Five-Year Review Report

Third Five-Year Review Report
for
Koppers Co., Inc. (Charleston Plant)
SCD980310239

Charleston
Charleston County, South Carolina

June 2013

United States Environmental Protection Agency
Region 4
Atlanta, Georgia

Approved by: Franklin E. Hill

Date: 7/22/13

Franklin E. Hill
Director, Superfund Division

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Braswell Street
Charleston
Charleston County, South Carolina

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List of Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
B(a)p-TE	Benzo(a)pyrene Toxicity Equivalent
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FTA	Former Treatment Area
FYR	Five-Year Review
HDPE	High-Density Polyethylene
IC	Institutional Control
JEM	Johnson and Ettinger Model
MCL	Maximum Contaminant Level
mg/kg	Milligrams per Kilogram
NAPL	Non-Aqueous Phase Liquid
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
OIA	Old Impoundment Area
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
POTW	Publicly Owned Treatment Works
PRP	Potentially Responsible Party
PSG	Passive Soil Gas
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level
SARA	Superfund Amendments and Reauthorization Act
SCDHEC	South Carolina Department of Health and Environmental Control
S/S	Stabilization and Solidification
TBC	To-Be-Considered
TEQ	Toxicity Equivalent Quotient
VOC	Volatile Organic Compound
µg/dL	Micrograms per Deciliter
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter

Executive Summary

Introduction

The 102-acre Koppers Co., Inc. (Charleston Plant) Superfund site (the Site) is a former wood treating facility in northern Charleston, South Carolina, on the west side of the peninsula formed by the Ashley and Cooper Rivers. The Site's soil, ground water and surface water were contaminated with polycyclic aromatic hydrocarbons, arsenic, dioxin, pentachlorophenol and lead. The triggering action for this five-year review (FYR) was the signing of the previous FYR on June 4, 2008.

Remedial Action

The Site's remedy included:

- Excavating soils and sediments that were above the selected excavation levels, with off-site disposal.
- Capping remaining areas that were above the selected capping levels.
- Capping sediments in the barge canal by natural deposition.
- Capping sediments in the Ashley River with an engineered, subaqueous cap.
- Extracting non-aqueous phase liquid (NAPL) and ground water from the subsurface.
- Immobilizing NAPL in the northwest corner using in-situ stabilization and solidification.

The 1998 Record of Decision (ROD), as modified by the subsequent Explanations of Significant Differences, listed the following performance standards:

Soil Cap

- Eliminate exposure for the future on-site worker to surface soil with concentrations greater than the selected capping levels.
- Provide a visible demarcation between cap material and underlying soil.
- Mitigate adverse impacts related to quantity and quality of resultant stormwater runoff.
- Mitigate on-site dust generation during installation and useful life.
- Ensure long-term permanence and effectiveness of installed cap to meet the four performance standards listed above.

Drainage Ditches

- Remove all soil and drainage ditch sediments with concentrations of constituents of concern greater than the excavation levels.
- Remove and/or control the transport of NAPL and/or dissolved phase constituents from the respective drainage ditch.
- Reconstruct the respective drainage ditch to: 1) eliminate exposure to sediments of the respective drainage ditch; and 2) provide for adequate drainage that is consistent with its future land use. Reconstruction activities shall be in full accordance with the regulations delineated in the *South Carolina Stormwater Management and Sediment Control Handbook for Land Disturbance Activities* (February 1997).

Tidal Marsh Sediments

- Physically remove those sediments from the tidal marshes that demonstrated significant acute toxicity to the selected indicator species.
- Manage the remaining sediments that may be a potential risk to ecological receptors in place via bioremediation.

Barge Canal Sediments

- Eliminate potential exposure to ecological receptors by allowing natural deposition of sediments over impacted bottom sediments of the barge canal.

Ashley River Sediments

- Ensure short-term protection to surrounding environment during construction and installation activities.
- Provide sufficient cover to mitigate exposure to benthic organisms and subsequent adverse impacts to the food chain.
- Ensure long-term effectiveness and permanence by mitigating erosional effects.

NAPL/Ground Water

- Remove or treat NAPL to the maximum extent practicable.
- Contain potentially non-restorable NAPL source areas.
- Contain and restore aqueous contaminant plumes.

