Five-Year Review Report

Fifth Five-Year Review Report
for
Lee's Lane Landfill
• KYD980557052

Louisville
Jefferson County, Kentucky

September 2013

United States Environmental Protection Agency
Region 4
Atlanta, Georgia

Approved by:

Franklin E. Hill
Director, Superfund Division

Date:

9/25/13

Fifth Five-Year Review Report
for
Lee's Lane Landfill
Lee's Lane at Ohio River
Louisville
Jefferson County, Kentucky

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List of Acronyms (LOA)

ACL	Alternate Concentration Limit
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
ATV	All Terrain Vehicle
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
COC	Contaminant of Concern
EDD	Enforcement Decision Document
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FYR	Five-Year Review
g/L	Grams per Liter
IC	Institutional Control
KDEP	Kentucky Department of Environmental Protection
KDHMWM	Kentucky Department of Hazardous Materials and Waste Management
KEPPC	Kentucky Environmental and Public Protection Cabinet
LEL	Lower Explosive Limit
LFG	Landfill Gas
LOA	List of Acronyms
MCL	Maximum Contaminant Level
µg/L	Microgram per Liter
mg/kg	Milligrams per Kilogram
MSD	Louisville and Jefferson County Metropolitan Sewer District
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PHA	Public Health Assessment
ppbV	parts per billion volume
ppm	parts per million
ppmV	parts per million volume
PRP	Potentially Responsible Party
PWS	Public Water Supply
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level
SAD	Surveillance and Analysis Division
SMG	Smith Management Group
TBC	To-Be-Considered

Executive Summary

Introduction

The 112-acre Lee's Lane Landfill Superfund site (the Site) is located in the Ohio River floodplain in Louisville, Kentucky. The Site was the location of a sand and gravel quarry and a landfill. Quarrying occurred as early as the 1940s; landfill operations occurred between 1948 and 1975. At least 212,400 tons of domestic, commercial, solid municipal and industrial wastes were disposed of at the landfill by industrial firms in and around the Louisville area. In 1975, nearby residents reported flash fires in their basements; methane, apparently from the landfill, was being ignited by the pilot lights of their hot water heaters. Subsequently, the State of Kentucky closed the landfill and local authorities evacuated and purchased seven nearby homes because of the presence of explosive levels of methane. In October 1980, the Kentucky Department of Hazardous Materials and Waste Management (KDHMWM) installed a gas collection system on the Site between the landfill and the adjacent Riverside Gardens community. Also in 1980, state personnel discovered about 400 drums of hazardous materials along the Ohio River next to the landfill. The drums contained more than 50 chemicals, including phenolic resins, benzene, and a variety of heavy metals. The Site owners removed the drums in 1981. The U.S. Environmental Protection Agency's remedial investigation identified soil, ground water, and surface water contamination of benzene, inorganic chemicals, and heavy metals, including lead and arsenic from the landfill. Methane gas venting from the landfill also impacted air quality.

The major components of the EPA's 1986 Record of Decision (ROD) selected remedy included a gas and air monitoring system to address the potential release of methane and hazardous gases to the air and subsurface. It also included a ground water monitoring program to establish baseline conditions at the Site and to serve as an early warning for any contamination migration. Additionally, the remedy incorporated putting riprap in place to prevent erosion of the Ohio River bank, capping "hot spot" areas and removing exposed drums.

As required by the 1986 ROD, access roads are gated and locked, and No Trespassing signs are posted around the Site perimeter. In addition, Metropolitan Sewer District (MSD) has fenced parts of the Site perimeter. Despite these measures, all terrain vehicle (ATV) use at the Site appears commonplace. MSD personnel visit the Site on a routine basis to conduct inspections of Site conditions. The Ohio River Valley section of the Louisville Loop trail runs along the eastern and southern perimeter of the site on top of the flood levee.

The EPA placed the Site on the National Priorities List (NPL) in 1983. Following cleanup activities, the EPA deleted the Site from the NPL in 1996. The triggering action for this five-year review (FYR) was the signing of the previous FYR on September 25, 2008.

Remedial Action Objectives

The 1986 ROD did not define Remedial Action Objectives, but it defined public health objectives to:

1. Construct a ground water monitoring program that will serve as an early warning system should site conditions change.
2. Control the vertical and lateral subsurface migration of methane and other gases.

3. Institute a routine monitoring program that will serve to detect any undesirable and possible dangerous levels of methane and/or toxic vapors migrating into the Riverside Gardens neighborhood.
4. Institute an ambient air monitoring program.

Technical Assessment

The landfill gas (LFG) collection system is necessary in order to meet the public health objective to control the vertical and lateral subsurface migration of methane and other gases. However, the system itself was not identified as part of the remedy in the decision documents. In addition, ground water wells were not screened accurately, and some soil contamination has not been delineated. A qualitative evaluation of potential human and ecological health risks was conducted by EPA in 2010, and data gaps were identified for soil and ground water, leading to plans for further sampling. In 2011, soil samples taken at targeted locations were evaluated, concluding that none of the data exceeded an excess cancer risk of 1×10^{-6} or a hazard index of 1, based on the conservative assumption of chronic daily residential exposure. Additional samples are being collected and will be evaluated for risk. Based on available data to date, no unacceptable risks have been identified based on current exposures to soil, ground water, surface water or air.

At this time, there is insufficient data to assess current exposure pathways.

Conclusion

A protectiveness determination of the remedy cannot be made at this time without further information. Recommended actions to obtain this information include: obtaining additional soil and ground water data to update the Site characterization; and, completing a data review and evaluation to evaluate health risks associated with current site conditions. Additionally, the LFG collection system needs to be included in the site remedy, and properly functioning to remove landfill gases. It is expected that these actions will take approximately 12 months to complete, at which time a protectiveness determination will be made.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Lee's Lane Landfill		
EPA ID: KYD980557052		
Region: 4	**State:** KY	**City/County:** Louisville/Jefferson
SITE STATUS		
NPL Status: Deleted		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA **If "Other Federal Agency" selected above, enter Agency name:** Click here to enter text.		
Author name: Johnny Zimmerman-Ward and Kirby Webster (Reviewed by EPA)		
Author affiliation: Skeo Solutions		
Review period: November 2012 – September 2013		
Date of site inspection: 12/12/2012		
Type of review: Policy		
Review number: 5		
Triggering action date: 09/25/2008		
Due date *(five years after triggering action date)*: 09/25/2013		

Five-Year Review Summary Form (continued)

Issues/Recommendations

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 1	Issue Category: Remedy Performance			
	Issue: The 1986 ROD did not identify a ground water remedy.			
	Recommendation: Review ground water data and determine if a ground water remedy needs to be established, along with ground water cleanup goals, in a decision document.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA	09/01/2014

OU(s): 1	Issue Category: Remedy Performance			
	Issue: The 1986 ROD did not identify RCRA capping requirements.			
	Recommendation: Evaluate capping requirements and incorporate them into a decision document, if necessary.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA	09/01/2014

OU(s): 1	Issue Category: Remedy Performance			
	Issue: The LFG collection system is currently not working as designed and may no longer be in an optimal location. Also, it was not selected as the remedy in the 1986 ROD.			
	Recommendation: Determine next steps for installing updated LFG collection system and install new system. Select the LFG collection system as the remedy if it was meant to be the remedy.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	EPA/State	EPA	09/01/2014

Five-Year Review Summary Form (continued)

OU(s): 1	Issue Category: Institutional Controls			
	Issue: The 1986 ROD did not include institutional controls.			
	Recommendation: Evaluate the need for institutional controls in conjunction with current ground water sampling efforts. Consider institutional controls for the capped landfill area. Identify institutional control requirements in an enforceable document, if necessary.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA	09/01/2014

OU(s): 1	Issue Category: Remedy Performance			
	Issue: Although prior risk assessments indicated minimal risk, data gaps have been identified that suggest a re-evaluation is needed.			
	Recommendation: Conduct an updated data review and evaluation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	EPA/State	EPA	09/01/2014

OU(s): 1	Issue Category: Monitoring			
	Issue: Ground water is not adequately characterized and new wells are needed to obtain sufficient data.			
	Recommendation: Install new ground water wells to appropriately characterize contamination and ground water flow. Address contamination as appropriate. Evaluate contaminant levels and ecological impacts at the discharge point to the Ohio River. Evaluate data to determine if additional sampling needs to be conducted for soil vapor intrusion.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA	09/01/2014

OU(s): 1	Issue Category: Monitoring			
	Issue: Soil contamination is insufficiently characterized.			
	Recommendation: Identify location of any remaining soil contamination through soil sampling, and address contamination, as appropriate.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	EPA/State	EPA	09/01/2014

Five-Year Review Summary Form (continued)

OU(s): 1	Issue Category: Site Access/Security			
	Issue: Trespassing results in surface erosion and exposure.			
	Recommendation: Identify whether additional measures are needed to discourage trespassers, and implement as appropriate.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	EPA/State	EPA	09/01/2014

Protectiveness Statement

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
1	Protectiveness Deferred	09/25/2014

Protectiveness Statement:

A protectiveness determination of the remedy cannot be made at this time without further information. Recommended actions to obtain this information include: obtaining additional soil and ground water data to update the Site characterization; and, completing a data review and evaluation to evaluate health risks associated with current site conditions. Additionally, the LFG collection system needs to be functional in order to remove landfill gases. It is expected that these actions will take approximately 12 months to complete, at which time a protectiveness determination will be made.

Five-Year Review Summary Form (continued)

Environmental Indicators
- Current human exposures at the Site are unknown. *- Current ground water migration is unknown.*

Are Necessary Institutional Controls in Place?
☐ All ☐ Some ☒ None

Has EPA Designated the Site as Sitewide Ready for Anticipated Use?
☐ Yes ☒ No

Has the Site Been Put into Reuse?
☐ Yes ☒ No

Fifth Five-Year Review Report
for
Lee's Lane Landfill Superfund Site

1.0 Introduction

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy will continue to be protective of human health and the environment. FYR reports document FYR methods, findings and conclusions. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA Section 121 states:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each 5 years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

EPA interpreted this requirement further in the NCP, 40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii), which states:

> If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after initiation of the selected remedial action.

Skeo Solutions, an EPA Region 4 contractor, conducted the FYR and prepared this report regarding the remedy implemented at the Lee's Lane Landfill Superfund site (the Site) in Louisville, Jefferson County, Kentucky. The EPA's contractor conducted this FYR from November 2012 to September 2013. The EPA is the lead agency for developing and implementing the remedy for the potentially responsible party-financed cleanup at the Site. Kentucky Department of Environmental Protection (KDEP), as the support agency representing Kentucky, has reviewed all supporting documentation and provided input to the EPA during the FYR process.

This is the fifth FYR for the Site. The triggering action for this policy review is the previous FYR. The FYR is required due to the fact that hazardous substances, pollutants or contaminants

remain at the Site above levels that allow for unlimited use and unrestricted exposure. The Site consists of one operable unit (OU).

2.0 Site Chronology

Table 1 lists the dates of important events for the Site.

Table 1: Chronology of Site Events

Event	Date
Residents complained of flash fires around water heaters due to migration of methane gas from the landfill	1975
The EPA conducted initial site inspection	November 1, 1978
State installed LFG collection system	October 1980
The EPA proposed Site to National Priorities List (NPL)	December 30, 1982
Site listed on NPL	September 8, 1983
The EPA began combined remedial investigation/feasibility study (RI/FS)	September 27, 1983
State conducted preliminary assessment	August 1, 1984
The EPA completed Health Assessment	November 25, 1985
The EPA completed combined RI/FS The EPA signed Record of Decision (ROD)	September 25, 1986
The EPA began remedial action The EPA began first removal	March 16, 1987
The EPA began remedial design	March 20, 1987
The EPA completed remedial action The EPA completed first removal	October 27, 1987
The EPA completed close-out report	March 18, 1988
The EPA completed remedial design	March 31, 1988
The EPA began second removal	September 14, 1988
The EPA completed second removal	September 27, 1988
The EPA signed an Administrative Order on Consent which transferred Operation & Maintenance (O&M) to the Metropolitan Sewer District (MSD)	July 16, 1991
The EPA signed first FYR	May 25, 1993
Consent decrees entered by court	August 4, 1993
Oversight of MSD's O&M transferred to Kentucky Environmental and Public Protection Cabinet (KEPPC)	April 7, 1994
Site deleted from the NPL	April 25, 1996
Consent decree entered by court	January 9, 1997
The EPA signed second FYR	July 1, 1998
The EPA signed third FYR	July 2, 2003
The EPA signed fourth FYR	September 25, 2008

3.0 Background

3.1 Physical Characteristics

The 112-acre Site is located in the City of Louisville, Jefferson County, Kentucky along the bank of the Ohio River and lies between the river and the Louisville Levee (Figure 1). The Site is located near a residential area and the paved Louisville Loop trail runs along

the perimeter of the Site, on top of the Levee. The Louisville Loop is an estimated 100-mile trail system that will encircle the city, and is used for walking, jogging, biking and other recreational activities. The Site is not located in an environmentally sensitive area.

