generally parallel federal EPA rules.	The selected remedy would meet these requirements by disposing of the removed contaminated media in a RCRA Subtitle D Landfill.
Risk Based Cleanup Objectives	Soil	35 IAC Part 742: Tiered Approach to Corrective Action Objectives	TBC for cleanup of contaminated soil and groundwater. For Site 14, can be used to derive soil remediation objectives to address contaminants in groundwater above Illinois Class I standards. This can be done using the soil component of the groundwater ingestion route.	Establishes tiered methodology for deriving soil and groundwater remediation objectives to be used for all Bureau of Land programs (state Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), RCRA, Leaking Underground Storage Tank (LUST), Site Remediation Program). Tabulates Tier 1 remediation objectives for a list of chemicals. Less stringent and more site-specific values can be derived under a Tier 2 or 3 assessment.	The remedy would comply with this guidance through institutional controls which would require special worker protection for any excavations in the area with residual contamination. This protection includes air monitoring equipment and backup respirators. This is necessary because of potential inhalation risks from ethylbenzene.

TABLE M-2

ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIRMENTS/ TO BE CONSIDERED CRITERIA (ARARs/TBCs) FOR SITE 14

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Federal					
Resource Conservation and Recovery Act (RCRA) (Solid Waste Disposal Act (SWDA)), as amended		**42 USCA Sect. 6901-6992K**			
Guidelines for the Land Disposal of Solid Wastes	Soil	40 CFR Part 241	Relevant and appropriate for remedial actions involving contaminated media disposed off-site.	Delineates minimum levels of performance required of any solid waste land disposal site operation; provides mandates for federal agencies. Primarily addresses design and operation of solid waste landfills.	The selected remedy would meet these requirements by disposing of the removed contaminated media in a RCRA Subtitle D Landfill.
Criteria for Classification of Solid Waste Disposal Facilities and Practices	Soil	Subtitle D 40 CFR Part 257	Relevant and appropriate for remedial actions involving contaminated media disposed off-site.	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health, and thereby constitute prohibited open dumps.	Same as above.
Criteria for Municipal Waste Landfills	Soil	Subtitle D 40 CFR Part 258	Relevant and appropriate for remedial actions involving contaminated media disposed off-site.	Sets forth minimum criteria for municipal solid waste landfills, including design, operation, monitoring, corrective action, closure, and post-closure care requirements.	Same as above.

TABLE M-2

ACTION-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Hazardous Waste Management Systems General	Soil	Subtitle C 40 CFR Part 260	Applicable for remedial activities involving hazardous waste management.	Provides definitions, general standards, and information applicable to 40 CFR Parts 260-265, 268.	The selected remedy would meet these requirements by stabilizing the material and disposing it in a permitted RCRA D landfill, if soil is determined to hazardous by characteristics.
Identification and Listing of Hazardous Wastes (Subtitle C)	Soil	Subtitle C 40 CFR Part 261	Applicable for remedial activities involving the need to identify hazardous waste.	Defines those solid wastes which are subject to regulations as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271.	The selected remedy will comply with these regulations through confirmation of the metal-contaminated material upon removal to determine whether it hazardous by characteristics and proper disposal.
Standards Applicable to Generators of Hazardous Waste	Soil	Subtitle C 40 CFR Part 262	Applicable for remedial activities involving generation of hazardous waste.	Establishes standards for generators of hazardous waste.	The selected remedy would meet these requirements by stabilizing the material and disposing it in a permitted RCRA D landfill, if soil is determined to hazardous by characteristics.
Standards Applicable to Transporters of Hazardous Waste	Soil	Subtitle C 40 CFR Part 263	Applicable for remedial activities that will involve off-site transportation if material is identified as hazardous waste.	Establishes standards which apply to transporting hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR Part 262.	The selected remedy would meet these requirements by stabilizing the material and disposing it in a permitted RCRA D landfill, if soil is determined to hazardous by characteristics.

TABLE M-2

ACTION-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Soil	Subtitle C 40 CFR Part 264	Applicable for remedial activities that will involve on-site treatment, storage, or disposal of hazardous waste.	Establishes minimum national standards which define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or disposal hazardous waste.	The selected remedy would meet these requirements by stabilizing the material and disposing it in a permitted RCRA D landfill, if soil is determined to hazardous by characteristics.
Interim Standards for Owners and Operators of Hazardous Waste Treatment Storage and Disposal Facilities	Soil	Subtitle C 40 CFR Part 265	Applicable for remedial activities that will involve on-site treatment, storage, or disposal of hazardous waste.	Establishes minimum national standards that define the acceptable management of hazardous waste during the period of interim status and until certification of final closure or if the facility is subject to post-closure requirements, until post-closure responsibilities are fulfilled.	The selected remedy would meet these requirements by stabilizing the material and disposing it in a permitted RCRA D landfill, if soil is determined to hazardous by characteristics.
Land Disposal	Soil	40 CFR Part 268	May be applicable to disposal of wastes that are specified in this regulation.	Identifies hazardous wastes restricted from land disposal and treatment standards for restricted wastes and waste treatment residuals.	The selected remedy would meet these requirements by stabilizing the material and disposing it in a permitted RCRA D landfill, if soil is determined to hazardous by characteristics.
Hazardous Waste Permit Program	Soil	40 CFR Part 270	Potentially applicable for waste material that meets definition of hazardous waste.	Establishes provisions covering basic EPA permitting requirements.	The selected remedy would meet these requirements by stabilizing the material and disposing it in a permitted RCRA D landfill, if soil is determined to hazardous by characteristics.

TABLE M-2

ACTION-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Clean Water Act (Federal Water Pollution Control Act)		**33 USCA Sect. 1251-1376**			
National Pollutant Discharge Elimination System (NPDES)	Surface Water	40 CFR Parts 122, 125	Applicable for discharge to surface water.	Requires permits for the discharge of pollutants from any point source into waters of the United States.	The selected remedy would meet these requirements through on-site treatment of groundwater from excavation before discharge.
Stormwater Runoff Requirements	Surface Water	40 CFR Sect. 122.26(b)(14)(x)	Applicable if the remediation site is greater than five acres; relevant and appropriate for smaller sites.	Requires that storm water runoff be monitored and controlled on construction sites greater than five acres.	Same as above.
National Pretreatment Standards	Surface Water	40 CFR Part 403	Applicable for discharge to a POTW.	Sets pretreatment standards to control pollutants which pass through or interfere with treatment processes in publicly owned treatment works (POTW) or which may contaminate sewage sludge.	Same as above.
Toxic Substances Control Act (TSCA)		**15 USCA Sect. 2601-2692**			
	Demolition Material	40 CFR Part 763[1]	May be applicable for building demolition.	Training for asbestos workers in public and commercial buildings.	The selected remedy complies with these regulations through requiring asbestos training for building demolition contractor.

TABLE M-2

ACTION-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
		15 USCA Sect. 2669[1]	May be applicable for building demolition.	Establishes requirements for radon studies and abatement, including federal buildings.	Same as above.
Clean Air Act (CAA), as amended		**42 USCA Sect. 7401-7671Q**			
National Emission Standards for Hazardous Air Pollutants (NESHAPS)	Air	40 CFR Part 61	Relevant and appropriate for remedial action that includes building demolition that results in releases of regulated compounds.	Provides standards for emissions of designated hazardous air pollutants, including mercury, beryllium, asbestos, and inorganic arsenic, from certain activities.	The selected remedy will comply with these requirements by implementing proper safety procedures during removal of asbestos.
Hazardous Materials Transportation Act		**40 USCA Sect. 1801-1813**			
Hazardous Materials Transportation Regulations	Soil	49 CFR Parts 107, 171-177	Applicable for remedial actions that involve off-site transportation of hazardous materials.	Regulates transportation of hazardous materials.	The selected remedy would meet these requirements by stabilizing the material and disposing it in a permitted RCRA D landfill, if soil is determined to hazardous by characteristics.
Occupation Safety and Health Act of 1970		**PL 91-596** **29 USCA Sect. 651-678**			
Occupational Safety and Health Standards		29 CFR Part 1910	Applicable to on-site remedial activities.	Establishes safety and health requirements for personnel working with hazardous materials and hazardous waste.	The selected remedy will comply with these regulations through proper worker safety measures.

TABLE M-2

ACTION-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Safety and Health Regulations for Construction		29 CFR Part 1926	Applicable to on-site remedial activities.	Establishes protection standards (e.g., hazard communication, excavation and trenching requirements) for workers involved in hazardous waste operations.	Same as above.
State					
Commercial and Public Building Asbestos Abatement Act		**225 Illinois Compiled Statutes (ILCS) 207**			
		Chapter I: Department of Public Health			
Asbestos Abatement for Public and Private Schools and commercial and Public Building in Illinois	Demolition Material	77 Illinois Administrative Code (IAC) Part 855	May be applicable for building demolition.	Training for asbestos workers in public and commercial buildings.	The selected remedy complies with these regulations through requiring asbestos training for building demolition contractor.
Illinois Environmental Protection Act		**415 ILCS 5/1 *et seq***			
		Subtitle B: Air Pollution			
Air Quality Standards	Air	35 IAC Part 243: Air Quality Standards 35 IAC 243.10, .122-.126	Applicable for remedial activities resulting in emissions to air.	Establishes ambient air quality standards.	Concentrations and quantity of contaminated material is small enough not to require air monitoring.