Technical Assessment

In general, the remedial action continues to operate and function as designed. The exposure assumptions and remedial action objectives used at the time of remedy selection are still valid. Some of the Site's constituents of concern now have more stringent toxicity values. However, the level of soil contamination remaining on the Site corresponds to risk levels within the EPA's acceptable range (10^{-4} to 10^{-6}). Furthermore, a large portion of the Site is capped, which prevents exposure to remaining soil contamination. Vapor intrusion may be a concern at occupied off-site buildings above the ground water plume. The arsenic MCL has become more stringent since the 1998 ROD. Some contaminants that have been present in the ground water at levels exceeding MCLs are no longer being monitored in the Site's ground water. Therefore, it is not known whether their current levels exceed MCLs. Additional land and ground water use restrictions are needed, given that the Site was cleaned to industrial levels and ground water contamination exists.

Conclusion

A protectiveness determination of the Site's remedy cannot be made at this time until further information is obtained. Further information will be obtained by conducting air sampling to assess more precisely the potential for vapor intrusion. It is expected that these actions will take approximately one year to complete, at which time a protectiveness determination will be made. In order for the remedy to be protective in the long term, the EPA will issue a decision document to select land and ground water use restrictions where needed, and implement the selected restrictions.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Koppers Co., Inc. (Charleston Plant)		
EPA ID: SCD980310239		
Region: 4	**State:** SC	**City/County:** Charleston/Charleston
SITE STATUS		
NPL Status: Final		
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: Hagai Nassau and Treat Suomi (Reviewed by the EPA)		
Author affiliation: Skeo Solutions		
Review period: November 2012 – June 2013		
Date of site inspection: January 17, 2013		
Type of review: Statutory		
Review number: 3		
Triggering action date: June 4, 2008		
Due date *(five years after triggering action date)*: June 4, 2013		

Five-Year Review Summary Form (continued)

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 1	Issue Category: Institutional Controls			
	Issue: Some of the Site's parcels do not have land use restrictions in place.			
	Recommendation: Issue decision document to select land use restrictions where needed. Implement selected restrictions.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	06/04/2014

OU(s): 1	Issue Category: Institutional Controls			
	Issue: Some of the on-site and off-site parcels above the NAPL/ground water plume do not have ground water use restrictions in place.			
	Recommendation: Issue decision document to select ground water use restrictions where needed. Implement selected restrictions.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	06/04/2014

OU(s): 1	Issue Category: Monitoring			
	Issue: The arsenic MCL has become more stringent since the 1998 ROD.			
	Recommendation: Determine whether the NAPL/ground water system should be modified to address arsenic.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	06/04/2014

OU(s): 1	Issue Category: Remedy Performance			
	Issue: Vapor intrusion may pose an unacceptable risk for the existing buildings in use at the Charleston Public Service area, and for potential future uses of on-site areas.			
	Recommendation: Conduct air sampling to further assess the potential for vapor intrusion at existing buildings. Require additional vapor intrusion assessment or mitigation prior to future construction.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	EPA	EPA	06/04/2014

OU(s): 1	Issue Category: Remedy Performance			
	Issue: Additional investigation is needed to delineate the northern extent of NAPL at the OIA.			
	Recommendation: Conduct additional investigation at the OIA to delineate the northern extent of NAPL. Determine if the existing recovery system for the intermediate water-bearing zone at the OIA is adequate.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	06/04/2014

Protectiveness Statement

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
1	Protectiveness Deferred	06/04/2014

Protectiveness Statement:
A protectiveness determination of the Site's remedy cannot be made at this time until further information is obtained. Further information will be obtained by conducting air sampling to assess more precisely the potential for vapor intrusion. It is expected that these actions will take approximately one year to complete, at which time a protectiveness determination will be made. In order for the remedy to be protective in the long term, the EPA will issue a decision document to select land and ground water use restrictions where needed, and implement the selected restrictions.

Sitewide Protectiveness Statement

Protectiveness Determination:	*Addendum Due Date (if applicable):*
Protectiveness Deferred	06/04/2014

Protectiveness Statement:
A protectiveness determination of the Site's remedy cannot be made at this time until further information is obtained. Further information will be obtained by conducting air sampling to assess more precisely the potential for vapor intrusion. It is expected that these actions will take approximately one year to complete, at which time a protectiveness determination will be made. In order for the remedy to be protective in the long term, the EPA will issue a decision document to select land and ground water use restrictions where needed, and implement the selected restrictions.

Five-Year Review Summary Form (continued)

Environmental Indicators
Current human exposures at the Site are under control. Current ground water migration is under control.

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

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

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

Third Five-Year Review Report
for
Koppers Co., Inc. (Charleston Plant) 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 United States 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.