The Site is divided into three portions: a Northern, Central and Southern Tract (Figure 2). The northern and central tracts of the landfill consist of level to gently sloping land, while the southern tract contains two depressions with steep slopes. Elevations on the Site range from 383 feet above mean sea level along the Ohio River to 461 feet at the top of the levee. Some of the property is covered with vegetation ranging from brush to woodlands.

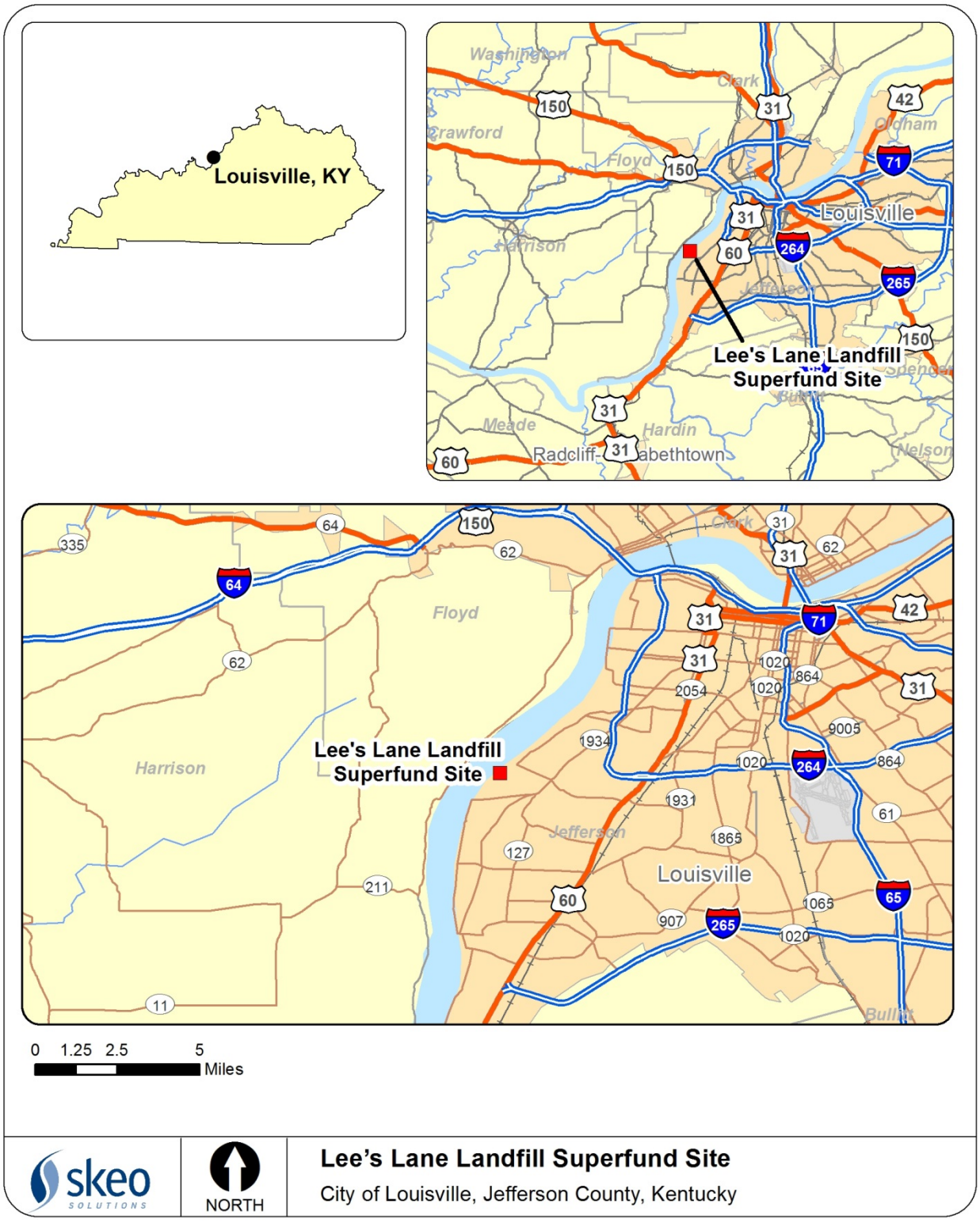
Landfilling of domestic, commercial and industrial wastes led to contamination of soil, ground water and surface water. Major contaminants discovered were benzene, inorganic chemicals and heavy metals, including lead and arsenic. Air was polluted with methane gas vented from the landfill. Exposed drums were found to contain more than 50 chemicals, including phenolic resins, benzene and a variety of heavy metals.

The geology of the Site consists of approximately 110 feet of Ohio River alluvium: 20-30 feet of silts and clay overlying 80-90 feet of sand with varying amounts of gravel. Underlying the river alluvium is New Albany Shale. The alluvial aquifer is unconfined with the shale forming an aquitard between the alluvial aquifer and the deep limestone aquifers. The water table is approximately 50 feet below the surface. Flow in the aquifer is predominantly toward the Ohio River. However, during periods of high river flow, ground water flow direction may reverse. Water levels in the aquifer vary with fluctuations of the Ohio River. The Site lies within the 100-year flood plain of the Ohio River. Table 2 shows the property parcels affected by the Site, some of the parcels are only partially affected by the Site.

Table 2: Affected Property Parcels for the Site

Parcel Number	Location of Parcel	Size	Owner
113500010000	Northern Tract	12 acres	Hofgesang Foundation
113500620000	Northern Tract	0.3 acres	Greater City Realty Corp
113500310000	Northern Tract	0.6 acres	Louisville/Jefferson County Metro Go
113500300000	Northern Tract	0.3 acres	Louisville/Jefferson County Metro Go
113500060000	Northern Tract	0.2 acres	Louisville/Jefferson County Metro Go
101100260001	Central Tract (Ohio River Side)	11 acres	Hofgesang Foundation
101100640000	Central Tract	35 acres	Hofgesang Foundation
101100030001	Southern Tract	62 acres	CT Gernert Inc.
101100070000	Southern Tract	9 acres	Louisville/Jefferson County Metro Go
101170000000	Southern Tract	19 acres	Louisville/Jefferson County Metro Go
101700190000	Southern Tract	313 acres	Louisville Gas & Electric Co

Figure 1: Site Location Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding the EPA's response actions at the Site.

Figure 2: Detailed Site Map

Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding the EPA's response actions at the Site. This map was created using data provided by MSD.

3.2 Land and Resource Use

The Site was used as a landfill from the late 1940s to 1975. The Site is not currently in use except by recreational trespassers, including trespassers on all terrain vehicles (ATVs) and trespassers on foot exploring the Site or collecting things to recycle. During the site inspection, participants noted marked trails for ATVs and confirmed reports of frequent ATV usage. Motor vehicles have restricted access, and Louisville and Jefferson County Metropolitan Sewer District (MSD) vehicles appear to be the main vehicles on site. The Louisville Loop runs along the top of the Louisville Levee, which borders the Site.

The residential area of Riverside Gardens, containing about 330 homes, runs along the southeast border of the Site. The 2008 FYR reported that the entire subdivision has been supplied public water by Louisville Water Company since 1993. In October 2012, EPA surveyed 276 properties surrounding the Site for ground water wells. EPA identified three properties with hand pumps, although property owners are not using the water for drinking water purposes. Property owners of two of the hand pump ground water wells use the water for landscaping or gardening purposes. Streets surveyed include: Putman Avenue; Melrose Avenue; Lucerne Avenue; Kenmore Avenue; Elmwood Avenue; Western Avenue from Melrose Avenue to Elmwood Avenue; and Lee's Lane, Wilmoth and Wilshire Avenues from the Site boundary to approximately Elmwood Avenue. Notification of the well survey was sent to the entire Riverside Gardens community. In response to this notification, EPA received phone calls from several residents on Flagler Avenue noting that homes on this street continued to use ground water as a source of drinking water.

3.3 History of Contamination

Domestic, commercial and industrial wastes were disposed of in the landfill from the late 1940s to 1975. Prior to and during its use as a landfill, sand and gravel were quarried in the south end of the Central Tract. In 1971, Kentucky permitted the Southern Tract of the landfill under its Solid Waste Program. In 1974, the Lee's Lane Landfill permit expired and, due to repeated compliance violations, was not renewed.

In March 1975, the Jefferson County Department of Public Health was notified of the presence of methane gas and flash fires in some homes in the Riverside Gardens subdivision. As a result of explosive gas levels, Jefferson County Housing Authority evacuated seven families along the street closest to the landfill. In April 1975, the Kentucky Natural Resources and Environmental Protection Cabinet filed a lawsuit against the landfill owners, which resulted in the closure of the landfill in the same year.

The EPA initially identified 700-800 companies, individuals, and other entities as having possibly utilized the landfill for waste disposal. After the EPA reviewed responses from the initial notice letters sent, the EPA identified approximately 30 potentially responsible parties (PRPs) as having either owned or operated the Site, transported hazardous

substances to the Site, or arranged for disposal of hazardous substances at the Site. This list of PRPs includes MSD.

3.4 Initial Response

In November 1978, the Surveillance and Analysis Division (SAD) of the Kentucky Division of Waste Management collected samples from residential wells in Riverside Gardens to determine the potential effects of the landfill on ground water quality. As a result of the study, the SAD reported that there was no indication of contaminated ground water migration from the landfill to the residential wells near the landfill.

Between 1975 and 1979, 44 gas observation wells were installed in and around the landfill and in Riverside Gardens to monitor the concentration, pressure and lateral extent of methane gas migration. Samples collected from these wells indicated that the source of the methane and associated toxic gas was the decomposition of landfill wastes. In October 1980, KDHMWM designed and installed a landfill gas (LFG) collection system between the landfill and Riverside Gardens.

In February 1980, the KDHMWM discovered approximately 400 drums within the landfill about 100 feet from the Ohio River bank on a 10-foot vertical rise above the river. In September and October 1981, the landfill owners removed the drums under Court Order. The wastes were removed from the drums and transported to an approved hazardous waste disposal facility. The remaining non-hazardous drummed materials and empty drums were buried on site within the landfill.

In early 1981, the Kentucky Natural Resources and Environmental Protection Cabinet installed 11 shallow ground water monitoring wells at the Site. The EPA later sampled five of these. Analyses of the samples indicated that the on-site ground water contained inorganic contaminants including arsenic, lead and chromium at elevated concentrations. However, the results were believed to be affected by the presence of sediment in the wells, apparently due to improper well installation. The EPA proposed the Site to the NPL on December 12, 1982, and listed it on the NPL on September 8, 1983.

3.5 Basis for Taking Action

The remedial investigation (RI) conducted by the EPA in 1986 described contaminant distribution as follows:

- On-site surface water contained very low levels of contaminants.
- On-site soils and sediments were similar to the off-site background sample collected in Riverside Gardens, suggesting the use of local soils as cover material. In two areas where “hot spot” soil samples were collected, the estimated concentrations of lead and chromium were 2,000 milligrams per kilogram (mg/kg) or parts per million (ppm) each. These areas were located along the access road in the Central Tract and are believed to be the result of indiscriminant dumping, since the concentrations found were not representative of overall soil

concentrations. Soil samples were collected to identify contaminants posing direct contact and runoff hazards. Eight of the 11 soil sampling locations were selected because the surface was crusted, discolored or moist, or because the area showed an obvious lack of vegetation.