TABLE M-2

ACTION-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Particulate Emission Standards	Air	35 IAC Part 212: Visual and Particulate Emission Standards 35 IAC 212.110, .123, .301.	Applicable for remedial activities involving soil/sediment excavation, stockpiling, and hauling, resulting in emissions to air.	Establishes criteria for the emission of particulate matter from different operations, including fugitive particulate emissions from storage piles.	Same as above.
Organic Emission Standards	Air	35 IAC Part 215: Organic Material Emission Standards and Limitations. 35 IAC 215.101, .122, .301, .541,.561-.563	Applicable for remedial activities resulting in emissions of organic material to air.	Establishes emission limits for new incinerators and lists emission report contents.	Same as above.
Standards for Effluents in State Waters	Surface Water	Subtitle C: Water Pollution 35 IAC Part 304: Effluent Standards 35 IAC 304.101-.106, .120-.126, .141.	Applicable for discharge to surface water.	Establishes requirements regarding effluent discharges, dilution, and maximum allowable chemicals for various chemical and physical parameters.	The selected remedy would meet these requirements through on-site treatment of groundwater from excavation before discharge.
NPDES Permits	Surface Water	Part X Subpart A: NPDES Permits 35 IAC 309.101-.119, .141-.152, .154-.156, .181-.185, .191	Applicable for discharge to surface water.	Establishes permit requirements for treatment, pretreatment, and discharge requiring NPDES permit.	Same as above.
		Subtitle F: Public Drinking Water Supply			

TABLE M-2

ACTION-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Ground Water Quality Standards and Use Classification	Groundwater	35 IAC Part 620: Groundwater Quality	Applicable for monitoring of groundwater and for establishing a groundwater management zone.	Establishes groundwater classification, non-degradation provisions, numerical Objectives for groundwater quality, and procedures and protocols for management and protection of groundwater.	The selected remedy will comply with these regulations through source excavation, off-site disposal and groundwater monitoring.
		Subtitle G: Waste Disposal			
Hazardous Waste Management Rules	Soil	35 IAC Part 702: RCRA and UIC Program 35 IAC Part 720: Hazardous Waste Management System 35 IAC Part 724: Standards for Owners an Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Applicable if removed material at site is determined to meet the definition of hazardous waste.	Outlines general management of hazardous waste in relation to RCRA. State of Illinois rules generally parallel federal EPA rules.	The selected remedy would meet these requirements by stabilizing the material and disposing it in a permitted RCRA D landfill, if soil is determined to hazardous by characteristics.

TABLE M-2

ACTION-SPECIFIC ARARs/TBCs FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Medium	Citation	Status	Synopsis of Requirement	Action to be Taken to Attain Requirement
Risk Based Cleanup Objectives	Soil	35 IAC Part 742: Tiered Approach to Corrective Action Objectives	TBC for cleanup of contaminated soil and groundwater.	Establishes tiered methodology for deriving soil and groundwater remediation objectives applicable to all Bureau of Land programs (state Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), Leaking Underground Storage Tank (LUST), Site Remediation Program). Tabulates Tier 1 remediation objectives for a list of chemicals. Less stringent and more site-specific values can be derived under a Tier 2 or 3 assessment.	The remedy would comply with this guidance through institutional controls which would require special worker protection for any excavations in the area with residual contamination. This protection includes air monitoring equipment and backup respirators. This is necessary because of potential inhalation risks from ethylbenzene.
Special Waste Regulations	Soil	35 IAC Part 808: Special Waste Hauling 35 IAC Part 809: Special Waste Classification	Applicable if contaminated media or other material are removed and disposed as a special waste in a permitted landfill.	Defined special (non-RCRA) wastes and outlines requirements for permitting and hauling of special wastes to TSD facilities.	The selected remedy would meet these requirements by stabilizing the material and disposing it in a permitted RCRA D landfill, if soil is determined to hazardous by characteristics.
Landfill Disposal	Soil	35 IAC Part 811: Standards for New Solid Waste Landfills	Relevant and appropriate for remedial actions involving containment of contaminated media left in-place. Applicable if remedial actions involve on-site disposal.	Outlines requirements for disposal of inert wastes (Subpart B), putrescible and chemical wastes (Subpart C) and special wastes (Subpart D).	The selected remedy would meet these requirements by stabilizing the material and disposing it in a permitted RCRA D landfill, if soil is determined to hazardous by characteristics.

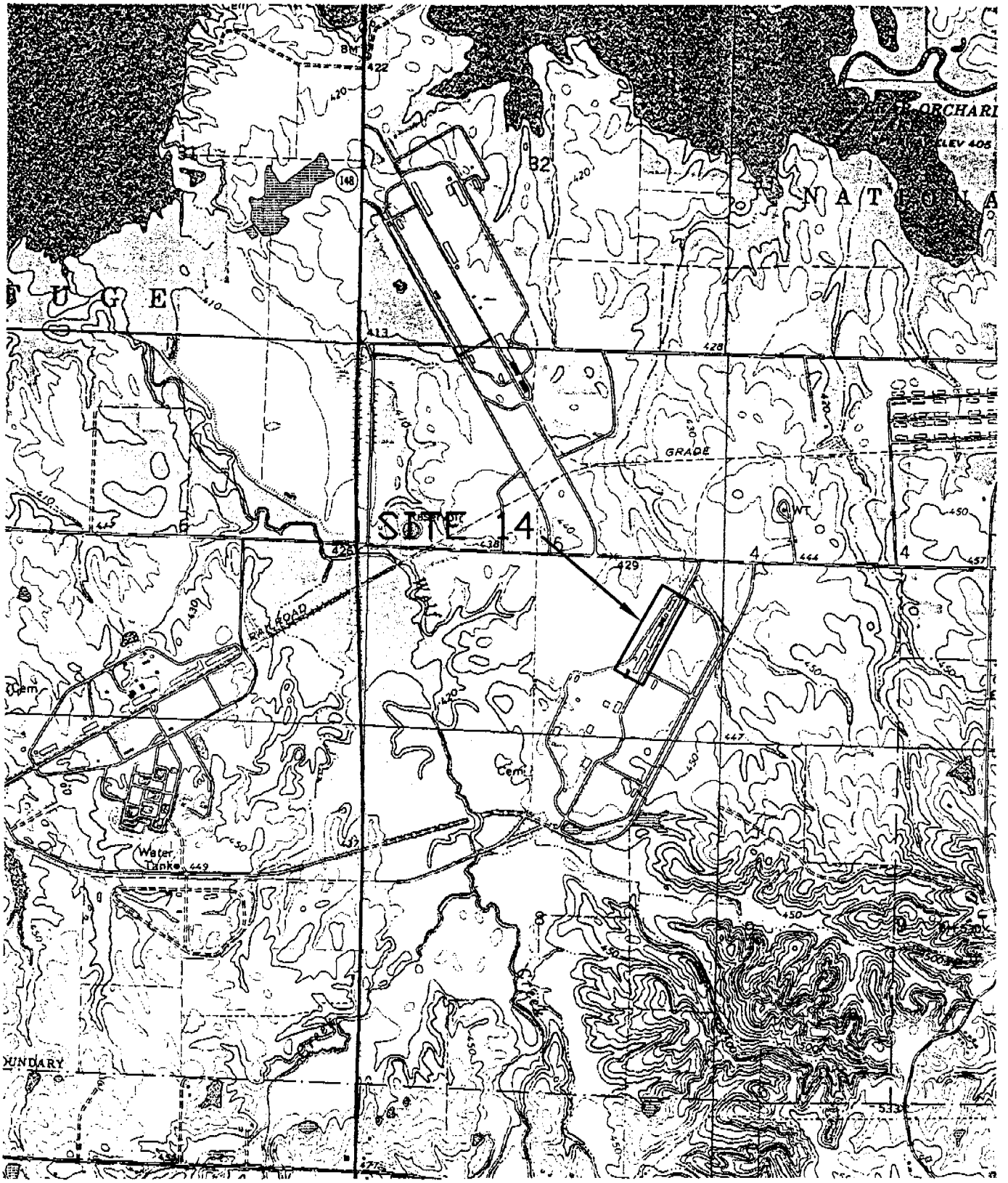
TABLE M-3

POTENTIAL LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS/ TO BE CONSIDERED CRITERIA (ARARs/TBCs) FOR SITE 14

Standard, Requirement, Criteria, or Limitation	Citation	Status	Synopsis of Requirement	Actions to be Taken to Attain Requirement
Federal				
National Wildlife Refuge System Administration Act **Management and General Public Use of the National Wildlife Reguge System** **National Wildlife Refuge System Improvement Act of 1977**	16 USC 668 et seq; Executive Order 12996 PL 105-57, 111 Stat. 1252.	Applicable. Remedial action must be compatible with the established purposes of the Refuge (e.g., wildlife conservation; development of agricultural, recreational, and industrial resources).	Limits actions allowed in areas designated as part of National Wildlife Refuge System.	The selected remedy includes DOI review of remedial action to insure that the action is consistent with these regulations.
Endangered Species Act	16 USCA Sect. 1531 to 1544 50 CFR Part 200 50 CFR Part 402	Applicable if endangered species or critical habitat is present.	Protects endangered species and the critical habitats upon which endangered species depend.	There are no endangered species or critical habitats at Site 14 and the selected remedy will not impact habitats off-site.
Archaeological and Historic Preservation Act of 1974	16 USCA Sect. 469; 36 CFR Part 65 40 CFR 6301(c)	Applicable if archaeological or historical data is uncovered during remedial action at Site 14.	Established procedures to provide for preservation of historical and archaeological data which might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	The site inspector, for the selected remedy, will be responsible for observations and notification of appropriate authorities, if necessary.
Native American Graves Protection and Repatriation Act[1]	PL 101-601	Applicable if Native American remains or cultural items are found during remedial activities.	Requires that if Native American remains or cultural items are found on federal lands, the appropriate tribe must be notified, and all activity in the area of discovery must cease for at least 30 days.	The site inspector, for the selected remedy, will be responsible for observations and notification of appropriate authorities, if necessary.

TABLE M-3
POTENTIAL LOCATION-SPECIFIC ARARS/TBCS FOR SITE 14
(Continued)

Standard, Requirement, Criteria, or Limitation	Citation	Status	Synopsis of Requirement	Actions to be Taken to Attain Requirement
Antiquities Act of 1906[1]	16 USCA 431-433 15 USC 461-467 43 CFR Part 3	Applicable if historical ruins or objects are found during remedial activities.	Provides for protection of historic and prehistoric ruins and objects on Federal lands.	The site inspector, for the selected remedy, will be responsible for observations and notification of appropriate authorities, if necessary.
State				
Human Skeletal Remains Protection Act	Illinois Revises Statutes 1989, Ch. 127, pars. 2661 et seq.	Applicable if human skeletal remains are discovered during remedial activities.	Requires action to be taken for the handling of skeletal remains resulting from unexpected discovery during construction activities.	The site inspector, for the selected remedy, will be responsible for observations and notification of appropriate authorities, if necessary.