The 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 Koppers Co., Inc. (Charleston Plant) site (the Site) in Charleston, Charleston County, South Carolina. The EPA's contractor conducted this FYR from November 2012 to June 2013. The EPA is the lead agency for developing and implementing the remedy for the potentially responsible party (PRP)-financed cleanup at the Site. The South Carolina Department of Health and Environmental Control (SCDHEC), as the support agency representing the State of South Carolina, has reviewed all supporting documentation and provided input to the EPA during the FYR process.

This is the third FYR for the Site. The triggering action for this statutory 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
The EPA conducted the preliminary assessment	June 1, 1980
Fed Serv, Koppers and other parties conducted a removal action at the tank farm area leased by Fed Serv	March 1985
Braswell Shipyards conducted a removal action at the Peppers Industries property	January 1987
The EPA conducted the site inspection	September 1988
The EPA proposed listing the Site on the National Priorities List	February 7, 1992
The EPA and Beazer signed an Administrative Order on Consent to conduct the remedial investigation/feasibility study	January 14, 1993
The EPA listed the Site on the National Priorities List	December 16, 1994
Beazer completed the Remedial Investigation Report	January 1995
The EPA issued the final Baseline Risk Assessment	January 18, 1995
The EPA issued the interim remedial action Record of Decision (ROD)	March 29, 1995
Beazer conducted supplemental ground water and ecological investigations	March 1995 - May 1996
The EPA and Beazer signed the interim remedial action Unilateral Administrative Order	May 22,1995
Beazer began the remedial design	June 5, 1995
Beazer completed the remedial design	March 25, 1996
The EPA issued a Consent Decree	April 9, 1996
Beazer mobilized for the on-site interim remedial action	June 11, 1996
Beazer completed the Feasibility Study Report	December 1996
The EPA issued the sitewide proposed plan	March 1997
Beazer completed the interim remedial action	November 13, 1997
The EPA issued the sitewide ROD	April 29, 1998
The EPA and Beazer signed the Unilateral Administrative Order to implement the sitewide ROD	January 25, 1999
Beazer mobilized for the soils, drainage ditch sediments and north tidal marsh components	February 1999
The EPA and Beazer signed an Administrative Order on Consent	August 4, 1999
Beazer mobilized for the Ashley River capping component	June 2001
The EPA issued an Explanation of Significant Differences (ESD) for the Ashley River remedy	August 8, 2001
The EPA and Beazer signed an Administrative Order on Consent	August 21, 2002
The EPA issued the first FYR report	January 10, 2003
Beazer mobilized for the south tidal marsh sediments, northwest corner stabilization and solidification and non-aqueous phase liquid/ground water recovery systems	March 2003
The EPA issued an ESD for the barge canal and northwest corner	April 24, 2003
Ashley I LLC purchased the portions of the Site owned by Beazer	July 15, 2003
The EPA conducted the pre-final/final construction inspection	July 30, 2003
Beazer submitted the Final Remedial Action Report	August 29, 2003
The EPA approved the Preliminary Close-Out Report, Site achieved construction completion milestone	September 25, 2003
Beazer began full-scale non-aqueous phase liquid and ground water recovery in the former treatment area and the old impoundment area	October 2003

Event	Date
The EPA issued the second FYR report	June 4, 2008
Beazer completed additional investigations at the old impoundment area and former treatment area	July 22, 2008
The North Charleston Sewer District renewed Beazer's original 1997 discharge permit. The current permit is effective January 1, 2013 through December 31, 2017.	December 31, 2012