- On-site ground water contained low levels of organic compounds and some inorganic contaminants. The major inorganic contaminants included arsenic (87 µg/L), barium (1,100µg/L), cadmium (22 µg/L), chromium (640 µg/L), lead (150 µg/L), manganese (44,000 µg/L) and iron (190,000 µg/L). The off-site concentrations of these contaminants were all below the maximum contaminant levels (MCL) set in the Interim Primary Drinking Water Regulations. Two metal contaminants were found at levels above MCLs: manganese and iron. Manganese was detected at 610µg/L in the Louisville Gas and Electric well and at 370 µg/L in an Indiana public water supply (PWS) well. Iron was detected at 8,900 g/L in an Indiana PWS well, but was below background in both industrial wells. Neither manganese nor iron is considered to have significant health effects.

In 1985, the public health assessment (PHA) concluded that the primary public health concern at the Site was the elevated chromium levels found in on-site ground water. It also concluded that there was no evidence of an off-site public health or environmental problem related to the Site at that time. The PHA did not indicate the need for ground water remediation, but did identify the need for long-term ground water monitoring and ambient air monitoring to establish baseline conditions and to serve as an early detection system should site conditions change. The PHA recognized that the existing gas collection system was mitigating gas migration, but indicated the potential for system repair or replacement. The PHA recommended that a routine subsurface gas monitoring program be implemented outside the collection system and in Riverside Gardens. The PHA also noted that unless access to the Site was controlled, the surface wastes should be removed and the soils containing elevated levels of chromium and lead should be covered.

Based on the detection frequency and chemical, biological and toxicological properties of contaminants identified in the RI, lead, arsenic, benzene and chromium were selected as critical contaminants for further evaluation. Table 3 below provides a summary of the concentration ranges for the critical contaminants identified during sampling for the RI at the Lee's Lane Landfill.

Table 3: Concentration Ranges for Critical Contaminants in the RI

Critical Contaminant	Ground Water (µg/L)	Surface Water (µg/L)	Bottom Sediments (mg/kg)	Surface Soil (mg/kg)
Lead	0 – 100	0 – 10J	10J – 100J	50J – 2,000J
Arsenic	0 – 87	0	5.4 - 27	0 - 25
Benzene	0 – 450	0 - 5J	0 - 15J	0
Chromium	0 – 640	0 - 6.2	9.8 – 30J	10J – 2,000J

J – Estimated value
0 – Not detected

4.0 Remedial Actions

A list of preliminary, applicable technologies was developed based on RI data. This list comprised actions that addressed the potential site problems and pathways of contamination identified during the RI. These technologies were then evaluated relative to the following criteria:

1. Technical considerations (reliability, implementability, etc.)
2. Public health and environmental considerations
3. Institutional considerations (permits, other laws, etc.)
4. Cost considerations

4.1 Remedy Selection

The EPA signed the Site's Record of Decision (ROD) on September 25, 1986. The 1986 ROD did not define Remedial Action Objectives, but the 1986 ROD defined public health objectives to:

1. Construct a ground water monitoring program that will serve as an early warning system should site conditions change.
2. Control the vertical and lateral subsurface migration of methane and other gases.
3. Institute a routine monitoring program that will serve to detect any undesirable and possible dangerous levels of methane and/or toxic vapors migrating into the Riverside Gardens neighborhood.
4. Institute an ambient air monitoring program.

The EPA's 1986 ROD and Enforcement Decision Document (EDD), signed on September 25, 1986, provided for the following response actions:

1. Provision of a properly operating gas collection system.
2. Consideration of a future alternate water supply.
3. Cleanup of the surface waste areas including removal of exposed drums, capping of "hot spot" soils and an area containing exposed trash.
4. Bank Protection Controls including installation of riprap and stabilization of the entire bank (29 acres) along the Ohio River.
5. Posting of cautionary signs.
6. Installation of a gate at the Putnam Street access point.
7. Operation and maintenance activities including inspection of the gas monitoring wells, quarterly gas and ground water sampling and analysis and sampling of air three times per year. Additionally, inspection and maintenance of the gas collection system, capped waste areas and the riprap along the Ohio River bank.
8. Provisions for the sampling of an additional ground water monitor well to aid in determining alternate concentration limits (ACLs).

In previous FYRs ground water concentration data were compared to the ACLs calculated for the Site, in order to evaluate the protectiveness of the remedy. ACLs were not selected as cleanup goals within the 1986 ROD, but rather identified as potential ARARs through RCRA compliance. No ground water remedy was selected in the 1986 ROD. In the 2008 FYR ground water sampling results were compared to the ACLs, which is not appropriate since a ground water remedy was not selected. In order to establish whether or not ground water is capable of being a risk for ingestion, inhalation and dermal contact, EPA will preliminarily compare ground water concentrations to ground water MCLs and other EPA Health Risk Based Levels. At this point, ACLs are not an appropriate measure for the Site per the July 2005 EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-39. The EPA directive provides that site ground water concentration data will be compared to Safe Drinking Water Act MCLs, KDEP ground water standards, and Health Risk Based tap water concentrations (Regional Screening Levels (RSLs) and EPA Region 4 Site Specific Health Risk Based Levels) in order to determine the presence of site related ground water contamination. River water samples will be analyzed and compared to EPA and KDEP surface water concentration standards in order to determine the presence of surface water contamination related to the Site. The additional data may also be used in the calculation of additional risk-based cleanup goals for certain constituents.

Table 4: Ground Water Cleanup Goals

Ground Water COC	Updated 2013 EPA Cleanup Goal (µg/L)
Arsenic	10[a]
Barium	2000[a]
Beryllium	4[a]
Cadmium	5[a]
Chromium (Total)	100[a]
Copper	1300[a]
Iron	24000[b]
Lead	15[a]
Manganese	900[b]
Mercury	2[a]
Selenium	50[a]
Zinc	10000[b]
Benzene	5[a]

a. MCL (Maximum Contaminant Level)
b. EPA Region 4 Site Specific Health Risk Based Level

4.2 Remedy Implementation

As summarized in the December 1987 Remedial Action Report, the remedial actions at the Site began in March 1987 and were completed October 1987. The actions implemented to remove the Site from the NPL included: sampling and disposal of exposed drums (296), identifying and covering “hot spots” of soil contamination, clearing of vegetation from the central tract, riprap placement on approximately 14 acres of riverbank, covering exposed trash with topsoil, sowing the ground with a mixture of grass

seed, and installing gas and water wells for monitoring of any future off-site migration of hazardous materials.

On July 16, 1991, the EPA signed an Administrative Order on Consent (AOC) with Louisville MSD to conduct remedy operation and maintenance. On August 4, 1993, and January 9, 1997, the EPA entered into three Consent Decrees with certain PRPs to reimburse the EPA for the expenses associated with the Site. In addition, the 1993 Consent Decrees included a covenant not to sue those PRPs for a portion of the operation and maintenance costs related to the Site. The EPA deleted the Site from the NPL on April 25, 1996.

Recurring issues with the LFG collection system have been documented in previous FYRs. In 2010, Smith Management Group (SMG) conducted a site inspection at the request of MSD to visually assess the overall condition of the blower equipment, headers and well moisture traps of the LFG collection system. The inspection concluded that "based on the 29-year age of the gas collection system, observations from the 2004 assessment by SCS Engineers, and results of the current assessment, SMG concludes that the current system is inoperable and has exceeded the useful life of the system."

Because of community concerns regarding health issues, in August 2011, the Agency for Toxic Substances and Disease Registry requested the Kentucky Department for Public Health to review cancer morbidity rates in the area surrounding the Site. The Kentucky Department for Public Health review looked at cancer rates from 1999 to 2008 in the 40216 zip code. Zip code 40216 covers over 14 square miles in Jefferson County, of which a small portion is Riverside Gardens. Based upon 2000 census data, approximately 2,074 cases of cancer would be expected. The number of cancers observed was 2,963. The Centers for Disease Control and Prevention guidelines recommend an expected cancer exceedance rate of 2 to 3 times before an environmental investigation is considered. The ratio in this case was 1.43. While somewhat elevated, it did not meet the threshold for further investigation.

In early April 2011, EPA collected soil samples from four locations to determine if hazardous constituents were present at levels exceeding EPA RSLs for residential soils. The four areas were targeted based on the presence of surface accumulation of various types of debris, including crushed drums, wiring, insulators, plastics, different types of metal and material from a fire at a local neoprene plant. All reported arsenic values exceeded the residential RSL for arsenic (0.39 mg/kg). The range of detections for arsenic was 2.9 mg/kg to 4.5 mg/kg. The report states that the detected concentration range is typical for soils derived from weathered sedimentary rock and is not thought to be indicative of contamination at the Site. Three of the four locations had contamination above the residential RSLs. One sample contained benzo(a)pyrene above the residential RSL. Two of the samples contained five semi-volatile compounds above the residential RSL: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene and indeno(1,2,3-cd pyrene). Two of the four sample locations had samples that exceeded the industrial RSL for benzo(a)pyrene.

In April 2012, MSD conducted a gas monitoring wells one year review. MSD evaluated trends of gas concentrations collected in the gas monitoring wells. The report concludes that consistent methane levels below the lower explosive limit (LEL) in the monitoring well indicate that the landfill's gas collection system is not required at this time to prevent migration of methane gas at dangerous levels.

In early April 2013, KDEP collected 33 surface and subsurface soil samples at 28 locations on the Site. Six soil samples were collected from the Northern Tract, 11 soil samples were collected from the Central Tract and 16 soil samples were collected from the Southern Tract. Three quality assurance/quality control samples were collected. The EPA RSLs were exceeded as follows:

- Metals
    - Arsenic: one (1) sample exceeded Kentucky's ambient background levels.
    - Lead: one (1) sample exceeded the residential RSL. The duplicate of this sample also exceeded the industrial RSL.
    - Thallium: one (1) sample exceeded the residential RSL.
    - Iron: one (1) sample exceeded the residential RSL, along with the sample's duplicate.
    - Chromium: currently does not have an RSL. Was detected in all soil samples analyzed ranging from 13-270 mg/kg.
- Organochlorine pesticides and PCBs
    - Dieldrin: one (1) sample exceeded the residential RSL.
    - PCBs: two (2) samples exceeded the residential RSL. Of these, one (1) sample exceeded the industrial RSL.
- Semivolatile organic compounds
    - Benzo(a)pyrene: twenty-three (23) samples exceeded the residential RSL. Of these, three (3)samples exceeded the industrial RSL.
    - Benzo(a)anthracene: three (3) samples exceeded the residential RSL. Of these, two (2)samples exceeded the industrial RSL.
    - Benzo(b)fluroanthene: Eleven (11) samples exceeded the residential RSL. Of these, three (3) samples exceeded the industrial RSL.
    - Dibenzo(a,h)anthracene: two (2) samples exceeded the residential RSL. Of these, one (1) sample exceeded the industrial RSL.
    - Indeno(1,2,3-cd)pyrene: three (3)samples exceeded the residential RSL.
    - Benzo(k)fluoranthene: one (1) sample exceeded the residential RSL. The duplicate of this sample equaled the industrial RSL.
    - Di(2-ethylhexyl)phthalate: one sample exceeded the residential and industrial RSL.

KDEP plans to install 4 to 5 additional ground water monitoring wells at the Site in late 2013. During the week of June 3, 2013, the EPA conducted soil gas monitoring between the gas collection system and the Riverside Gardens community. Sampling extended slightly to the north and south of each end of the current gas collection system monitoring wells. Several existing gas collection monitoring wells were sampled at the same time, for comparison. Data from this soil gas sampling should be available by late September

2013. The EPA and Agency for Toxic Substances and Disease Registry will evaluate the data gathered in each of these events, in order to determine what, if any, additional actions may be necessary at the Site.

4.3 Operation and Maintenance (O&M)

The July 1991 O&M Plan for Post Removal Site Control designated the O&M activities for the Site. These activities were anticipated to be conducted quarterly, unless otherwise specified in the O&M Plan. Activities include:

- Site Inspections
  - Gas collection system
  - Ground water monitoring wells
  - Gas monitoring wells
  - Institutional controls
  - Area wide site conditions (i.e., settlement, erosion, unauthorized dumping)
- Air Quality Monitoring
  - Ambient air sampling
  - Gas monitoring well sampling
- Gas Collection System Balancing and Maintenance
- Ground Water Quality Monitoring
  - Ground water monitoring well sampling
  - Private well sampling
- River Bank Protection Controls
  - Rip-rap slope and drainage swales
  - Surveying
- Landfill Surface and Cap Monitoring and Maintenance
  - Capped area adjacent to Ohio River and “hot spot” areas
  - Mowing

The EPA performed O&M from July 1988 to June 1989. On July 16, 1991, the EPA issued an AOC under which MSD agreed to perform certain O&M activities at the Site for 29 years. The AOC also capped MSD’s spending on specific repair activities at $250,000. On April 7, 1994, KDEP entered into an Intergovernmental Response Agreement with the EPA. Under the agreement, KDEP assumed responsibility for the oversight of MSD’s O&M activities. MSD is conducting all required O&M activities.