SOURCE: USGS DIGITAL RASTER GRAPHIC

N

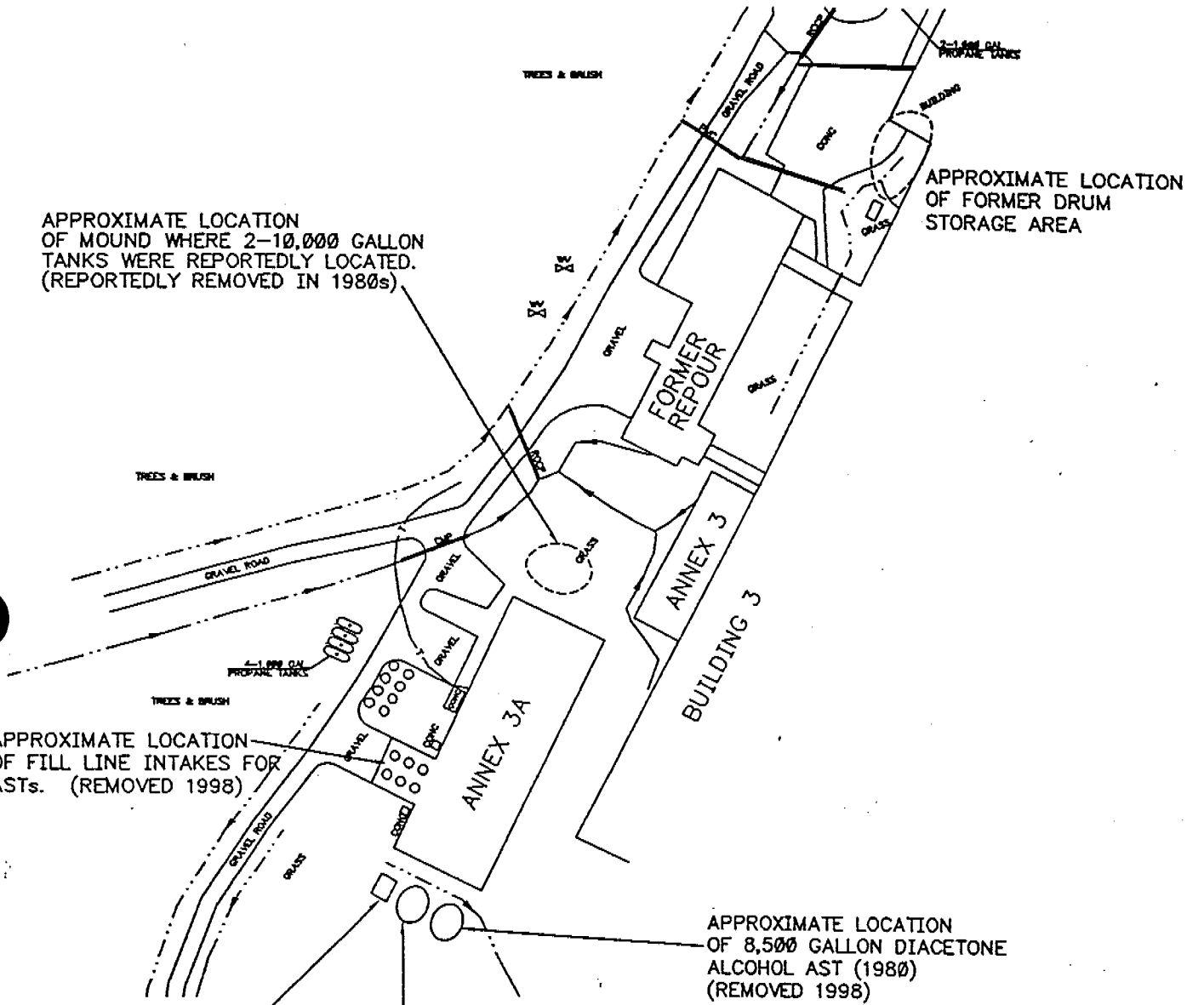
Ø .5

SCALE MILES

RECORD OF DECISION SITE 14–MISCA OU CRAB ORCHARD NWR MARION, ILLINOIS	Site 14 Location	FIG. NO. A–1

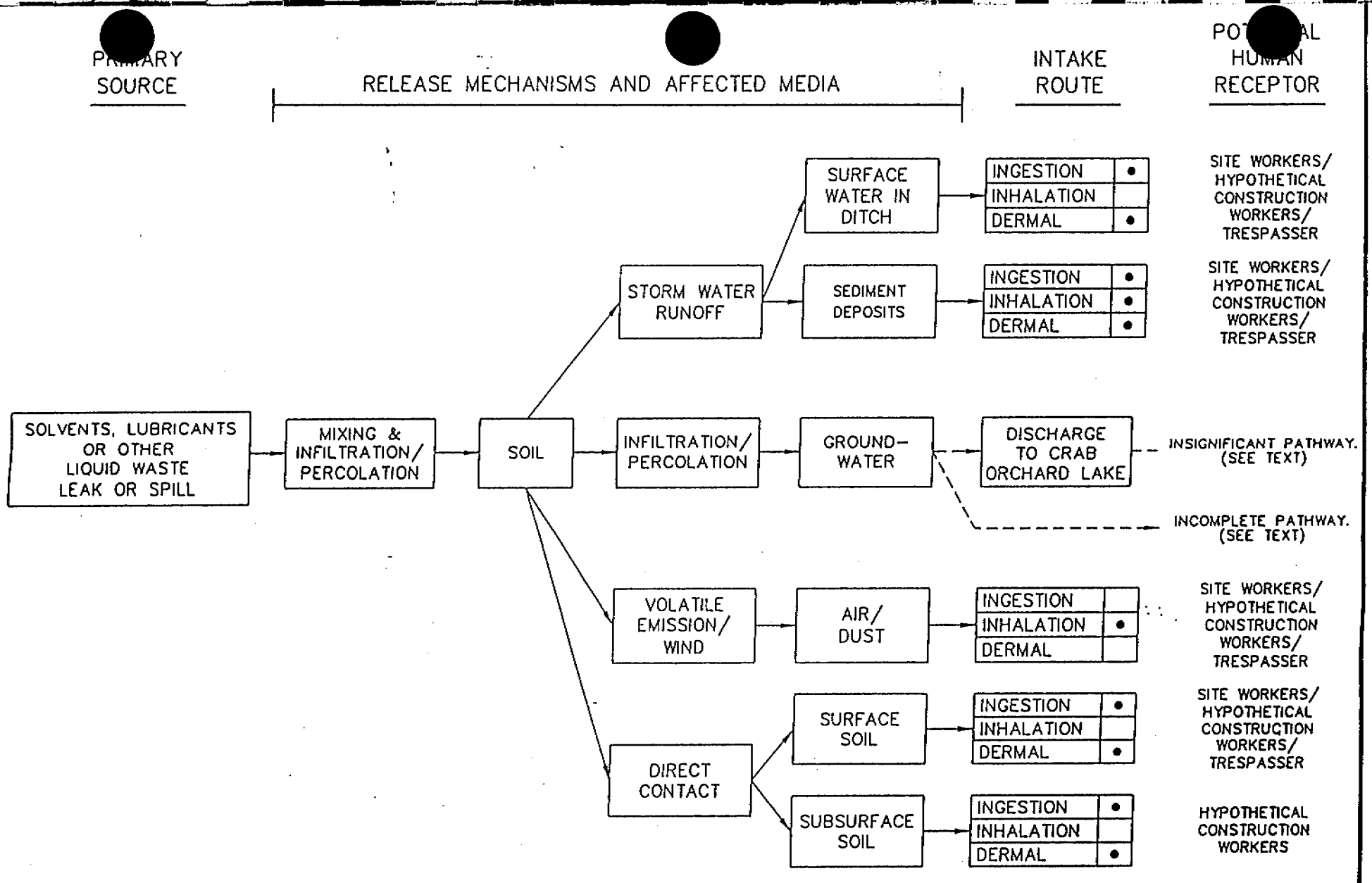
File: E:\45R...02N\SITE14FIG1.DWG Last edited: 07/31/01 @ 2:11 p.m. @ ...ST.LOUIS