3.0 Background

3.1 Physical Characteristics

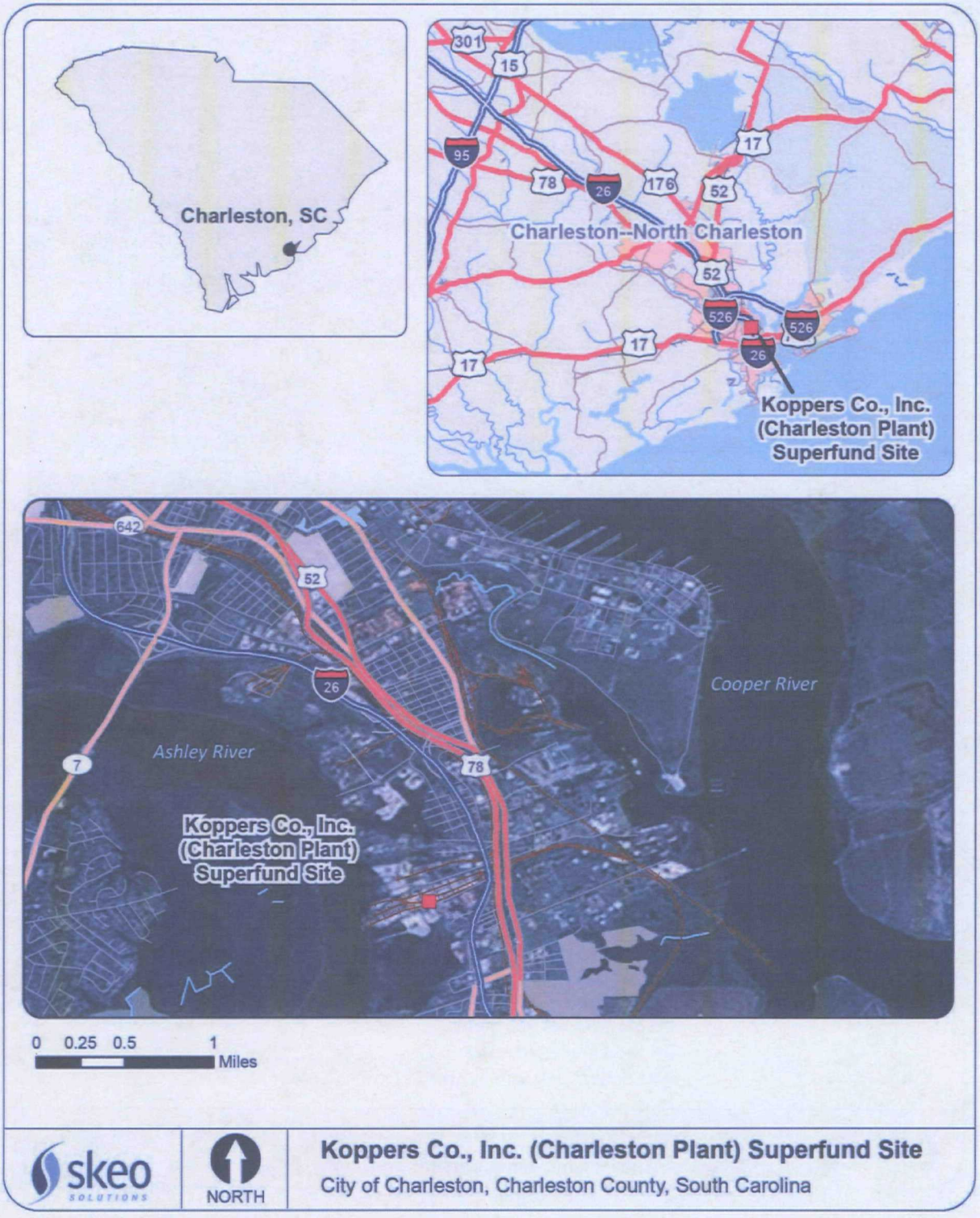
The Site is approximately 102 acres in size and is located in the neck area of northern Charleston, South Carolina, on the west side of the peninsula formed by the Ashley and Cooper Rivers. The Site is bounded by Milford Street on the north, King Street Extended on the east, a large wetland to the south and the Ashley River to the west. The Site also includes part of a drainage ditch north of Hagood Avenue. The general Site location is depicted on Figure 1.

The Site is mostly vacant and is surrounded on the north, south and east by a mixture of industrial, commercial, residential and wetland areas. The southern part of the Site contains part of a large wetland area along the Ashley River.

The Site is in an industrial section of Charleston County known as the "neck area." Pockets of residential development exist within 1/2 mile of the Site to the north, south and east. These neighborhoods include Silver Hill south of the Site, Four Mile Hibernian east of the Site and Rosemont north of the Site.

The Site is flat with topographic relief ranging from 0 to approximately 15 feet above sea level. Surface water drainage at the Site occurs as overland flow or through many engineered conveyances, including the Milford Street drainage ditch, the Hagood Avenue drainage ditch, the Central drainage ditch and the Braswell Street drainage ditch. The ground water table at the Site is very shallow, and is commonly encountered about 3 to 5 feet below land surface. The Site is located in the Atlantic Coastal Plain physiographic province, and is underlain by the Cooper Marl clay formation. The Cooper Marl, a regional confining unit approximately 260 feet thick, is encountered at depths ranging from 50 to 67 feet below land surface at the Site. Therefore, subsurface data collection was focused on the water-bearing units above the Cooper Marl. Ground water in the shallow and intermediate water-bearing units above the Cooper Marl generally flows to the nearest surface water body. Ground water flow in the eastern portion of the Site is to the north toward the north tidal marsh. Ground water flow in remaining portions of the Site is west toward the Ashley River and/or toward the adjacent tidal marshes.