In 2005, gas extraction repair estimates were $315,970. The LFG collection system is currently not active, and the EPA, KDEP and MSD are discussing the next steps for the LFG collection system. Table 5 below shows the O&M expenses reported by MSD since the 2008 FYR.

Table 5: Annual O&M Costs Since the 2008 FYR

Year	Total Cost *(rounded to the nearest $1,000)*
2008	$77,000
2009	$67,000
2010	$142,000
2011	$129,000
2012	$116,000

5.0 Progress Since the Last Five-Year Review

The protectiveness statement from the 2008 FYR for the Site stated the following:

"The remedy at the Lee's Lane Landfill Site currently is protective of human health and the environment. However, because of the blockage in the landfill gas collection system causing the system not to function properly, the level of methane in one gas monitoring well is rising. The system needs to function properly to prevent the migration of explosive gases from the landfill to the environment and minimize on-site and off-site risk of exposure to contamination or explosive hazards. In order for the remedy to be protective in the long-term, repairs of the subsurface gas collection system need to be made as soon as possible. Current pedestrian traffic adjacent to the landfill and the quad-runner ATV traffic at the Site should be curtailed to prevent damages to the landfill cap and potential human exposure to Site risks. In addition, restricting use of groundwater at the Site through institutional controls should ensure that the Site continues to be protective of human health and the environment."

The 2008 FYR included four issues and recommendations. This report summarizes each recommendation and its current status in table 6 below.

Table 6: Progress on Recommendations from the 2008 FYR

Section	Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
5.1	Repair and maintenance of the gas collection system.	MSD	12/2009	Additional gas monitoring wells were installed to assess the methane fluctuations.	9/30/2010
5.2	Re-evaluate and improve Site access restriction.	MSD, KEPPC	12/2009	MSD took steps to improve Site access.	6/30/2011
5.3	Establish an information repository locally.	EPA	12/2008	A local repository has been established at the Shively Branch Library.	7/18/2012
5.4	Protect or plug and abandon the monitoring wells no longer being sampled.	MSD	12/2009	The wells were decommissioned.	12/31/2010

5.1 Repair and maintenance of the gas collection system

In order to combat the increasing methane levels and LFG collection system condition, the 2008 FYR recommended that the gas collection system be repaired and maintained. Some repairs have been conducted on the LFG collection system and the blower's effectiveness is unknown. While MSD continues to run the blower, the effect of this is not known. Passive gas venting may be occurring but the system is not currently functional as designed.

Methane has been recorded in well G-1 at various times prior to 2010; however, recent sampling since 2010 has not detected methane in the well. Three additional gas monitoring wells were installed in September 2010 to determine if the drop in methane concentrations for well G-1 was an anomaly due to well damage or if methane continues to migrate from the landfill in the area of well G-1. Results in 2011 and 2012 from the additional gas monitoring wells indicate that the drop in methane concentration is not an anomaly.

5.2 Re-evaluate and improve Site access

As required by the 1986 ROD, the site access roads are gated and locked, and signage is present indicating that trespassing is not allowed and that the Site is a Superfund Site and may have hazards. However, trespassing pedestrians and unauthorized ATVs have raised concern about access restrictions, and the ATVs create eroded soil areas which must be filled and re-seeded on a regular basis. Since the last FYR, MSD took actions to limit access and discourage ATV intrusions and trespassing onto the Site and the flood protection levee area. MSD hired a contractor to install "no trespass signs" and a 6-foot tall, chain-link security fence at three locations, as follows:

- Four signs and a security fence were installed at the end of Elmwood Street adjacent to the Elmwood Auto Salvage Yard.
- One sign and a security fence were installed at the rear of 6628 Huff Lane.
- Four signs, one set of locked 15-feet wide double panel gates and security fence were installed across the abandoned levee section near the railroad track and Cane Run Road.

Work was completed on June 30, 2011, at a total cost of $18,660.00. Although measures have been taken to reduce trespassing, trespassing continues to be an issue at the Site.

5.3 Establish an information repository locally

In July 2012, the EPA re-established a records repository at the Shively-Newman Branch of the Louisville Free Public Library. The repository includes the Site Administrative Record (those documents used to support the ROD at the Site) and the Deletion Docket (those documents used to support the deletion of the Site from the NPL). While not required by statute, the EPA also included all documents which had already been reviewed and released under the Freedom of Information Act. Receipt of the EPA CDs

was acknowledged by the Shively-Newman Branch of the Louisville Free Public Library on July 18, 2012. In addition, KDEP sent a CD containing all KDEP files available for the Site through May 2012 and requested the library make this available with the EPA repository.

5.4 Protect or plug and abandon the monitoring wells no longer being sampled

The three ground water monitoring wells, MW-A, MW-B and MW-02 that were no longer part of the sampling program were decommissioned by the end of 2010.

6.0 Five-Year Review Process

6.1 Administrative Components

EPA Region 4 initiated the FYR in September 2012 and scheduled its completion for September 2013. EPA remedial project manager Donna Seadler led the EPA site review team, which also included EPA site attorney John Sheesley, EPA community involvement coordinator (CIC) Sherryl Lane and contractor support provided to the EPA by Skeo Solutions. In January 2013, the EPA held a scoping call with the review team to discuss the Site and items of interest as they related to the protectiveness of the remedy currently in place. The review schedule established consisted of the following activities:

- Community notification.
- Document review.
- Data collection and review.
- Site inspection.
- Local interviews.
- FYR Report development and review.

6.2 Community Involvement

On February 13, 2013, the EPA published a public notice in the Neighborhood Section of the Louisville Courier-Journal newspaper announcing the commencement of the FYR process for the Site, providing contact information for Donna Seadler and Sherryl Lane and inviting community participation. The press notice is available in Appendix B. One person contacted the EPA as a result of the advertisement but only to say he had not received his copy yet. A copy of the advertisement was emailed and/or sent by the U.S. Post Office to persons on the Site mailing list. The list includes anyone within the immediate community, as well as any interested persons requesting addition to the list.

The EPA will make the final FYR Report available to the public. The EPA will place copies of the document in the designated site repository: Shively Branch of the Louisville Free Public Library located at 3920 Dixie Highway Louisville, Kentucky 40216. Upon completion of the FYR, the EPA will mail out announcements to the community to announce the availability of the final FYR Report in the Site's document repository.

6.3 Document Review

This FYR included a review of relevant, site-related documents, including the Records of Decision, Remedial Action Reports and recent monitoring data. A complete list of the documents reviewed can be found in Appendix A.

ARARs Review

CERCLA Section 121(d)(1) requires that Superfund remedial actions attain "a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further release at a minimum which assures protection of human health and the environment." The remedial action must achieve a level of cleanup that at least attains those requirements that are legally applicable or relevant and appropriate.

- 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 siting laws that specifically address a hazardous substance, remedial action, location or other circumstance found at a CERCLA site.

- Relevant and appropriate requirements are those standards that, while not "applicable," 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 more stringent than federal requirements may be applicable or relevant and appropriate.

- To-Be-Considered (TBC) criteria are non-promulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary remedial action. For example, TBC criteria may be particularly useful in determining health-based levels where no ARARs exist or in developing the appropriate method for conducting a remedial action.

Chemical-specific ARARs are health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish an acceptable amount or concentration of a chemical that may remain in, or be discharged to, the ambient environment. Examples of chemical-specific ARARs include MCLs under the federal Safe Drinking Water Act and ambient water quality criteria enumerated under the federal Clean Water Act.

Action-specific ARARs are technology- or activity-based requirements or limits on actions taken with respect to a particular hazardous substance. These requirements are triggered by a particular remedial activity, such as discharge of contaminated ground water or in-situ remediation.

Location-specific ARARs are restrictions on hazardous substances or the conduct of the response activities solely based on their location in a special geographic area. Examples include restrictions on activities in wetlands, sensitive habitats and historic places.

Remedial actions are required to comply with the chemical-specific ARARs identified in the ROD. In performing the FYR for compliance with ARARs, only those ARARs that address the protectiveness of the remedy are reviewed.

Ground Water ARARs

In previous FYRs, ground water concentration data were compared to the ACLs calculated for the Site, in order to evaluate the protectiveness of the remedy. ACLs were not selected as cleanup goals within the 1986 ROD, but rather identified as potential ARARs through RCRA compliance. No ground water remedy was selected in the 1986 ROD. In the 2008 FYR ground water sampling results were compared to the ACLs, which is not appropriate since a ground water remedy was not selected. In order to establish whether or not ground water is capable of being a risk for ingestion, inhalation and dermal contact, EPA will preliminarily compare ground water concentrations to ground water MCLs and other EPA Health Risk Based Levels. At this point, ACLs are not an appropriate measure for the Site per the July 2005 EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-39. The EPA directive provides that site ground water concentration data will be compared to Safe Drinking Water Act MCLs, KDEP ground water standards, and Health Risk Based tap water concentrations (Regional Screening Levels (RSLs) and EPA Region 4 Site Specific Health Risk Based Levels) in order to determine the presence of site related ground water contamination. River water samples will be analyzed and compared to EPA and KDEP surface water concentration standards in order to determine the presence of surface water contamination related to the Site. The additional data may also be used in the calculation of additional risk-based cleanup goals for certain constituents.

A data review and evaluation will allow EPA to evaluate health risks associated with current site conditions. Once current risks are determined, cleanup goals may need to be established in a decision document.

Table 7: ARAR Review for Ground Water COCs (mg/L)

Ground Water COC	Updated 2013 EPA Cleanup Goal (µg/L)
Arsenic	10[a]
Barium	2000[a]
Beryllium	4[a]
Cadmium	5[a]
Chromium (Total)	100[a]
Copper	1300[a]
Iron	24000[b]
Lead	15[a]
Manganese	900[b]
Mercury	2[a]

Ground Water COC	Updated 2013 EPA Cleanup Goal (µg/L)
Selenium	50[a]
Zinc	10000[b]
Benzene	5[a]

a. MCL (Maximum Contaminant Level)
b. EPA Region 4 Site Specific Health Risk Based Level

Soil ARARs

The 1986 ROD and EDD did not specify ARARs for soil.

Institutional Controls Review

Although institutional controls were not called for in the decision documents, contaminants remain on site above levels that allow for unlimited use and unrestricted exposure.