SITE 14, T-9-S, R-2-E, OF THE 3RD P.M., WILLIAMSON COUNTY, ILLINOIS



RECORD OF DECISION SITE 14-MISCA OU CRAB ORCHARD NWR MARION, ILLINOIS	Site Features	FIG. NO. A-2

File: E:\45F0\WO9910DFIG2.DWG Last edited: 01/09/01 @ 3:39 p.m. @ WCC-ST.LOUIS

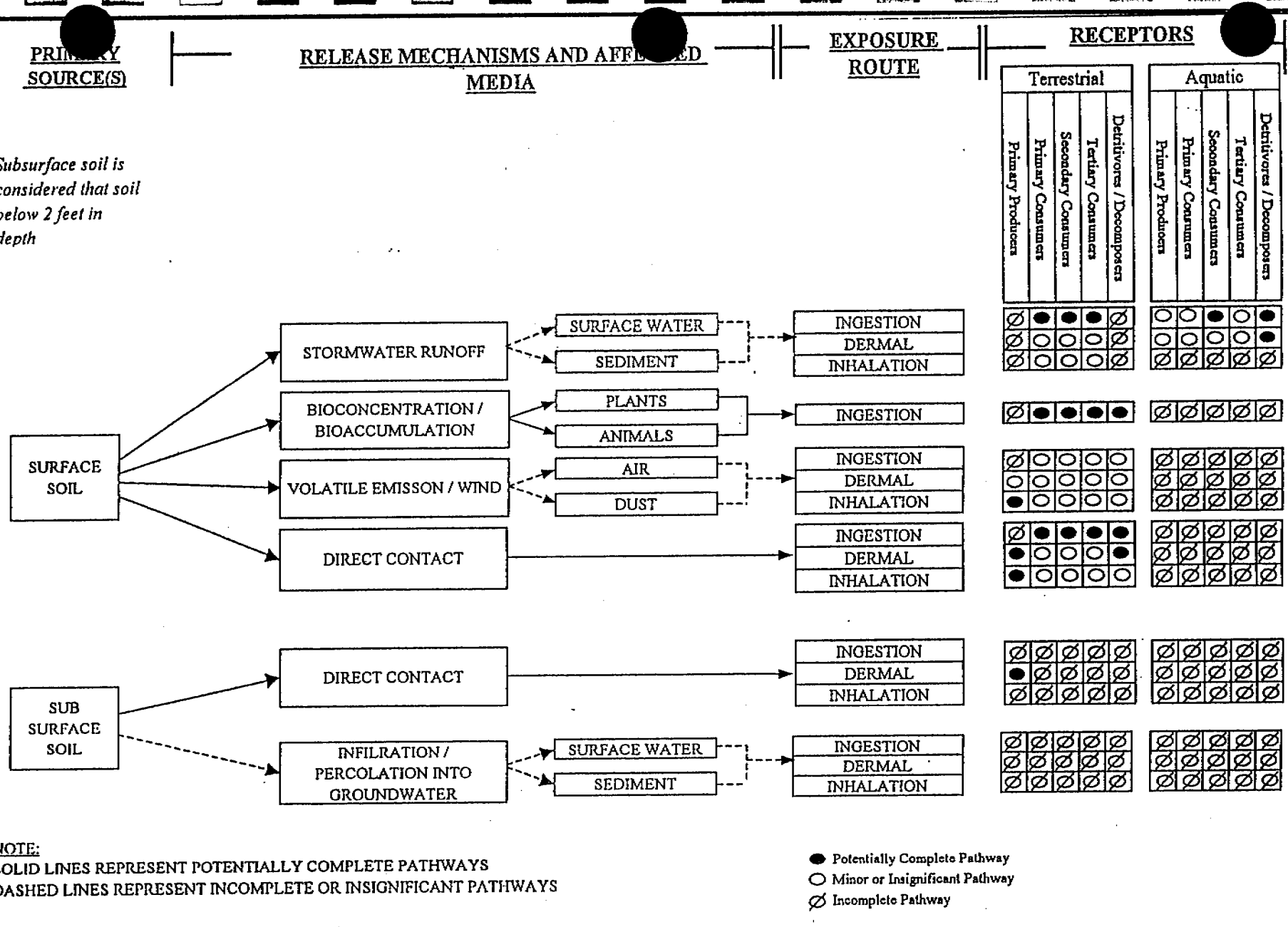


NOTE:

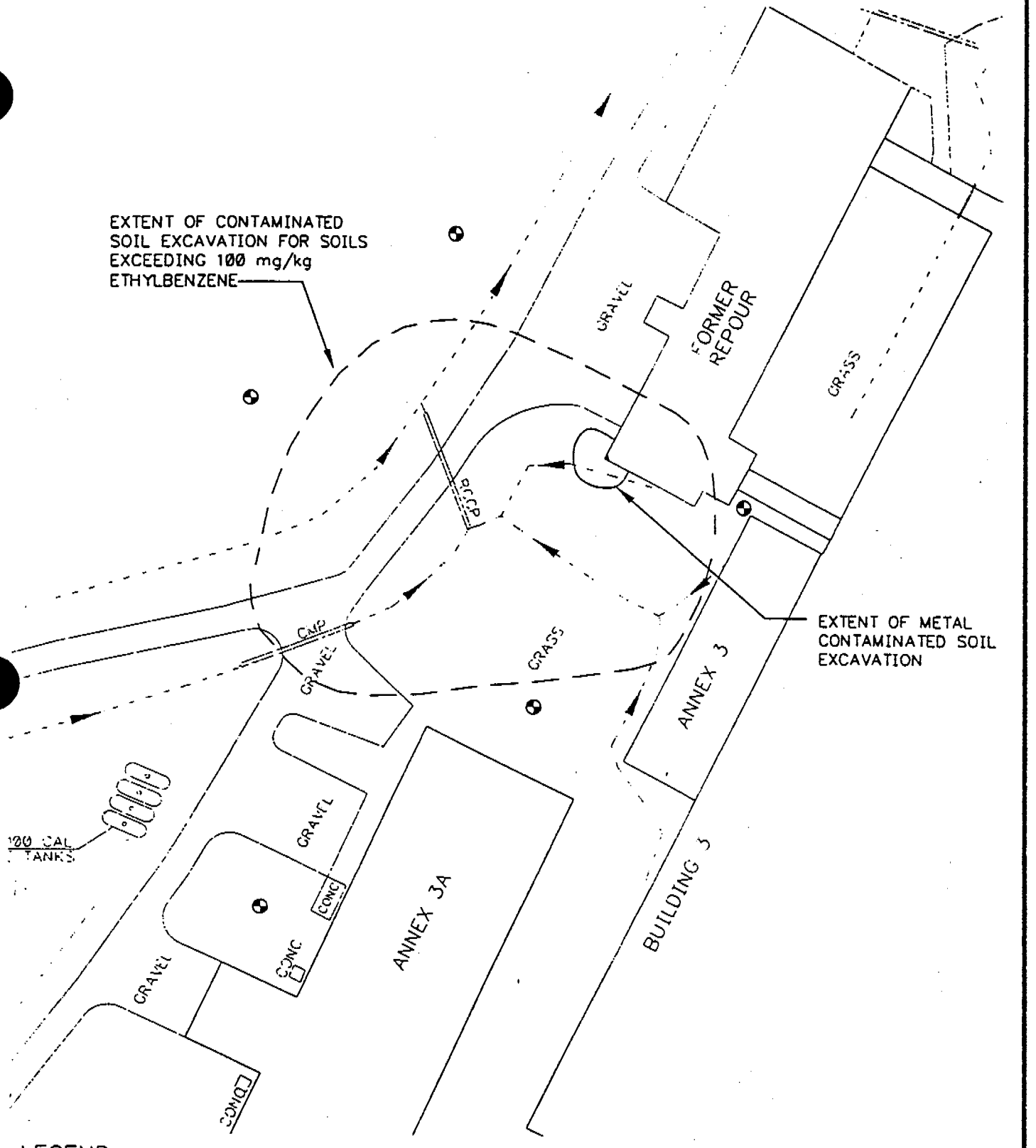
SOLID LINES REPRESENT POTENTIALLY COMPLETE AND SIGNIFICANT PATHWAYS

DASHED LINES REPRESENT INCOMPLETE OR INSIGNIFICANT PATHWAYS

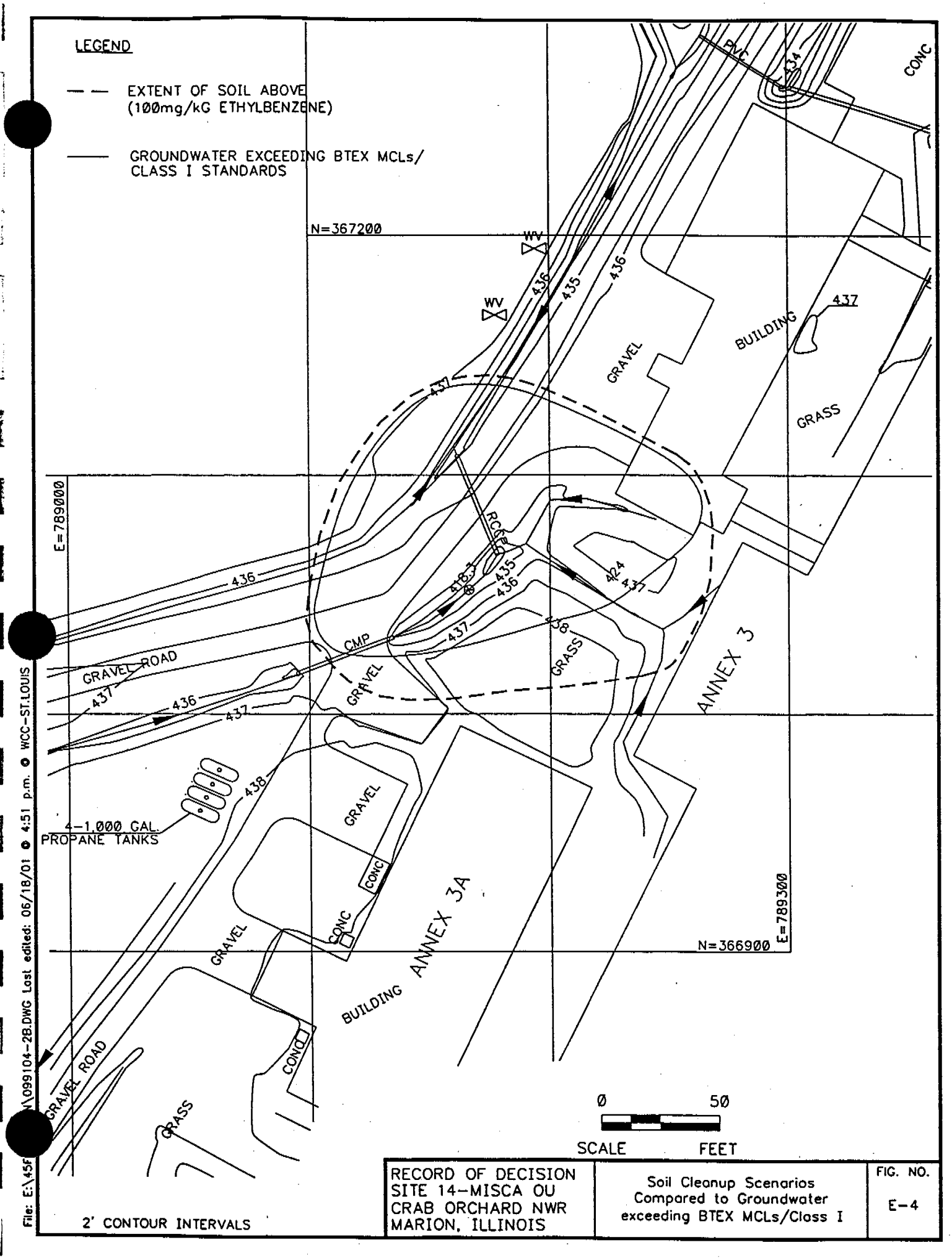
RECORD OF DECISION SITE 14–MISCA OU CRAB ORCHARD NWR MARION, ILLINOIS	Site Conceptual Exposure Model–Human Health	FIG. NO. E–1