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.

3.2 Land and Resource Use

From 1940 to 1978, the Koppers Company operated a wood treatment facility on approximately 45 acres of the Site, bounded on the north by Milford Street, on the south by Braswell Street, on the east by King Street Extended and on the west by the Ashley River.

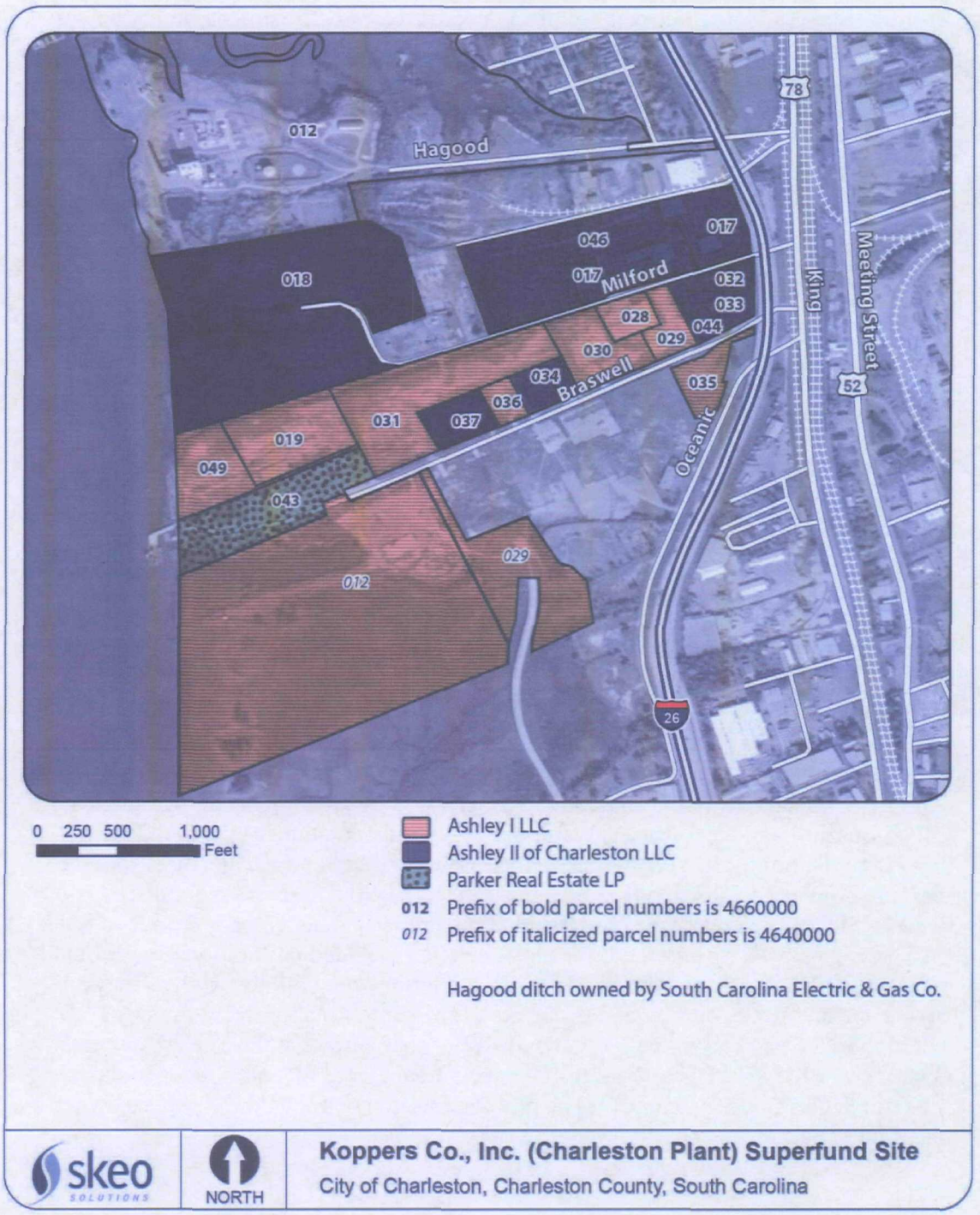
Land use at the Site subsequent to Koppers' operations consisted of a mixture of commercial and light industrial operations. After the Koppers facility shut down, several entities leased the property. From 1978 to 1982, Pepper Industries used Koppers' former working tanks to store ship bilge and tank wastes. Braswell Shipyards operated a commercial and military ship cleaning, repair and refurbishing business on the northwestern corner of the Site from 1978 until the mid-1990s. Koppers' former bulk creosote storage tanks in the tank farm area were used by Fed Serv in the early 1980s to store waste oil.