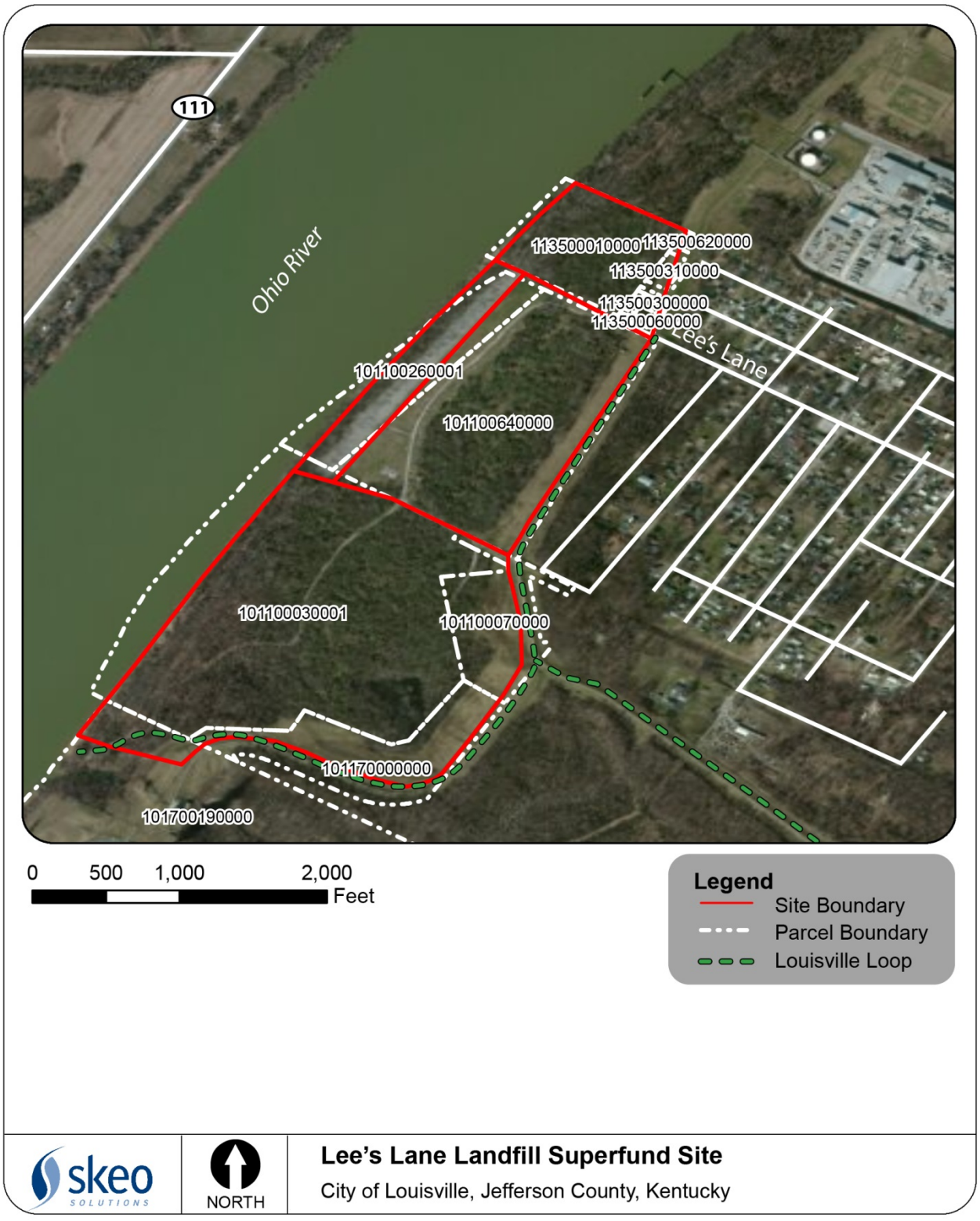
At this time, the ROD does not call for the implementation of institutional controls. However, institutional controls may need to be implemented to ensure the long-term protectiveness of the remedy. At this time, the EPA is considering three types of institutional controls. First, restrictions on ground water use will preclude the drilling of wells or making other use of ground water at properties in the Site vicinity. Second, restrictions on activities at the Site will prevent excavation, drilling or other actions that could impair the integrity of the cap. Third, land use restrictions will prohibit non-industrial uses of the Site properties. All three types of institutional controls can be implemented through restrictive covenants under Kentucky law. Implementation may require the voluntary cooperation of the property owners because no enforcement documents require their cooperation with institutional controls. If institutional controls are necessary, an Explanation of Significant Differences to the ROD would be issued.

Tables 8 lists the institutional controls associated with areas of interest at the Site.

Table 8: Institutional Control (IC) Summary Table

Media	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Instrument in Place	Notes
Ground Water	Yes	No	Currently unknown.	Restrict ground water use.	None	The ground water plume will be evaluated with the construction of five new wells.
Soil	Yes	No	Currently unknown.	Restrict soil disturbance and “hot spot” cap disturbance and property to industrial use.	None	Soil sampling was conducted in 2013 with additional sampling planned.

Figure 3: Institutional Control Base Map



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding the EPA's response actions at the Site. This map was created using information from MSD.

6.4 Data Review

Ground Water Monitoring

In June 1987, the EPA's Ground Water Technology Unit recommended ACLs for the Ohio River (or western) side of the Site. These ACLs were designed to take into account the fact that portions of the Site are adjacent to the Ohio River and that the shallow ground water beneath the Site is diluted when discharging directly into the river. The recommended ACLs were specifically created for the COCs in monitoring wells MW-04 and MW-05.

The EPA does not believe that the current ground water wells are screened at an appropriate depth, therefore current ground water sampling data is not included in this FYR. Plans for additional ground water wells are currently underway.

Ambient Air and Landfill Gas Monitoring

MSD conducts semi-annual ambient air and landfill gas monitoring sampling to evaluate the potential impacts to the surrounding community due to methane and other organic gas generated from the landfill. Kentucky regulations require that the level of gases shall not exceed 25 percent of the LEL in facility structures, or the LEL for all gases at the property boundaries. The O&M manual dictates that readings equal to or greater than 10 percent of the LEL shall require continuous monitoring and readings greater than 25 percent of the LEL shall require that operations stop and evacuation procedures as set forth in the Health and Safety Plan be initiated. Although concentrations of methane and other organic gases exist, they exist at low concentrations, well below their respective lower explosive limits. Table 9 provides maximum and minimum detections reported from 2008-2012 in the gas monitoring wells. Table 10 provides maximum and minimum detections reported from 2008 to 2012 in ambient air samples.

Table 9: Summary of Constituents of Concern in Gas Monitoring Wells

Constituents of Concern during the Five Year Review Period (2008-2012)				
COC	**10 % LEL***	**Range of Detections**	**Date of Highest Reading**	**Date of Lowest Reading**
Benzene (ppbV)	1,350,000	ND-8.93	September 2008 (G1)	Numerous
Methylene Chloride (ppbV)	10,700,000	ND-0.64	April 2008 (G1)	Numerous
Toluene (ppbV)	1,270,000	ND-2	September 2012 (G1)	April 2008 (G2)
Vinyl Chloride (ppbV)	3,600,000	ND-7.96	September 2008 (G1)	Numerous
Xylene (ppbV)	1,000,000	ND-1.24	September 2012 (G1)	Numerous
Methane (ppmV)	5,000	1.24-699	September 2008 (G1)	April 2012 (GMW-1)

Notes:ppmV is parts per million volume
ppbV is parts per billion volume
ND is non-detect
* Kentucky regulations require that the level of gases shall not exceed 25 percent of the LEL in facility structures, or the LEL for all gases at the property boundaries.

Table 10: Summary of Constituents of Concern in Ambient Air Samples

Constituents of Concern during the Five Year Review Period (2008-2012)				
COC	**10 % LEL***	**Range of Detections**	**Date of Highest Reading**	**Date of Lowest Reading**
Benzene (ppbV)	1,350,000	ND-0.33	September 2008 (A2)	Numerous
Methylene Chloride (ppbV)	10,700,000	ND-0.53	September 2009 (R1)	Numerous
Toluene (ppbV)	1,270,000	0.0211-1.15	September 2008 (A2)	April 2012 (U1)
Vinyl Chloride (ppbV)	3,600,000	ND-<0.099	September 2012 (U2)	Numerous
Xylene (ppbV)	1,000,000	ND-<1.25	April 2010 (R2)	Numerous
Methane (ppmV)	5,000	3.04-6.69	September 2010 (R1)	September 2008 (R1)

Notes:
ppmV is parts per million volume
ppbV is parts per billion volume
ND is non-detect
*Kentucky regulations require that the level of gases shall not exceed 25 percent of the LEL in facility structures, or the LEL for all gases at the property boundaries.

For methane, the LEL is 5 percent by volume (50,000 ppm). In September 2008, gas monitoring well G-1 experienced the highest methane level reported during the review period, with a result of 699 ppm. Though much higher than the usual methane concentrations observed at the Site, the value still fell well below the Kentucky standard. The elevated result was an isolated event. Following that monitoring event, methane concentrations in the well fell back to the very low levels typical of the well.

Gas concentrations from the five gas monitoring wells (G-1, 2, 3, 4 and 5) and the six current ambient air monitoring stations (R1, R2, R3, U1, A1 and A2) can be found in Appendix E. All gas well and ambient air monitoring results were well below the 25 percent LEL values for each constituent. No noticeable trends were observed.

6.5 Site Inspection

The FYR site inspection was performed on December 12, 2012. It was a sunny day with temperatures in the mid-40s Fahrenheit. There had been no rain that day or the day before. In attendance were: EPA remedial project manager Donna Seadler; KDEP staff Sheri Adkins and Dan Phelps; Heather Dodds and Tony Marconi from MSD; and Johnny Zimmerman-Ward and Kirby Webster from Skeo Solutions. The completed site inspection checklist is included in Appendix C. Photographs were taken of site features including the capped area, the gas extraction system, ground water monitoring wells and general vegetative cover. Photos are available in Appendix D.

The Site was accessed from Lee's Lane, which is perpendicular to the Site. Access to the Site from Lee's Lane was restricted by a locked security gate. The Site can also be accessed on the southern portion. The southern access is fenced and gated and controlled by Louisville Gas and Electric Company. The Site appears to be accessed frequently by

MSD for maintenance, as well as by pedestrians using the Louisville Loop Trail, a paved trail that traverses the levee along the eastern portion of the Site. Vehicle traffic is limited, although ATV use appears to occur throughout the Site, including the presence of marked trails for such recreational use.

During the site inspection, participants toured the capped landfill area and rip-rap along the Ohio River, viewed the LFG collection system's wells and blower house, and drove throughout the Site to view ground water sampling wells and the status of site vegetation. The Site was in good condition. Small amounts of trash were observed in the area of the old Quarry, on the southern portion of the Central Tract. Some vehicle marks were noted, including rutting along the old levee. All marks appeared to be relatively recent. Signs of ATV use were observed, along with trails marked throughout the wooded sections.

The current status of ground water contamination is unknown because the EPA does not believe the current ground water wells are screened at an appropriate depth. Additionally, the two ground water wells currently sampled are located on the western side of the Site (along the riverbank), so ground water contamination on the side of the Site adjacent to the residential homes is unknown. There was also very little data regarding the surface soil at the Site. Plans for conducting additional soil sampling as well as the installation of new ground water wells for ground water monitoring were discussed. Upgrades to the LFG collection system were also discussed, including the need to install a new system because of the age and status of the current system.

The Site contains two ground water monitoring wells, both of which were clearly labeled and properly secured. MSD performs annual ground water sampling at the Site and MSD is responsible for site maintenance and inspections.

6.6 Interviews

The FYR process included interviews with parties affected by the Site, including the current landowners and regulatory agencies involved in Site activities or aware of the Site. The purpose was to document the perceived status of the Site and any perceived problems or successes with the phases of the remedy implemented to date. The interviews took place on February 12 and February 13, 2013. The interviews are summarized below.

Residents near the Site had health concerns. Many of the people in the community lived there as children and played on the Site. Some residents reported that their family members had multiple health problems. There is a public bicycle trail that cuts through the Site and residents wanted to be sure that it was safe to ride on the trail. Some residents felt that the Site was not safe and would like to see a more thorough clean up. The homeowners association would like to get a copy of the results of sampling taken on or near the Site.

7.0 Technical Assessment

7.1 Question A: Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, risk assumptions, and the site inspection indicate that the Site's remedy was constructed in accordance with the requirement of the site ROD; however the systems are not currently functioning. Additionally, the ROD did not: identify a ground water remedy; identify RCRA capping requirements; select the LFG collection system as the remedy; identify institutional controls; or identify risk at the Site.

Removal activities conducted in 1987 included sampling and disposal of exposed drums (296), identifying and covering "hot spots" of contamination, clearing of vegetation from the central tract, riprap placement on approximately 14 acres of riverbank, covering exposed trash with topsoil, sowing the ground with a mixture of grass seed and the installation of gas and water wells for monitoring of any future off-site migration of hazardous materials. The Site achieved construction completion on March 18, 1988, and was deleted from the NPL on April 25, 1996.

The 2010 system evaluation conducted by MSD concluded that the current system is not operating as designed and requires full replacement.

Due to the age of the LFG collection system, the placement of the original ground water wells, and the original soil sampling, current protectiveness is unknown. Updated sampling will characterize the remaining contamination. Data will be evaluated to determine if additional sampling needs to be conducted for soil vapor intrusion.