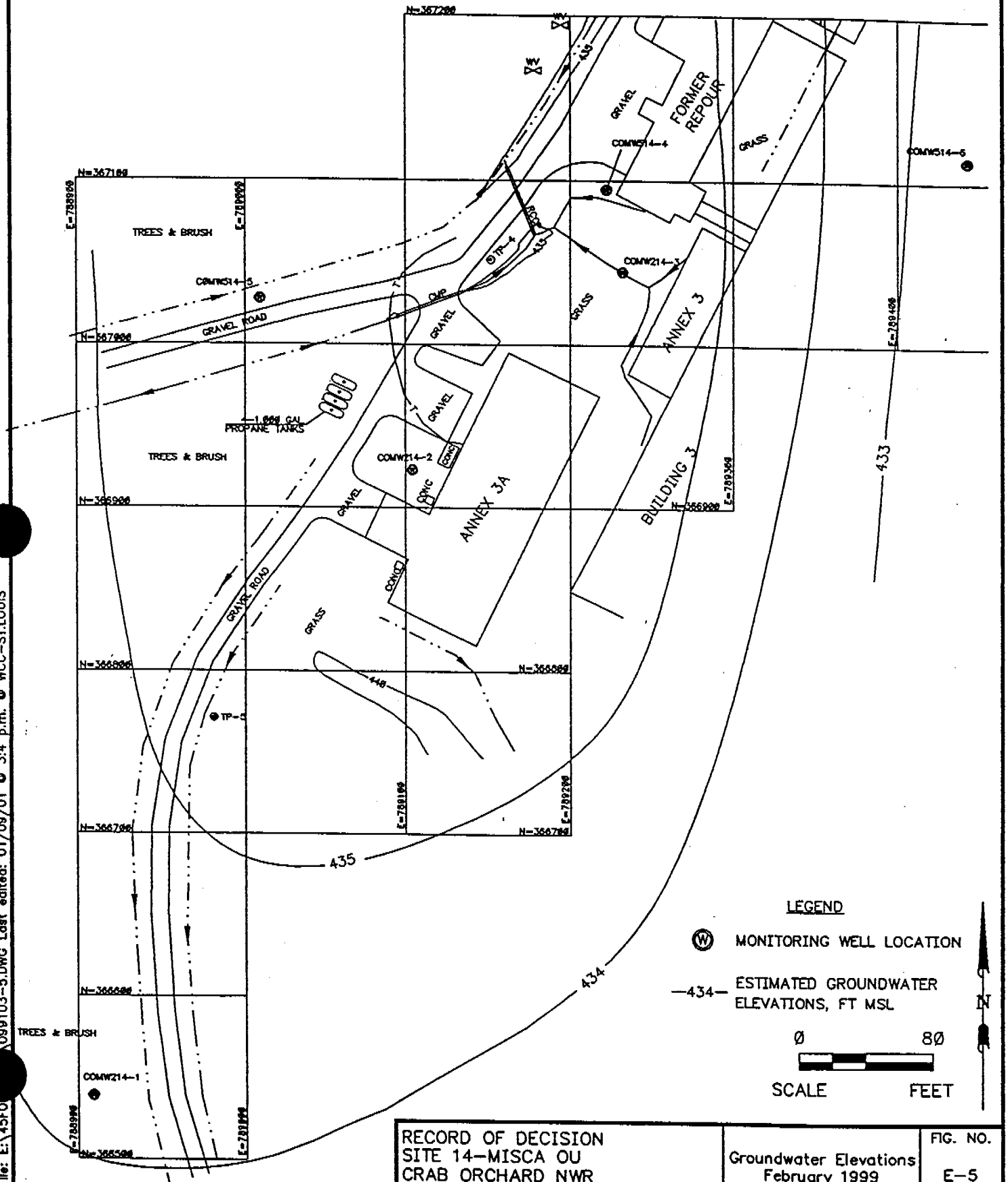
RECORD OF DECISION SITE 14–MISCA OU CRAB ORCHARD NWR MARION, ILLINOIS	Site Conceptual Exposure Model–Ecological	FIG. NO. E–2



RECORD OF DECISION SITE 14-MISCA OU CRAB ORCHARD NWR MARION, ILLINOIS	Selected Alternative	FIG. NO. E-3


LEGEND
EXTENT OF SOIL ABOVE (100mg/kG ETHYLBENZENE)
GROUNDWATER EXCEEDING BTEX MCLs/ CLASS I STANDARDS
N=367200
E=789000
E=789300
N=366900
WV
WV
436
435
436
437
437
GRAVEL
BUILDING
437
GRASS
RCRA
418
435
436
424
437
436
CMP
437
GRASS
ANNEX 3
GRAVEL ROAD
437
436
437
GRAVEL
438
4-1,000 GAL. PROPANE TANKS
GRAVEL
CONC
CONC
GRAVEL
BUILDING ANNEX 3A
CONC
GRAVEL ROAD
GRASS
PVC
434
CONC
0
50
SCALE
FEET
2' CONTOUR INTERVALS
RECORD OF DECISION
SITE 14-MISCA OU
CRAB ORCHARD NWR
MARION, ILLINOIS
Soil Cleanup Scenarios Compared to Groundwater exceeding BTEX MCLs/Class I
FIG. NO.
E-4
File: E:\45F\099104-2B.DWG Last edited: 06/18/01 @ 4:51 p.m. @ WCC-ST.LOUIS

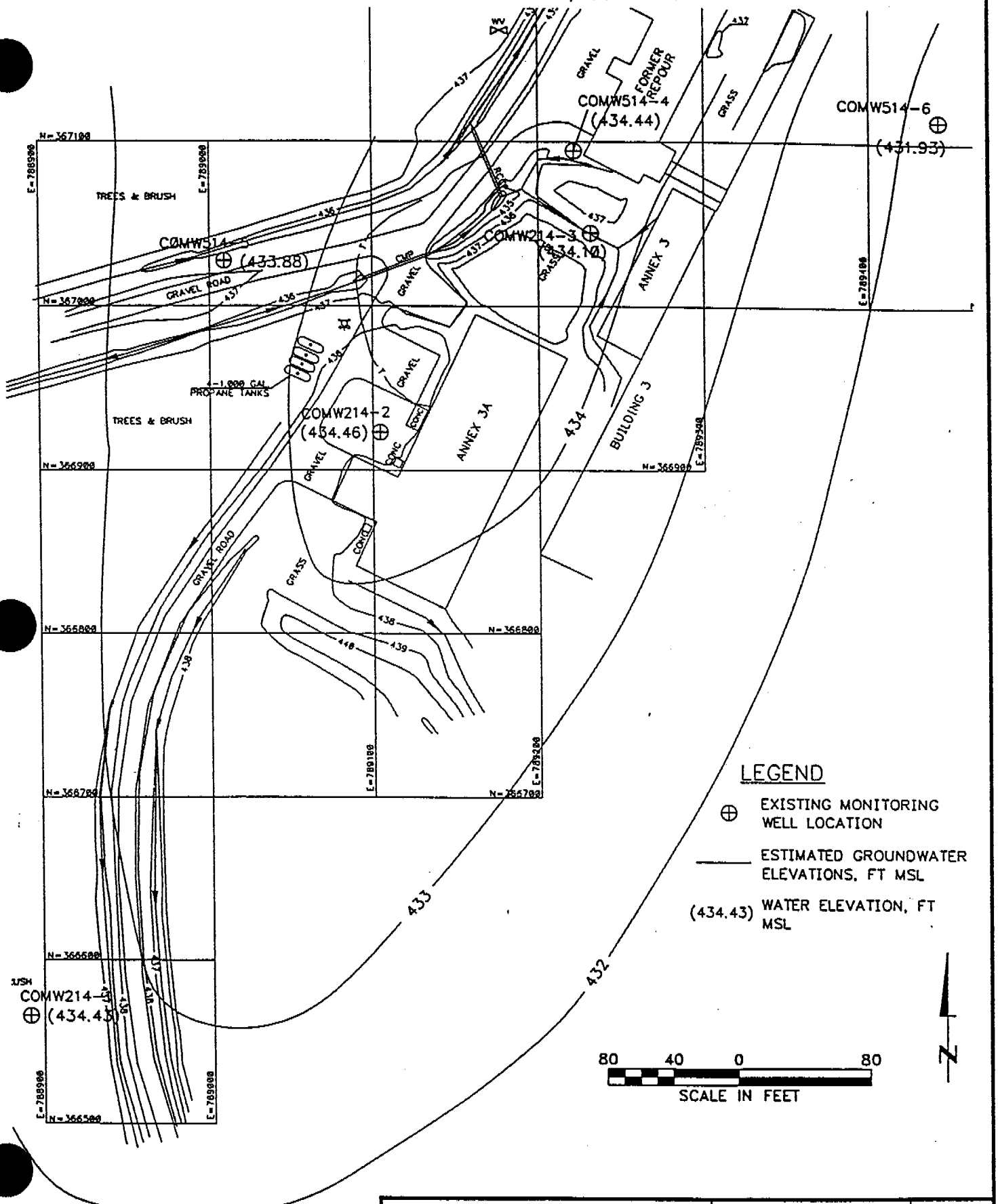
SITE 14, T-9-S, R-2-E, OF THE 3RD P.M., WILLIAMSON COUNTY, ILLINOIS



File: E:\45FO\099103-5.DWG Last edited: 01/09/01 @ 3:4 p.m. @ WCC-ST.LOUIS

RECORD OF DECISION SITE 14-MISCA OU CRAB ORCHARD NWR MARION, ILLINOIS	Groundwater Elevations February 1999	FIG. NO. E-5

SITE 14, T-9-S, R-2-E, OF THE 3RD P.M., WILLIAMSON COUNTY, ILLINOIS



LEGEND

⊕ EXISTING MONITORING WELL LOCATION

——— ESTIMATED GROUNDWATER ELEVATIONS, FT MSL

(434.43) WATER ELEVATION, FT MSL

RECORD OF DECISION SITE 14-MISCA OU CRAB ORCHARD NWR MARION, ILLINOIS	Groundwater Elevations June 1999	FIG. NO. E-6

APPENDIX A

RESPONSIVENESS SUMMARY

Stakeholder Issues and Lead Agency Responses

A public meeting to present and discuss the contents of the Proposed Plan for Site 14 was held on October 5, 2000 at the Refuge Visitors' Center. A court reporter was present to record stakeholder comments. A thirty-day extension to the comment period was granted at the request of the Diagraph Corporation, the tenant at Site 14.

The stakeholder issues that were included in the court reporter's transcript and in the Diagraph comments that were submitted in writing on November 22, 2000 are summarized below, along with the lead agency's responses.

Stakeholders

Diagraph employees showed the most interest in the proposed remediation. Few other members of the public attended the public meeting.

Summary of Stakeholder's Major Position

Diagraph's general argument is that the cost of the remedy is out of proportion to the benefits resulting from it. The remedy is almost entirely focussed on remediation of the groundwater. The baseline risk assessment showed that there was no unacceptable risk from groundwater because the groundwater was not being used for a drinking water source and was unlikely to be used as such in the future. Diagraph argued that it didn't seem to make sense to spend over 1.5 million dollars to remediate groundwater that was unlikely ever to be used.

A Diagraph official also stated in the public meeting comments that he felt that Diagraph had been singled out.

Lead Agency Response to Stakeholders' Major Position

The NCP states in 40 CFR 300.430(a)(1)(iii)(F) that USEPA expects to return usable ground waters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances at the site. When restoration of groundwater to beneficial uses is not practicable, USEPA expects to prevent further migration of the plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction. The Illinois Comprehensive State Ground Water Protection Plan clearly lays out Illinois' plan to meet its goal to protect, restore, and prevent degradation of groundwater in accordance with Illinois Groundwater Protection Act.

Title 35 of the Illinois Administrative Code, Part 620 (35 IAC 620) establishes groundwater standards and uses. Based on hydraulic conductivity results, the groundwater at Site 14 is classified as a Potable Resource Groundwater and is subject to State of Illinois Class I groundwater standards. The Illinois regulation is an applicable state requirement for Site 14.

USEPA's drinking water standards (Federal MCLs, non-zero MCLGs, or more stringent State Drinking water standards) are relevant and appropriate requirements for Site 14.

In addition, Diagraph incorrectly states that there are no risks at the site. Ecological risks have been identified, as well as potential risks to site workers and construction workers.

Other Stakeholder Issues and Lead Agency Responses

Contaminants at Site

In written comments (November 22, 2000), Diagraph states that "with the exception of lead, all contaminants of concern were below background values." In fact, other contaminants were detected above background levels, including chromium, manganese, mercury, nickel, selenium, zinc, benzene, ethylbenzene, toluene, xylene, and cyanide.

Slug testing compared with pump tests

In written comments, Diagraph suggests that a pump test should have been done at the site, since it will give a more accurate measurement of hydraulic conductivity. A pump test is more accurate, and considerably more expensive. Pump tests are often used to calculate hydraulic conductivity for pumping wells, relief wells or pilot tests, where more accurate values are needed. Slug testing is standard for measuring hydraulic conductivity as part of an RI/FS.

Interpretation of slug test data

In written comments, Diagraph incorrectly states "The slug test data taken from monitoring wells in the immediate area of the impacted soils, i.e., monitoring wells 3 and 4, show that the underlying groundwater is not "Class One" groundwater." According to 35 IAC 620.210(a)(4)(B), any saturated geologic material that is capable of the following is considered a source of Potable Resource Groundwater:

> *Hydraulic conductivity of 1 x 10-4 cm/sec or greater using one of the following test methods or its equivalent: i) permeameter, ii) slug test, or iii) pump test.*

All six of the monitoring wells at Site 14 showed measured hydraulic conductivity values greater than 1×10^{-4} cm/sec. The results are shown in Table 3-2 of the RI Addendum report (September, 1999). Monitoring Well No. 3 (COMW214-3) was measured twice, in August 1998 and February 1999. The measured hydraulic conductivity values were 1.97×10^{-3} and 8.60×10^{-4} cm/sec, respectively. In Monitoring Well 4, the measured hydraulic conductivity was 7.75×10^{-4} cm/sec.

Ethylbenzene cleanup level

In written comments, Diagraph noted that there are no published standards to support the cleanup level of 100 mg/kg ethylbenzene. Studies showed that the lateral boundary of soil with a maximum level of ethylbenzene contamination at 100 mg/kg generally coincides with the limits of groundwater contamination at or below MCLs/State of Illinois Class I standards for ethylbenzene and all other contaminants of concern. Reducing ethylbenzene contamination in soil to 100 mg/kg, would meet the remedial action objectives for Site 14.

Excavation below water table

Diagraph believes that soil should not be excavated below the water table. Excavation below the water table was judged to be the most cost-effective means of achieving the remedial action objectives as stated in the feasibility study. Both USEPA and IEPA support excavation of soils below the water table at this site.

Cost of biopile alternative

In a meeting on November 29, 2000, Diagraph's representative stated that they thought the cost of the biopile alternative was overstated, and that in their experience, the cost should be significantly less than excavation and offsite disposal.

The cost estimate for the biopile alternative was reviewed and judged to be appropriate. A review of the biopile cost estimate has indicated that increasing the overall surface area of the biopile (as suggested by Diagraph), thereby decreasing the height of the piles will not decrease the overall cost. Increasing the surface area of biopile will still require approximately the same length of piping for aeration and might require a larger pump for the blower. The cost estimates presented in the August 2000 Feasibility Study were calculated using guidance from the Biopile Design and Construction Manual, Technical Memorandum (TM-2189-ENV), June 1996 and the Biopile Operations and Maintenance Manual, Technical Memorandum (TM-2190-ENV), June 1996 which were published by the Naval Facilities Engineering Service Center.

The Federal Remediation Technologies Roundtable (FRTR) provides a treatment technologies screening matrix on their webpage www.frtr.gov. This screening matrix states that the range of costs for the biopile option is $100 to $200 per cubic yard. For the cleanup goals that correspond to 100 mg/kg ethylbenzene, 7,300 cubic yard of soil will be treated in the biopile. This indicates that the cost presented in the August 2000 Feasibility Study is consistent with the FRTR range of costs considering that the biopile alternative also includes the following factors: excavation and off-site disposal of approximately 10 cubic yards of metal contaminated soil; ORC® treatment under the Repour Building; purchase, hauling, and placement of approximately 8,550 cubic yards of fill material for the excavation; and pumping and treatment of approximately 268,925 gallons of groundwater that seeps into the excavation.

Public meeting format

One comment was made objecting to the format of the public meeting. The commentor felt that the format did not give people the opportunity to hear one another's comments.

Anonymous Letter

An anonymous letter was sent to a number of people involved with this project, including project managers and contractors. The letter stated that there were two additional areas of disposal by Diagraph and described locations. These locations were investigated by DOI. No contamination above cleanup levels was found.

APPENDIX B

SELECTED REMEDY COST ESTIMATE

Table of Contents

B.1 Cost Estimate Methodology
- B.1.1 Capital Costs
- B.1.2 Operation and Maintenance Costs
- B.1.3 Other Costs
- B.1.4 Present Worth Cost

B.2 Site 14 Cost Estimates

Tables

Table B-1 Cost Estimate Summary for Selected Alternative (Alternative 5)

Unit Cost Sheets

Unit Cost Sheet No. 1 Capital Costs – Verification Sampling
Unit Cost Sheet No. 2 Capital Costs – Verification Sampling
Unit Cost Sheet No. 3 Capital Costs – Confirmation Sampling
Unit Cost Sheet No. 4 Capital Costs – Install Monitoring Well
Unit Cost Sheet No. 5a O&M Cost: Monitoring Wells
Unit Cost Sheet No. 5b O&M Cost: Monitoring Wells
Unit Cost Sheet No. 5c O&M Cost: Monitoring Wells
Unit Cost Sheet No. 5d O&M Cost: Monitoring Wells

B.1 COST ESTIMATE METHODOLOGY

The information presented in the cost estimate is used to compare alternatives. Unit prices and general cost information were obtained from cost estimated references (R.S. Means 1999), cost estimates for similar work, vendor quotes, guidance documents, and engineering judgement.

Cost estimates are intended to provide an accuracy range of –30 to +50 percent of actual cost. The actual project cost will depend on actual labor and material cost, productivity, competitive market conditions, actual project scope and schedule, and other variable factors. As a result of these factors, the actual project cost is likely to vary from the estimates provided in this study. Funding needs should be carefully evaluated, taking these factors into consideration before budgets are established.

Costs included capital costs, operation and maintenance costs, and total present worth cost of the selected alternative.

B.1.1 Capital Costs

Capital costs are expenditures required to construct or install the remedial action. Capital costs include only the expenditures that are initially incurred to implement an action and major expenditures in future years. They do not include the costs required to operate and maintain the remedial action throughout its lifetime.

B.1.2 Operation and Maintenance Costs

Operation and maintenance (O&M) costs are those post construction/installation costs necessary to ensure or verify the continued effectiveness of a remedial action. They include all labor, equipment, and material costs associated with activities such as monitoring; operating and maintaining extraction, containment, or treatment systems; and disposal residuals.

B.1.3 Other Costs

Other costs that were added to capital and O&M costs are contingencies and professional/ technical support. Contingencies are used to reduce the risk of possible cost overruns. They are used to cover unknowns, unforeseen circumstances, or unanticipated conditions that cannot be determined from the known data. The two types of contingencies are scope and bid. Scope contingencies cover costs due to scope changes that may occur during design. Bid contingencies cover unknown costs associated with constructing or implementing the project scope.

Professional/technical support is non-construction or implementation costs that do not fall under any one line item cost. They included costs associated with project management, legal services, engineering design, construction management, and all other professional/technical services needed to support the remedial action.

B.1.4 Present Worth Cost

Present worth is the amount of money needed in the base year to cover the future costs associated with a particular time period at a particular interest or discount rate. Computation of present worth allows for the evaluated and comparison of future costs discounted to a base year. For this estimate, a discount rate of 7% was used. The base year for the estimate is 1999.