Once ground water and soil data have been evaluated, institutional controls may need to be put in place. At this time, the ROD does not call for the implementation of institutional controls. However, institutional controls may need to be implemented to ensure the long-term protectiveness of the remedy. At this time, the EPA is considering three types of institutional controls. First, restrictions on ground water use will preclude the drilling of wells or making other use of ground water at properties in the Site vicinity. Second, restrictions on activities at the Site will prevent excavation, drilling or other actions that could impair the integrity of the cap. Third, land use restrictions will prohibit non-industrial uses of the Site properties. All three types of institutional controls can be implemented through restrictive covenants under Kentucky law. Implementation may require the voluntary cooperation of the property owners because no enforcement documents require their cooperation with institutional controls. If institutional controls are necessary, an Explanation of Significant Differences to the ROD would be issued at a minimum. Depending on the scope of changes to the ROD, a ROD amendment or new ROD may be necessary.

7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of remedy selection still valid?

The exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection need to be updated. In previous FYRs, ground water concentration data were compared to the ACLs calculated for the Site, in order to evaluate the protectiveness of the remedy. ACLs were not selected as cleanup goals within the 1986 ROD, but rather identified as potential ARARs through RCRA compliance. No ground water remedy was selected in the 1986 ROD. In the 2008 FYR ground water sampling results were compared to the ACLs, which is not appropriate since a ground water remedy was not selected. In order to establish whether or not ground water is capable of being a risk for ingestion, inhalation and dermal contact, EPA will preliminarily compare ground water concentrations to ground water MCLs and other EPA Health Risk Based Levels. At this point, ACLs are not an appropriate measure for the Site per the July 2005 EPA Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-39. The EPA directive provides that site ground water concentration data will be compared to Safe Drinking Water Act MCLs, KDEP ground water standards, and Health Risk Based tap water concentrations (Regional Screening Levels (RSLs) and EPA Region 4 Site Specific Health Risk Based Levels) in order to determine the presence of site related ground water contamination. River water samples will be analyzed and compared to EPA and KDEP surface water concentration standards in order to determine the presence of surface water contamination related to the Site. The additional data may also be used in the calculation of additional risk-based cleanup goals for certain constituents.

A qualitative evaluation of potential human and ecological health risks was conducted by EPA in 2010, and data gaps were identified for soil and ground water, leading to plans for further sampling. In 2011, soil samples taken at targeted locations were evaluated, concluding that none of the data exceeded an excess cancer risk of 1×10^{-6} or a hazard index of 1, based on the conservative assumption of chronic daily residential exposure. Additional samples are being collected and will be evaluated for risk. Based on available data to date, no unacceptable risks have been identified based on current exposures to soil, ground water, surface water or air. Institutional controls may need to be established in a decision document, if warranted by additional sampling.

Trespassing has been an ongoing issue at the Site. ATV trails were observed during the site inspection. Trespassing results in surface erosion and exposure. Additional measures may need to be taken to discourage trespassers.

7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

7.4 Technical Assessment Summary

The LFG collection system is necessary in order to meet the public health objective to control the vertical and lateral subsurface migration of methane and other gases. However, the system itself was not identified as part of the remedy in the decision documents. In addition, ground water wells were not screened accurately, and some soil contamination has not been delineated. A qualitative evaluation of potential human and ecological health risks was conducted by EPA in 2010, and data gaps were identified for soil and ground water, leading to plans for further sampling. In 2011, soil samples taken at targeted locations were evaluated, concluding that none of the data exceeded an excess cancer risk of 1×10^{-6} or a hazard index of 1, based on the conservative assumption of chronic daily residential exposure. Additional samples are being collected and will be evaluated for risk. Based on available data to date, no unacceptable risks have been identified based on current exposures to soil, ground water, surface water or air.

At this time, there is insufficient data to assess current exposure pathways.

8.0 Issues

Table 11 summarizes the current site issues.

Table 11: Current Site Issues

Issue	Affects Current Protectiveness?	Affects Future Protectiveness?
The 1986 ROD did not identify a ground water remedy.	No	Yes
The 1986 ROD did not identify RCRA capping requirements.	No	Yes
The LFG collection system is currently not working as designed and may no longer be in an optimal location. Also it was not selected as the remedy in the 1986 ROD.	Yes	Yes
The 1986 ROD did not include institutional controls.	No	Yes
Risk has not been identified at the Site.	Yes	Yes
Ground water is not adequately characterized and new wells are needed to obtain sufficient data.	No	Yes
Soil contamination is insufficiently characterized at the Site.	Yes	Yes
Trespassing results in surface erosion and exposure.	Yes	Yes

9.0 Recommendations and Follow-up Actions

Table 12 provides recommendations to address the current site issues.

Table 12: Recommendations to Address Current Site Issues

Issue	Recommendation / Follow-Up Action	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
					Current	Future
The 1986 ROD did not identify a ground water remedy.	Review ground water data and determine if a ground water remedy needs to be established, along with ground water cleanup goals, in a decision document.	EPA/KDEP	EPA	09/01/2014	No	Yes
The 1986 ROD did not identify RCRA capping requirements.	Evaluate capping requirements and incorporate them into a decision document, if necessary.	EPA/KDEP	EPA	09/01/2014	No	Yes
The LFG collection system is currently not working as designed and may no longer be in an optimal location. Also it was not selected as the remedy in the 1986 ROD.	Determine next steps for installing updated LFG collection system and install new system. Select the LFG collection system as the remedy if it was meant to be the remedy.	EPA/KDEP	EPA	09/01/2014	Yes	Yes
The 1986 ROD did not include institutional controls.	Evaluate the need for institutional controls in conjunction with current ground water sampling efforts. Consider institutional controls for the capped landfill area. Identify institutional control requirement in an enforceable document, if necessary.	EPA/KDEP	EPA	09/01/2014	No	Yes
Risk has not been identified at the Site.	Conduct an updated data review and evaluation.	EPA/KDEP	EPA	09/01/2014	Yes	Yes

Issue	Recommendation / Follow-Up Action	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
					Current	Future
Ground water is not adequately characterized and new wells are needed to obtain sufficient data.	Install new ground water wells to appropriately characterize contamination and ground water flow. Address contamination as appropriate. Evaluate contaminant levels and ecological impacts at the discharge point to the Ohio River. Evaluate data to determine if additional sampling needs to be conducted for soil vapor intrusion.	EPA/KDEP	EPA	09/01/2014	No	Yes
Soil contamination is insufficiently characterized.	Identify location of any remaining soil contamination through soil sampling, and address contamination, as appropriate.	EPA/KDEP	EPA	09/01/2014	Yes	Yes
Trespassing results in surface erosion and exposure.	Identify whether additional measures are needed to discourage trespassers, and implement as appropriate.	EPA/KDEP	EPA	09/01/2014	Yes	Yes

10.0 Protectiveness Statement

A protectiveness determination of the remedy cannot be made at this time without further information. Recommended actions to obtain this information include: obtaining additional soil and ground water data to update the Site characterization; and completing a data review and evaluation to evaluate health risks associated with current site conditions. Additionally, the LFG collection system needs to be included in the site remedy, and properly functioning to remove landfill gases. It is expected that these actions will take approximately 12 months to complete, at which time a protectiveness determination will be made.

11.0 Next Review

The next FYR will be due within five years of the signature/approval date of this FYR.

Appendix A: List of Documents Reviewed

Administrative Order on Consent. In the Matter of: Lee's Lane Superfund Site, Jefferson County, Kentucky. Louisville and Jefferson County Metropolitan Sewer District and Jefferson County, Kentucky. July 16, 1991.

Intergovernmental Response Agreement between the Kentucky Natural Resources and Environmental Protection Cabinet and the U.S. Environmental Protection Agency, Region IV for Operation and Maintenance Activities at the Lee's Lane Landfill Site. April 7, 1994.

Lee's Lane Landfill Gas Monitoring Wells One-Year Review Report. Prepared for Louisville and Jefferson County Metropolitan Sewer District by Smith Management Group. April 2012.

Lee's Lane Landfill Sampling Report April 1, 2013 Sampling Event. Lees Lane. Louisville, Jefferson County, Kentucky. Federal Section, Superfund Branch. Division of Waste Management. Frankfort, KY.

Lee's Lane Satellite Sites. Report of Soil Sampling Investigation. Lee's Lane, Louisville, Kentucky. U.S. EPA Region 4 Science and Ecosystem Support Division. April 6, 2011.

Memorandum summarizing Task 3.0: Phase I Site Evaluation of Landfill Gas Collection System. Lee's Lane Landfill Superfund Site. Louisville, Kentucky. Smith Management Group. August 4, 2010.

Operation and Maintenance Plan For Post-Removal Site Control at the Lee's Lane Landfill Site. Louisville, Kentucky. 1991

Results of Air Quality Monitoring FY 08, Fourth Quarter (FY08-4Q), Lee's Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. June 19, 2008.

Results of Air Quality Monitoring FY 09, Fourth Quarter (FY09-4Q), Lee's Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. December 31, 2008.

Results of Air Quality Monitoring FY 09, Fourth Quarter (FY09-4Q), Lee's Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. June 9, 2009.

Results of Air Quality Monitoring FY 09, Fourth Quarter (FY09-1Q), Lee's Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. December 31, 2008.

Results of Air Quality Monitoring FY 10, First Quarter (FY10-1Q), Lee's Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. November 9, 2009.

Results of Air Quality Monitoring FY 10, First Quarter (FY10-4Q), Lee's Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. September 8, 2009.

Results of Air Quality Monitoring FY 11, First Quarter (FY10-1Q), Lee's Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. November 29, 2010.

Results of Air Quality Monitoring FY 11, Fourth Quarter (FY11-4Q), Lee's Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. August 4, 2011.

Results of Air Quality Monitoring FY 12, Fourth Quarter (FY12-4Q), Lee's Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. June 20, 2012.

Results of Air Quality Monitoring FY 13, First Quarter (FY13-1Q), Lee's Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. November 26, 2012.

Sampling Event #34, Result of Groundwater Quality Monitoring – FY 10, First Quarter (FY10-1Q, Lees Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. October 16, 2009.

Sampling Event #36, Result of Groundwater Quality Monitoring – FY 11, First Quarter (FY11-1Q, Lees Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. October 22, 2010.

Sampling Event #37, Result of Groundwater Quality Monitoring – FY 12, First Quarter (FY12-1Q, Lees Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. October 17, 2011.

Sampling Event #38, Result of Groundwater Quality Monitoring – FY 12, First Quarter (FY12-1Q, Lees Lane Superfund Site, Jefferson County, Kentucky, Administrative Order on Consent, USEPA Docket No-91-32-C. MSD. November 16, 2012.

Summary Report: Task 1: Gas Monitoring Well Installations and Task 2: Groundwater Monitoring Well Closures. Lee's Lane Landfill Superfund Site. Louisville-Jefferson County, KY. Prepared for Louisville and Jefferson County Metropolitan Sewer District by Smith Management Group. December 2010.

Appendix B: Press Notice

The U. S. Environmental Protection Agency, Region 4
Announces the Fifth Five-Year Review for
the Lee's Lane Landfill Superfund Site,
Louisville, Jefferson County, Kentucky

Purpose/Objective: The U.S. Environmental Protection Agency (EPA) is conducting a Five-Year Review of the remedy for the Lee's Lane Landfill Superfund site (the Site) in Louisville, Kentucky. The purpose of the Five-Year Review is to make sure the selected cleanup actions effectively protect human health and the environment.

Site Background: The 112-acre Site is located in the Ohio River floodplain in Louisville, Kentucky. The Site was the location of a sand and gravel quarry; a landfill also operated on site between 1948 and 1975. In 1975, nearby residents reported flash fires around their water heaters. In 1980, state personnel discovered about 400 drums of hazardous materials along the Ohio River next to the landfill. The drums contained more than 50 chemicals, including phenolic resins, benzene and a variety of heavy metals. Soil, ground water, and surface water were contaminated with benzene, inorganic chemicals and heavy metals, including lead and arsenic. Methane gas vented from the landfill also impacted air quality. EPA placed the Site on the National Priorities List (NPL) in 1983. EPA deleted the Site from the NPL in 1996.

Cleanup Actions: EPA's 1986 Record of Decision selected a remedy to address the Site's soil, ground water and surface water contamination. The major components included a gas and air monitoring system to address the potential release of methane and hazardous gases to the air and subsurface. It also included a ground water monitoring program to establish baseline conditions at the Site and to serve as an early warning for any contamination migration. The remedy also included putting riprap in place to prevent erosion of the Ohio River bank, capping "hot spot" areas and removing exposed drums.