B.2 SITE 14 COST ESTIMATES

The tables contained in this appendix show a detailed cost estimate for the Selected Alternative (Alternative 5). For this alternative, a table of capital, O&M, and present worth is included. Table B-1 summarizes the costs for the Selected Alternative. Also included in this appendix is the backup costs for the alternative. Calculations used in completing the estimates are presented in Appendix A of the Site 14 Feasibility Study.

Table B-1

Alternative 5 - Ethylbenzene > 100 mg/kg
Demolition, Excavation, and Disposal

COST ESTIMATE SUMMARY

Site: Crab Orchard N.W.R.
Location: Marion. Illinois
Phase: Feasibility Study (-30% to +50%)
Date: February 17, 2000

Description: Alternative 5 includes excavation and disposal of VOC and metal contaminated soils with demolition of the existing buildings. Contaminated soils will be excavated under the removed buildings. O&M includes 6 years of groundwater monitoring

CAPITAL COSTS (Year 0):

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
1. Pre-design sampling					
a. Geoprobe	1	LS	$5,000.00	$5,000	
b. Labor	1	LS	$5,000.00	$5,000	
b. Lab Analytical (BTEX, MC)	1	LS	$10,000.00	$10,000	
SUBTOTAL				$20,000	
2. Mobilization / Demobilization					
a. Well Installation	1	LS	$2,000.00	$2,000	Rig and crew
b. Soils Excavation	1	LS	$1,545.00	$1,545	15% of total site work
c. Demolition Crew	1	LS	$3,000.00	$3,000	Crane, Dozer, Dumptruck
d. Submittals / Implementation Plans	1	LS	$5,000.00	$5,000	
SUBTOTAL				$11,545	
3. Monitoring, Sampling, Testing, and Analysis					
a. Confirmation Sampling - Metals[1]	2	EA	$275.00	$550	Includes Duplicate: 1 sample/100 cy
b. Confirmation Sampling - VOCs[1]	30	EA	$247.50	$7,425	20 ' x 20' grid @ 5' intervals
c. Verification Sampling - Metals[1]	69	EA	$275.00	$18,975	Includes Duplicate: 1 sample/100 cy
d. Verification Sampling - VOCs/Metals[1]	20	EA	$379.50	$7,590	Sample for Discharge, 1 / 10,000 gal
e. Hnu Monitoring	3	DAY	$500.00	$1,500	
SUBTOTAL				$36,040	
4. Site Work					
a. Institutional Controls	1	LS	$5,000.00	$5,000	Deed Restrictions
b. Site Preparation	1	LS	$5,000.00	$5,000	Fencing, Outhouse, Parking, Erosion
c. Dewatering Pumps	1	EA	$170.00	$170	Rented
d. Excavate and Stockpile VOC Soils	7,323	CY	$7.00	$51,261	
e. Borrow Fille, Spread, Compact, Grade	8,788	CY	$15.00	$131,820	1.2 compaction factor
f. Excavate and Load Metals Soils	10	CY	$7.00	$70	
g. Building Demolition	18,000	CY	$0.32	$5,760	30' x 50' Building
h. Asbestos Removal	1,500	CF	$25.00	$37,500	
i. Haul and dump debris	170	CY	$55.00	$9,350	
SUBTOTAL				$245,931	
5. On-Site Treatment Air Stripping					
a. Air Stripper Rental	2	MO	$1,000.00	$2,000	
b. Treat Water	268,925	GAL	$1.00	$268,925	
c. Install Monitoring Well[1]	4	EA	$1,485.00	$5,940	
SUBTOTAL				$276,865	
6. Off-Site Treatment / Disposal					
a. Haul Contaminated Soils	10,985	TON	$15.00	$164,775	25 miles to landfill
b. Landfill Disposal	10,985	TON	$30.00	$329,550	Local quote
SUBTOTAL				$494,325	
SUBTOTAL				$1,084,706	
7. Contingency (% of Subtotal)		25%		$271,177	15% scope + 10% bid
8. Project Management and Support (% of Subtotal)					
a. Project Management		5%		$54,235	
b. Remedial Design		8%		$86,776	
c. Construction Management		6%		$65,082	
SUBTOTAL				$206,094	
TOTAL CAPITAL COST - Year 0				$1,561,977	

Table B-1

Alternative 5 - Ethylbenzene > 100 mg/kg
Demolition, Excavation, and Disposal

COST ESTIMATE SUMMARY

ANNUAL O&M COSTS (YEARS 1-6):

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
1. Monitoring, Sampling, Testing, and Analysis					
a. Sample Monitoring Wells[1]	4	EA	$2,904.00	$11,616	Sample Quartlerly
SUBTOTAL				$11,616	
SUBTOTAL				$11,616	
2. Contingency (% of Subtotal)		25%		$2,904.00	15% scope + 10% bid
3. Project Management and Support (% of Subtotal)					
a. Project Management		5%		$580.80	
b. Technical Support		10%		$1,161.60	
SUBTOTAL				$1,742	
TOTAL ANNUAL O&M COST - Years 1-6				$16,262	

PRESENT WORTH ANALYSIS:

YEAR	CAPITAL COST	ANNUAL O&M COST	TOTAL COST	DISCOUNT FACTOR (7%)	PRESENT WORTH	NOTES
0	$1,561,977		$1,561,977	1.000	$1,561,977	
1		$16,262	$16,262	0.935	$15,199	
2		$16,262	$16,262	0.873	$14,204	
3		$16,262	$16,262	0.816	$13,275	
4		$16,262	$16,262	0.763	$12,407	
5		$16,262	$16,262	0.713	$11,595	
6		$16,262	$16,262	0.666	$10,836	
TOTALS	$1,561,977	$81,312	$1,643,289		$1,639,492	
TOTAL PRESENT WORTH COST					$1,639,492	

FOOTNOTE
1. See Unit Cost Worksheets for Breakdown

GENERAL NOTES:

1. Expected accuracy range of cost estimate = -30% to +50%.
2. Base year of estimate = 2000. Costs from pre-2000 sources have been escalated to 2000.
3. Capital costs are incurred in Year 0 (initial construction).
4. Annual O&M costs are incurred for 6 years at a constant amount.

UNIT COST WORKSHEET No. 1

Project:	Crab Orchard NWR	**By:**	MPM
Location:	Marion, Illinois	**Date:**	02/17/2000
Item:	Capital Costs - Verification Sampling	**Check By:**	
Alternative:	all	**Date:**	

Work Statement (Incl. Assumptions):
Verification: Verification sampling for soils going to an off-site landfill facility (TCLP). Verification sampling will be completed at 1 sample / 100 CY. Duplicate and split sample taken for every 10 samples. Confirmation sampling for metal contaminated soil will be completed to ensure cleanup. 6 metal confirmation samples will be taken.

Costs Per Sample

ACTIVITY	QTY	UNIT	UNIT $	COST
Environmental Engineer	0.5	HR	60	30.00
Materials (gloves, vials, jars, etc)	1	LS	10	10.00
Ship to Lab	1	LS	10	10.00
Lab Analytical (TCLP for Metals or VOCs)	1	EA	200	200.00
TOTALS				250.00

Source of Cost Data:
Engineering judgement based on typical rates: Environmental Engineer
Engineering judgement for lump sums
Typical Lab Rates

Calculation of Total Adjusted Unit Cost:

Unit Cost / Factor	LABOR	EQPMT	MTRL	OTHER	TOTAL	Notes
Bare Cost	-	-	-	-	-	
Cost Including OH&P	-	-	-	-	250.00	From above quote
H&S Productivity *	-	-	-	-	-	n/a
Escalation	-	-	-	-	-	n/a
Area Cost	-	-	-	-	-	Included
Overhead (OH)	-	-	-	-	-	Included
Profit (P)	-	-	-	-	-	Included
Other	-	-	-	-	-	Included
Allowance	-	-	-	-	25.00	+10% for standby/travel
TOTAL	-	-	-	-	$275.00	

UNIT COST WORKSHEET No. 2

Project:	Crab Orchard NWR	**By:**	MPM
Location:	Marion, Illinois	**Date:**	02/17/2000
Item:	Capital Costs - Verification Sampling	**Check By:**	
Alternative:	all	**Date:**	

Work Statement (Incl. Assumptions):
Verification Sampling: Verification sampling for treated groundwater (VOCs and Metals). Verification sampling will be completed at 1 sample / 10,000 Gallons. Duplicate and split sample taken for every 10 samples.

Costs Per Sample

ACTIVITY	QTY	UNIT	UNIT $	COST
Environmental Engineer	0.5	HR	60	30.00
Materials (gloves, vials, jars, etc)	1	LS	10	10.00
Ship to Lab	1	LS	10	10.00
Lab Analytical (Groundwater - VOCs)	1	EA	175	175.00
Lab Analytical (Groundwater - Metals)	1	EA	120	120.00
TOTALS				345.00

Source of Cost Data:
Engineering judgement based on typical rates: Environmental Engineer
Engineering judgement for lump sums
Typical Lab Rates

Calculation of Total Adjusted Unit Cost:

Unit Cost / Factor	LABOR	EQPMT	MTRL	OTHER	TOTAL	Notes
Bare Cost	-	-	-	-	-	
Cost Including OH&P	-	-	-	-	345.00	From above quote
H&S Productivity *	-	-	-	-	-	n/a
Escalation	-	-	-	-	-	n/a
Area Cost	-	-	-	-	-	Included
Overhead (OH)	-	-	-	-	-	Included
Profit (P)	-	-	-	-	-	Included
Other	-	-	-	-	-	Included
Allowance	-	-	-	-	34.50	+10% for standby/travel
TOTAL	-	-	-	-	$379.50	

UNIT COST WORKSHEET No. 3

Project:	Crab Orchard NWR	**By:**	MPM
Location:	Marion, Illinois	**Date:**	02/17/2000
Item:	Capital Costs - Confirmation Sampling	**Check By:**	
Alternative:	all	**Date:**	

Work Statement (Incl. Assumptions):
Confirmation Sampling: Confirmation sampling will be completed for VOC contaminated soils to ensure cleeanup. 30 confirmation samples will be taken depending on the ethlybenze cleanup goal (100 mg/kg ethylbenzene).