Five-Year Review Schedule: The National Contingency Plan requires review of remedial actions that result in any hazardous substances, pollutants or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure every five years to ensure the protection of human health and the environment. EPA will complete the fifth of the Five-Year Reviews for the Site by September 2013.

EPA Invites Community Participation in the Five-Year Review Process: EPA is conducting this Five-Year Review to evaluate the effectiveness of the Site's remedy and to make sure the remedy remains protective of human health and the environment. As part of the Five-Year Review process, EPA staff members are available to answer any questions about the Site. Community members who have questions about the Site or the Five-Year Review process, or who would like to participate in a community interview, are asked to contact:

Donna Seadler, EPA Remedial Project Manager
Phone: (404) 562-8870
Email: seadler.donna@epa.gov

Sherryl Lane, EPA Community Involvement Coordinator
Phone: (404) 562-8611
Email: lane.sherryl@epa.gov

Mailing Address: U.S. EPA Region 4, 61 Forsyth Street, S.W., 11th Floor, Atlanta, GA 30303-8960

Additional site information is available at the Site's local document repository, located at the Shively Branch Library, 3920 Dixie Highway, Louisville, Kentucky 40216, and online at: *http://www.epa.gov/region4/superfund/sites/npl/kentucky/leelky.html*.

Appendix C: Site Inspection Checklist

Site Inspection Checklist

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST	
I. SITE INFORMATION	
Site Name: Lee's Lane Landfill	**Date of Inspection: 12/12/2012**
Location and Region: Louisville, Kentucky, Region 4	**EPA ID: KYD980557052**
Agency, Office or Company Leading the Five-Year Review: EPA	**Weather/Temperature: mostly sunny/45°**
Remedy Includes: (Check all that apply) ☒ Landfill cover/containment ☒ Access controls ☐ Institutional controls ☐ Ground water pump and treatment ☐ Surface water collection and treatment ☒ Other: Gas extraction system	☐ Monitored natural attenuation ☐ Ground water containment ☐ Vertical barrier walls
Attachments: ☒ Inspection team roster attached ☐ Site map attached	
II. INTERVIEWS (check all that apply)	
1. **O&M Site Manager** _____ Name _____ Title mm/dd/yyyy Date Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____ Problems, suggestions ☐ Report attached: _____	
2. **O&M Staff** _____ Name _____ Title mm/dd/yyyy Date Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____ Problems/suggestions ☐ Report attached: _____	

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone No.
Problems/suggestions ☐ Report attached: _____

Agency _____
Contact _____Name _____ _____ _____
Title Date Phone No.
Problems/suggestions ☐ Report attached:_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone No.
Problems/suggestions ☐ Report attached:_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone No.
Problems/suggestions ☐ Report attached: _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone No.
Problems/suggestions ☐ Report attached:_____

4. **Other Interviews** (optional) ☐ Report attached: _____

III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☒ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☒ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

2.	**Site-Specific Health and Safety Plan**	☐ Readily available	☐ Up to date	☒ N/A
	☐ Contingency plan/emergency response plan	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

3.	**O&M and OSHA Training Records**	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	☒ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
	☐ Other permits: _____	☐ Readily available	☐ Up to date	☒ N/A
	Remarks: _____			
5.	**Gas Generation Records**	☒ Readily available	☐ Up to date	☐ N/A
	Remarks: The LFG collection system is off line.			
6.	**Settlement Monument Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks: _____			
7.	**Ground Water Monitoring Records**	☒ Readily available	☐ Up to date	☐ N/A
	Remarks: _____			
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks: _____			
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	☒ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☒ N/A
	Remarks: _____			
10.	**Daily Access/Security Logs**	☐ Readily available	☐ Up to date	☒ N/A
	Remarks: _____			

IV. O&M COSTS

1.	**O&M Organization**	
	☐ State in-house	☐ Contractor for state
	☒ PRP in-house	☒ Contractor for PRP
	☐ Federal facility in-house	☐ Contractor for Federal facility
	☐ _____	

2. **O&M Cost Records**

☒ Readily available ☒ Up to date

☒ Funding mechanism/agreement in place ☐ Unavailable

Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From: 01/01/2008 Date	To: 12/31/2008 Date	$77,000 Total cost	☐ Breakdown attached
From: 01/01/2009 Date	To: 12/31/2009 Date	$67,000 Total cost	☐ Breakdown attached
From: 01/01/2010 Date	To: 12/31/2010 Date	$142,000 Total cost	☐ Breakdown attached
From: 01/01/2011 Date	To: 12/31/2011 Date	$129,000 Total cost	☐ Breakdown attached
From: 01/01/2012 Date	To: 12/31/2012 Date	$116,000 Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: _____

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☐ N/A

Remarks: Signs were legible and in good condition.

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): _____

Frequency: _____

Responsible party/agency: _____

Contact _____ _____ mm/dd/yyyy _____

Name Title Date Phone no.

Reporting is up to date ☐ Yes ☐ No ☐ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☐ N/A

Other problems or suggestions: ☐ Report attached

Remarks: ICs are not required in the decision documents.

2. **Adequacy** ☐ ICs are adequate ☒ ICs are inadequate ☐ N/A

Remarks: There are no ICs currently in place to restrict land use.

D. General

1. **Vandalism/Trespassing** ☒ Location shown on site map ☐ No vandalism evident

Remarks: Trespassers use the Site for ATV use.

2. **Land Use Changes On Site** ☒ N/A

Remarks: _____

3. **Land Use Changes Off Site** ☒ N/A

Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads Damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: _____

B. Other Site Conditions

Remarks: _____

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (low spots) ☐ Location shown on site map ☒ Settlement not evident

Arial extent: _____ Depth: _____

Remarks: _____

2.	**Cracks**	☐ Location shown on site map	☒ Cracking not evident
	Lengths: _____	Widths: _____	Depths: _____
	Remarks: _____		
3.	**Erosion**	☐ Location shown on site map	☒ Erosion not evident
	Arial extent: _____		Depth: _____
	Remarks: _____		
4.	**Holes**	☐ Location shown on site map	☒ Holes not evident
	Arial extent: _____		Depth: _____
	Remarks: _____		
5.	**Vegetative Cover**	☐ Grass	☒ Cover properly established
	☐ No signs of stress	☐ Trees/shrubs (indicate size and locations on a diagram)	
	Remarks: Some rutting evident.		
6.	**Alternative Cover** (e.g., armored rock, concrete)		☒ N/A
	Remarks: _____		
7.	**Bulges**	☐ Location shown on site map	☒ Bulges not evident
	Arial extent: _____		Height: _____
	Remarks: _____		
8.	**Wet Areas/Water Damage**	☒ Wet areas/water damage not evident	
	☐ Wet areas	☐ Location shown on site map	Arial extent: _____
	☐ Ponding	☐ Location shown on site map	Arial extent: _____
	☐ Seeps	☐ Location shown on site map	Arial extent: _____
	☐ Soft subgrade	☐ Location shown on site map	Arial extent: _____
	Remarks: _____		
9.	**Slope Instability**	☐ Slides	☐ Location shown on site map
	☒ No evidence of slope instability		
	Arial extent: _____		
	Remarks: _____		
B. Benches		☐ Applicable ☒ N/A	
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench**	☐ Location shown on site map	☐ N/A or okay
	Remarks: _____		
2.	**Bench Breached**	☐ Location shown on site map	☐ N/A or okay
	Remarks: _____		

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay

Remarks: _____

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mats, riprap, grout bags or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ No evidence of settlement

Arial extent: _____ Depth: _____

Remarks: _____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation

Material type:_____ Arial extent: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☐ No evidence of erosion

Arial extent: _____ Depth: _____

Remarks: _____

4. **Undercutting** ☐ Location shown on site map ☐ No evidence of undercutting

Arial extent: _____ Depth: _____

Remarks: _____

5. **Obstructions** Type: _____ ☐ No obstructions

☐ Location shown on site map Arial extent: _____

Size: _____

Remarks: _____

6. **Excessive Vegetative Growth** Type: _____

☐ No evidence of excessive growth

☐ Vegetation in channels does not obstruct flow

☐ Location shown on site map Arial extent: _____

Remarks: _____

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☐ Active ☒ Passive

☒ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: _____

2. **Gas Monitoring Probes**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: _____

3. **Monitoring Wells** (within surface area of landfill)

☐ Properly secured/locked ☒ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☐ N/A

Remarks: Monitoring wells are functioning and sampled but not located on capped area.

4. **Extraction Wells Leachate**

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ Evidence of leakage at penetration ☐ Needs maintenance ☒ N/A

Remarks: _____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☒ N/A

Remarks: _____

E. Gas Collection and Treatment ☐ Applicable ☒ N/A

1. **Gas Treatment Facilities**

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Gas Collection Wells, Manifolds and Piping**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs maintenance ☐ N/A

Remarks: _____

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A

Remarks: _____

2. **Outlet Rock Inspected** ☐ Functioning ☐ N/A

Remarks: _____

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. **Siltation** Area extent: _____ Depth: _____ ☐ N/A

☐ Siltation not evident

Remarks: _____

2. **Erosion** Area extent: _____ Depth: _____

☐ Erosion not evident

Remarks: _____

3. **Outlet Works** ☐ Functioning ☐ N/A

Remarks: _____

4. **Dam** ☐ Functioning ☐ N/A

Remarks: _____

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident

Horizontal displacement: _____ Vertical displacement: _____

Rotational displacement: _____

Remarks: _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident

Remarks: _____

I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☒ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A

☐ Vegetation does not impede flow

Area extent: _____ Type: _____

Remarks: _____

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident

Area extent: _____ Depth: _____

Remarks: _____

4. **Discharge Structure** ☐ Functioning ☐ N/A

Remarks: _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident

Area extent: _____ Depth: _____

Remarks: _____

2. **Performance Monitoring** Type of monitoring: _____

☐ Performance not monitored

Frequency: _____ ☐ Evidence of breaching

Head differential: _____

Remarks: _____

IX. GROUND WATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

A. Ground Water Extraction Wells, Pumps and Pipelines ☐ Applicable ☐ N/A

1. **Pumps, Wellhead Plumbing and Electrical**

☐ Good condition ☐ All required wells properly operating ☐ Needs maintenance ☐ N/A

Remarks: _____

2. **Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

B. Surface Water Collection Structures, Pumps and Pipelines ☐ Applicable ☐ N/A

1. **Collection Structures, Pumps and Electrical**

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

C. Treatment System ☐ Applicable ☒ N/A

1. **Treatment Train** (check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☐ Carbon adsorbers

☐ Filters: _____

☐ Additive (e.g., chelation agent, flocculent): _____

☐ Others: _____

☐ Good condition ☐ Needs maintenance

☐ Sampling ports properly marked and functional

☐ Sampling/maintenance log displayed and up to date

☐ Equipment properly identified

☐ Quantity of ground water treated annually: _____

☐ Quantity of surface water treated annually: _____

Remarks: _____

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks: _____

4. **Discharge Structure and Appurtenances**

☐ N/A ☐ Good condition ☐ Needs maintenance

Remarks: _____

5. **Treatment Building(s)**

☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair

☐ Chemicals and equipment properly stored

Remarks: _____

6. **Monitoring Wells** (pump and treatment remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

D. Monitoring Data

1. **Monitoring Data**

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. **Monitoring Data Suggests:**

☐ Ground water plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation	
1.	**Monitoring Wells** (natural attenuation remedy)
	☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
	☐ All required wells located ☐ Needs maintenance ☒ N/A
	Remarks: _____
X. OTHER REMEDIES	
If there are remedies applied at the site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.	
XI. OVERALL OBSERVATIONS	
A.	**Implementation of the Remedy**
	Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions). The current status of ground water, vapor intrusion and soil contamination is unknown.
B.	**Adequacy of O&M**
	Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. O&M appears to be adequate, in the long term, O&M operations need to be appropriate for contamination identified.
C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. No issues were observed based on the current O&M activities.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. In order to identify opportunigies for optimization, it is imperative to identify the status of the contamination and risks, if any.

Site Inspection Team:

Donna Seadler, EPA Region 4
Sheri Adkins, KDEP
Dan Phelps, KDEP
Heather Dodds, MSD
Toni Marconi, MSD
Johnny Zimmerman-Ward, Skeo Solutions
Kirby Webster, Skeo Solutions

Appendix D: Photographs from Site Inspection Visit

Looking across the cap toward the Ohio River.