Costs Per Sample

ACTIVITY	QTY	UNIT	UNIT $	COST
Environmental Engineer	0.5	HR	60	30.00
Materials (gloves, vials, jars, etc)	1	LS	10	10.00
Ship to Lab	1	LS	10	10.00
Lab Analytical (Groundwater or Soil - VOCs)	1	EA	175	175.00
TOTALS				225.00

Source of Cost Data:
Engineering judgement based on typical rates: Environmental Engineer
Engineering judgement for lump sums
Typical Lab Rates

Calculation of Total Adjusted Unit Cost:

Unit Cost / Factor	LABOR	EQPMT	MTRL	OTHER	TOTAL	Notes
Bare Cost	-	-	-	-	-	
Cost Including OH&P	-	-	-	-	225.00	From above quote
H&S Productivity *	-	-	-	-	-	n/a
Escalation	-	-	-	-	-	n/a
Area Cost	-	-	-	-	-	Included
Overhead (OH)	-	-	-	-	-	Included
Profit (P)	-	-	-	-	-	Included
Other	-	-	-	-	-	Included
Allowance	-	-	-	-	22.50	+10% for standby/travel
TOTAL	-	-	-	-	$247.50	

UNIT COST WORKSHEET No. 4

Project:	Crab Orchard NWR	**By:**	MPM
Location:	Marion, Illinois	**Date:**	02/17/2000
Item:	Capital Costs - Install Monitoring Well	**Check By:**	
Alternative:	All	**Date:**	

Work Statement (Incl. Assumptions):
Install Monitoring Well: 15 feet 2" pvc monitoring well. 10 feet casing, 5 feet screen.

Install Well

ACTIVITY	QTY	UNIT	UNIT $	COST
2" PVC Well Casing	10	LF	7	70.00
2" PVC Well Screen	5	LF	10	50.00
2" PVC Well Plug	1	EA	15	15.00
Drill Well	15	LF	20	300.00
2" Filter Pack	5	LF	8	40.00
2" Bentonite Seal	10	LF	30	300.00
Well Pad	1	EA	250	250.00
Well Cap	1	EA	75	75.00
Protective Enclosure	1	EA	250	250.00
TOTALS				1350.00

Source of Cost Data:
Engineering judgement based on typical rates: Environmental Engineer
Engineering judgement for lump sums
Typical Lab Rates

Calculation of Total Adjusted Unit Cost:

Unit Cost / Factor	LABOR	EQPMT	MTRL	OTHER	TOTAL	Notes
Bare Cost	-	-	-	-	-	
Cost Including OH&P	-	-	-	-	1350.00	From above quote
H&S Productivity *	-	-	-	-	-	n/a
Escalation	-	-	-	-	-	n/a
Area Cost	-	-	-	-	-	Included
Overhead (OH)	-	-	-	-	-	Included
Profit (P)	-	-	-	-	-	Included
Other	-	-	-	-	-	Included
Allowance	-	-	-	-	135.00	+10% for standby/travel
TOTAL	-	-	-	-	$1,485.00	

UNIT COST WORKSHEET No. 5a

Project:	Crab Orchard NWR	**By:**	MPM
Location:	Marion, Illinois	**Date:**	07/31/2001
Item:	O&M Cost: Monitoring Wells	**Check By:**	
Alternative:	All	**Date:**	

Work Statement (Incl. Assumptions):
Monitor Wells: Monitor 4 Wells Quarterly (4 times a year) Assume 1 duplicate, 1 split, 1 blank per event. Groundwater will be monitored for 8260 VOCs.

Costs per Event

ACTIVITY	QTY	UNIT	UNIT $	COST	
Environmental Engineer	1	DAY	480	480.00	
Geologist / Chemist	1	DAY	480	480.00	
Materials (gloves, vials, jars, etc)	1	LS	50	50.00	
Ship to Lab	1	LS	50	50.00	
Lab Analytical (8260B, VOCs)	7	EA	175	1225.00	Includes Duplicate, split, and blank
Reporting, Chemist	3	HR	60	180.00	
TOTALS				2465.00	

Source of Cost Data:
Engineering judgement based on typical rates: Environmental Engineer, Chemist
Engineering judgement for lump sums
Typical Lab Rates

Calculation of Total Adjusted Unit Cost:

Unit Cost / Factor	LABOR	EQPMT	MTRL	OTHER	TOTAL	Notes
Bare Cost	-	-	-	-	-	
Cost Including OH&P	-	-	-	-	2465.00	From above quote
H&S Productivity *	-	-	-	-	-	n/a
Escalation	-	-	-	-	-	n/a
Area Cost	-	-	-	-	-	Included
Overhead (OH)	-	-	-	-	-	Included
Profit (P)	-	-	-	-	-	Included
Other	-	-	-	-	-	Included
Allowance	-	-	-	-	246.50	+10% for standby/travel
TOTAL	-	-	-	-	$2,711.50	

UNIT COST WORKSHEET No. 5b

Project:	Crab Orchard NWR	**By:**	MPM
Location:	Marion, Illinois	**Date:**	07/31/2001
Item:	O&M Cost: Monitoring Wells	**Check By:**	
Alternative:	All	**Date:**	

Work Statement (Incl. Assumptions):
Monitor Wells: Monitor 5 Wells Quarterly (4 times a year) Assume 1 duplicate, 1 split, 1 blank per event. Groundwater will be monitored for 8260 VOCs.

Costs per Event

ACTIVITY	QTY	UNIT	UNIT $	COST	
Environmental Engineer	1	DAY	480	480.00	
Geologist / Chemist	1	DAY	480	480.00	
Materials (gloves, vials, jars, etc)	1	LS	50	50.00	
Ship to Lab	1	LS	50	50.00	
Lab Analytical (8260B, VOCs)	8	EA	175	1400.00	Includes Duplicate, split, and blank
Reporting, Chemist	3	HR	60	180.00	
TOTALS				2640.00	

Source of Cost Data:
Engineering judgement based on typical rates: Environmental Engineer, Chemist
Engineering judgement for lump sums
Typical Lab Rates

Calculation of Total Adjusted Unit Cost:

Unit Cost / Factor	LABOR	EQPMT	MTRL	OTHER	TOTAL	Notes
Bare Cost	-	-	-	-	-	
Cost Including OH&P	-	-	-	-	2640.00	From above quote
H&S Productivity *	-	-	-	-	-	n/a
Escalation	-	-	-	-	-	n/a
Area Cost	-	-	-	-	-	Included
Overhead (OH)	-	-	-	-	-	Included
Profit (P)	-	-	-	-	-	Included
Other	-	-	-	-	-	Included
Allowance	-	-	-	-	264.00	+10% for standby/travel
TOTAL	-	-	-	-	$2,904.00	

UNIT COST WORKSHEET No. 5c

Project:	Crab Orchard NWR	**By:**	MPM
Location:	Marion, Illinois	**Date:**	07/31/2001
Item:	O&M Cost: Monitoring Wells	**Check By:**	
Alternative:	All	**Date:**	

Work Statement (Incl. Assumptions):
Monitor Wells: Monitor 6 Wells Quarterly (4 times a year) Assume 1 duplicate, 1 split, 1 blank per event. Groundwater will be monitored for 8260 VOCs.

Costs per Event

ACTIVITY	QTY	UNIT	UNIT $	COST	
Environmental Engineer	1	DAY	480	480.00	
Geologist / Chemist	1	DAY	480	480.00	
Materials (gloves, vials, jars, etc)	1	LS	50	50.00	
Ship to Lab	1	LS	50	50.00	
Lab Analytical (8260B, VOCs)	9	EA	175	1575.00	Includes Duplicate, split, and blank
Reporting, Chemist	3	HR	60	180.00	
TOTALS				2815.00	

Source of Cost Data:
Engineering judgement based on typical rates: Environmental Engineer, Chemist
Engineering judgement for lump sums
Typical Lab Rates

Calculation of Total Adjusted Unit Cost:

Unit Cost / Factor	LABOR	EQPMT	MTRL	OTHER	TOTAL	Notes
Bare Cost	-	-	-	-	-	
Cost Including OH&P	-	-	-	-	2815.00	From above quote
H&S Productivity *	-	-	-	-	-	n/a
Escalation	-	-	-	-	-	n/a
Area Cost	-	-	-	-	-	Included
Overhead (OH)	-	-	-	-	-	Included
Profit (P)	-	-	-	-	-	Included
Other	-	-	-	-	-	Included
Allowance	-	-	-	-	281.50	+10% for standby/travel
TOTAL	-	-	-	-	$3,096.50	

UNIT COST WORKSHEET No. 5d

Project:	Crab Orchard NWR	**By:**	MPM
Location:	Marion, Illinois	**Date:**	07/31/2001
Item:	O&M Cost: Monitoring Wells	**Check By:**	
Alternative:	All	**Date:**	

Work Statement (Incl. Assumptions):
Monitor Wells: Monitor 7 Wells Quarterly (4 times a year) Assume 1 duplicate, 1 split, 1 blank per event. Groundwater will be monitored for 8260 VOCs.

Costs per Event

ACTIVITY	QTY	UNIT	UNIT $	COST	
Environmental Engineer	1	DAY	480	480.00	
Geologist / Chemist	1	DAY	480	480.00	
Materials (gloves, vials, jars, etc)	1	LS	50	50.00	
Ship to Lab	1	LS	50	50.00	
Lab Analytical (8260B, VOCs)	10	EA	175	1750.00	Includes Duplicate, split, and blank
Reporting, Chemist	3	HR	60	180.00	
TOTALS				2990.00	

Source of Cost Data:
Engineering judgement based on typical rates: Environmental Engineer, Chemist
Engineering judgement for lump sums
Typical Lab Rates

Calculation of Total Adjusted Unit Cost:

Unit Cost / Factor	LABOR	EQPMT	MTRL	OTHER	TOTAL	Notes
Bare Cost	-	-	-	-	-	
Cost Including OH&P	-	-	-	-	2990.00	From above quote
H&S Productivity *	-	-	-	-	-	n/a
Escalation	-	-	-	-	-	n/a
Area Cost	-	-	-	-	-	Included
Overhead (OH)	-	-	-	-	-	Included
Profit (P)	-	-	-	-	-	Included
Other	-	-	-	-	-	Included
Allowance	-	-	-	-	299.00	+10% for standby/travel
TOTAL	-	-	-	-	$3,289.00	