Rip rap between the cap and the Ohio River.

Signage on the northern edge of the cap, with a trail on the right side of the sign.

Ground water monitoring well near the cap along Ohio River. The well is securely locked.

Sign identifying the Site.


Clearly marked four wheeling trail near sign and ground water monitoring well.

Debris near the location of the old Quarry in the southern portion of the Site.

Wells along the gas extraction system and the blower house for the gas extraction system.

Signs clearly marking the gas extraction system.


Southern access controlled by Louisville Gas and Electric Company.

Entrance from Lee's Lane. Gate is locked and maintained by MSD.

Louisville Loop walkway along the levee on the east side of the Site. Gas extraction blower house can be viewed on right side of photo.

Appendix E: Data

Ambient Air Samples 2008-2012

Sample ID	Benzene (ppbV)	Methylene chloride (ppbV)	Toluene (ppbV)	Vinyl Chloride (ppbV)	Xylene (ppbV) (Total)	Methane (ppmV)
A1						
Apr-08	0.08	ND	0.12	ND	ND	3.88
Sep-08	0.11	0.11	0.61	ND	0.1	3.81
Apr-09	0.08	0.1	0.04	ND	ND	4.48
Sep-09	0.146	0.057	0.653	ND	0.121	4.65
Apr-10	0.0353	ND	0.0715	ND	<0.979	4.61
Sep-10	0.0318	ND	0.053	ND	0.016	5.18
Apr-11	0.0905	0.0724	0.0561	ND	ND	6.17
Sep-11	0.0811	0.0438	0.229	ND	0.0378	4.32
Apr-12	ND	0.0756	0.0348	ND	ND	4.11
Sep-12	0.14	0.096	0.631	<0.068	0.083	5.07
A2						
Apr-08	NA	NA	NA	NA	NA	NA
Sep-08	0.33	0.11	1.15	ND	0.3	3.42
Apr-09	0.13	0.49	1.01	ND	1.01	5.18
Sep-09	0.159	0.052	0.742	ND	0.162	4.29
Apr-10	0.0521	ND	0.117	ND	<1.09	4.86
Sep-10	0.0275	ND	0.0858	ND	0.017	5.75
Apr-11	0.0855	0.0819	0.0953	ND	ND	5.94
Sep-11	0.0834	0.0257	0.209	ND	ND	5.06
Apr-12	ND	0.0522	0.0772	ND	ND	4.56
Sep-13	0.098	0.072	0.407	<0.083	<0.265	4.76
U1						
Apr-08	ND	ND	0.1	ND	ND	3.95
Sep-08	0.11	0.09	0.6	ND	0.07	3.82
Apr-09	0.1	ND	0.25	ND	0.25	4.64
Sep-09	0.138	0.049	0.574	ND	0.182	3.54
Apr-10	ND	ND	0.117	ND	<1.18	4.53
Sep-10	ND	0.0243	0.046	ND	0.0057	6.59
Apr-11	0.0665	0.0774	0.0769	ND	ND	5.65
Sep-11	0.0713	0.0248	0.274	ND	ND	5.44
Apr-12	ND	0.0157	0.0211	ND	ND	4.53
Sep-12	<0.075	0.165	0.498	<0.094	<0.299	4.71
U2						
Apr-08	Not Reported					

Sample ID	Benzene (ppbV)	Methylene chloride (ppbV)	Toluene (ppbV)	Vinyl Chloride (ppbV)	Xylene (ppbV) (Total)	Methane (ppmV)
Sep-08	Not Reported					
Apr-09	Not Reported					
Sep-09	Not Reported					
Apr-10	Not Reported					
Sep-10	Not Reported					
Apr-11	Not Reported					
Sep-11	0.0767	0.0178	0.195	ND	ND	5.16
Apr-12	ND	0.0332	0.0566	ND	ND	4.07
Sep-12	<0.079	0.066	0.358	<0.099	<0.315	4.78
R1						
Apr-08	ND	ND	0.14	ND	ND	5.35
Sep-08	0.11	0.07	0.58	ND	0.08	3.04
Apr-09	0.05	0.04	0.04	ND	ND	4.87
Sep-09	0.192	0.53	1.11	ND	0.182	3.54
Apr-10	0.073	0.0415	0.19	ND	<0.901	4.06
Sep-10	0.0669	ND	0.147	ND	0.0647	6.69
Apr-11	0.107	0.0675	0.116	ND	0.0649	5.41
Sep-11	0.126	0.0537	0.338	ND	0.0902	4.61
Apr-12	0.105	0.273	0.136	ND	ND	3.82
Sep-12	0.139	0.093	0.519	<0.064	0.079	3.95
R2						
Apr-08	ND	ND	0.09	ND	ND	4.81
Sep-08	0.12	0.07	0.67	ND	0.08	3.41
Apr-09	ND	ND	0.08	ND	ND	4.32
Sep-09	0.152	0.053	0.842	ND	0.154	4.03
Apr-10	0.0525	ND	0.0974	ND	<1.25	5.04
Sep-10	0.0356	0.0496	0.0971	ND	0.0315	5.9
Apr-11	0.0818	0.0592	0.108	ND	ND	6.11
Sep-11	0.0802	0.0537	0.219	ND	ND	4.56
Apr-12	ND	0.0325	0.0813	ND	ND	4.81
Sep-12	<0.068	0.075	0.379	<0.085	<0.271	4.25
R3						
Apr-08	0.08	ND	0.07	ND	ND	3.81
Sep-08	0.18	0.07	0.89	ND	0.21	3.73
Apr-09	0.08	ND	0.18	ND	ND	3.76
Sep-09	0.153	0.04	0.754	ND	0.125	3.74
Apr-10	ND	ND	0.0693	ND	<1.13	4.38
Sep-10	ND	0.0206	0.064	ND	ND	6.02
Apr-11	0.0704	0.0654	0.0536	ND	ND	5.42

Sample ID	Benzene (ppbV)	Methylene chloride (ppbV)	Toluene (ppbV)	Vinyl Chloride (ppbV)	Xylene (ppbV) (Total)	Methane (ppmV)
Sep-11	0.076	0.0433	0.176	ND	ND	4.31
Apr-12	ND	0.082	0.102	ND	ND	4.26
Sep-12	<0.068	0.066	0.326	<0.084	<0.180	4.34

Gas Monitoring 2008-2012

Sample ID	Benzene (ppbV)	Methylene chloride (ppbV)	Toluene (ppbV)	Vinyl Chloride (ppbV)	Xylene (ppbV) (Total)	Methane (ppmV)
G1						
Apr-08	0.11	ND	0.32	ND	0.062	24.5
Sep-08	8.93	0.16	0.97	7.96	1.06	699
Apr-09	ND	ND	0.16	ND	ND	4.19
Sep-09	0.089	0.028	0.418	ND	0.0605	3.53
Apr-10	0.198	0.64	0.311	0.543	<0.916	103
Sep-10	0.0309	ND	0.0867	ND	0.036	5.2
Apr-11	0.524	0.0685	0.455	1.87	0.323	9.28
Sep-11	ND	ND	0.0799	ND	ND	2.73
Apr-12	0.349	0.096	0.568	1.68	0.325	8.93
Sep-12	0.96	0.123	2	4.9	1.24	10.8
G2						
Apr-08	ND	ND	ND	ND	ND	1.41
Sep-08	0.08	0.05	0.16	ND	0.03	1.41
Apr-09	ND	ND	0.02	ND	ND	1.51
Sep-09	0.08	ND	0.086	ND	ND	11.4
Apr-10	ND	ND	0.0531	ND	<0.884	22.5
Sep-10	0.0169	ND	0.0212	ND	ND	4.36
Apr-11	0.0506	0.0603	0.0582	ND	ND	105
Sep-11	0.0355	ND	0.128	ND	ND	2.22
Apr-12	ND	ND	0.0299	ND	ND	12.7
Sep-12	<0.0486	<0.065	0.0698	<0.0605	<0.193	1.56
G3						
Apr-08	ND	ND	0.25	ND	0.219	2.09
Sep-08	0.02	ND	0.08	ND	0.03	1.41
Apr-09	ND	ND	0.21	ND	ND	2.18
Sep-09	ND	ND	0.052	ND	ND	1.75
Apr-10	0.0833	0.0499	0.221	ND	<0.893	1.56
Sep-10	ND	ND	0.0355	ND	0.0603	3.24
Apr-11	0.0643	0.0532	0.102	0.128	0.0137	4.07

Sample ID	Benzene (ppbV)	Methylene chloride (ppbV)	Toluene (ppbV)	Vinyl Chloride (ppbV)	Xylene (ppbV) (Total)	Methane (ppmV)
Sep-11	ND	ND	0.0676	ND	ND	2.22
Apr-12	0.0839	0.0641	0.304	0.116	ND	3.43
Sep-12	<0.0492	<0.0659	0.135	<0.0613	<0.195	2.24
G4						
Apr-08	0.08	ND	0.24	ND	ND	2.18
Sep-08	0.09	0.03	0.23	0.23	0.19	1.26
Apr-09	ND	ND	0.28	ND	ND	4.22
Sep-09	0.071	ND	0.514	ND	ND	4.02
Apr-10	ND	ND	0.0799	ND	<0.898	1.56
Sep-10	0.0022	ND	0.0872	ND	0.0793	5.87
Apr-11	0.0282	ND	0.121	0.0455	ND	2.47
Sep-11	ND	ND	0.054	ND	ND	2.1
Apr-12	ND	0.136	0.219	ND	ND	2.25
Sep-12	<0.0496	<0.0664	0.0749	<0.0618	<0.197	2.3
G5-L						
Apr-08	0.18	ND	0.58	ND	0.219	3.41
Sep-08	0.15	0.06	0.45	0.25	0.17	3.36
Apr-09	0.11	0.05	0.19	ND	0.06	3.88
Sep-09	ND	ND	0.074	ND	ND	1.74
Apr-10	ND	ND	0.0503	ND	<0.852	2.52
Sep-10	0.0543	ND	0.104	0.0727	0.0092	3.98
Apr-11	0.0634	0.0491	0.0586	ND	ND	4.67
Sep-11	ND	ND	0.0781	ND	ND	2.46
Apr-12	ND	ND	0.0924	0.0561	ND	1.77
Sep-12	<0.0482	<0.0646	0.187	0.0289	<0.191	2.08
G5-R						
Apr-08	ND	ND	0.05	ND	ND	2.59
Sep-08	0.1	ND	0.18	0.06	0.04	1.87
Apr-09	ND	ND	0.06	ND	ND	2.7
Sep-09	ND	ND	0.012	0.161	ND	1.35
Apr-10	ND	ND	0.0582	ND	<0.856	1.62
Sep-10	0.0105	ND	0.0427	0.126	0.0469	3.66
Apr-11	0.0283	0.0167	0.0811	ND	ND	3.17
Sep-11	ND	ND	0.0759	0.054	ND	2.21
Apr-12	ND	ND	0.0924	0.0561	ND	1.77
Sep-12	<0.0479	<0.0642	0.131	0.0586	<0.191	1.53
GMW-1						
Apr-11	0.298	0.0565	0.212	ND	0.421	2.76
Sep-11	a	a	a	a	a	1.91

Sample ID	Benzene (ppbV)	Methylene chloride (ppbV)	Toluene (ppbV)	Vinyl Chloride (ppbV)	Xylene (ppbV) (Total)	Methane (ppmV)
Apr-12	0.072	ND	0.0426	ND	ND	1.24
Sep-12	0.122	0.0852	0.0692	<0.0675	<0.216	1.7
GMW-2						
Apr-11	0.134	ND	0.162	ND	0.116	3.12
Sep-11	ND	ND	0.0628	ND	ND	2.47
Apr-12	ND	ND	0.0586	ND	ND	1.6
Sep-12	0.0463	<0.0655	0.0782	<0.0609	<0.195	1.83
GMW-3						
Apr-11	0.152	ND	0.124	ND	0.14	296
Sep-11	0.0426	ND	0.068	ND	ND	2.29
Apr-12	0.0687	0.0253	0.0649	ND	ND	11.8
Sep-12	<0.0499	0.106	0.385	<0.621	<0.198	2.04

Notes:
a: sample lost during TO-15 Analysis due to instrument malfunction