The property at the western end of Braswell Street, next to the Ashley River, is used by Parker Marine for manufacturing pre-stressed concrete pilings and prefabricating marine structures.

A series of owners used the 57-acre property south of, and adjacent to, the Koppers property to produce phosphate-based fertilizers from around the turn of the century until 1978. These 57 acres were part of a larger tract of land south of Braswell Street owned by the Ashepoo Phosphate/Fertilizer Works. As discussed below in Section 3.3, the EPA incorporated these 57 acres into the site boundaries to determine the environmental impact that previous dredging operations had on the Ashley River and neighboring tidal marsh.

Koppers Company, which operated the former wood treatment plant at the Site, is now called Beazer East, Inc. (Beazer). After discontinuing operations at the facility in 1978, Beazer sold all of its property at the facility. Beazer reacquired a majority of the Site through property acquisitions in 1993 and 1998 and held that property until July 2003, when Ashley I LLC purchased the parcels. The property transfer from Beazer to Ashley I LLC was conveyed by a limited warranty deed that included prohibitions on residential development and ground water use. These prohibitions run with the land, so they apply to all current and future owners and occupiers of the parcels purchased by Ashley I LLC. In addition to the parcels owned by Ashley I LLC, other parcels at the Site are currently owned by Ashley II of Charleston LLC, Parker Real Estate LP and South Carolina Electric & Gas Co (see Figure 3). The prohibitions do not apply to the parcels owned by these other parties.

Figure 3: Parcel Map with Current Ownership[1]



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.

[1] Parcel numbers and ownership were obtained from the County of Charleston's Property Information System, http://ccgisweb.charlestoncounty.org/website/Charleston/viewer.htm, accessed 2/19/2013.

The Site parcels owned by Ashley I LLC and Ashley II of Charleston LLC are part of a 218-acre tract that developers planned to redevelop as the Magnolia project. However, that development project is no longer proceeding. Ashley I and Ashley II have defaulted on their mortgage payments. In December 2012, a lender bought the bank note secured against the Ashley I and Ashley II properties. That lender is conducting Phase I and II assessments on the properties, and may take ownership of the properties.

Except for the Parker Marine property, the Site is currently vacant. Part of the Site is used for parking by employees of the adjacent City of Charleston Public Service Operations. During the January 2013 FYR site inspection, a trespasser was seen skateboarding on the Site (see photograph in Appendix E). The Site is not fenced, except for the area containing the ground water treatment trailer, non-aqueous phase liquid (NAPL) storage tank and storage buildings.

Most of the Site is within a Gathering Place zoning district, which allows "diverse mixed-use, pedestrian oriented development."[2] Other areas of the Site are zoned for "heavy industrial" or "conservation." Drinking water for this area is supplied by the City of Charleston via surface water intakes. Ground water above the Cooper Marl geologic layer, including the Site's contaminated ground water, is not used for residential or industrial supply.

3.3 History of Contamination

Wood-treatment activities primarily consisted of treating raw lumber with creosote. Pentachlorophenol and copper chromium arsenate were also used as wood preservatives for short periods of time. The plant processed utility poles, foundation pilings, bridge timbers and railroad materials (e.g., crossties). The volume of wood treated at the facility was approximately 200,000 cubic feet per month. The majority of wood-treatment operations were conducted in the eastern portion of the Site, now identified as the former treatment area (FTA) (Figure 2). Koppers maintained numerous aboveground storage tanks in the FTA for storing wood preservatives. The tank farm area in the northeastern corner of the FTA contained six tanks, ranging in size from 50,000 to 650,000 gallons. Koppers also had six aboveground working tanks, four of which were on an elevated platform located east of the treatment building. When pentachlorophenol and copper chromium arsenate were in use, separate working tanks contained these preservatives.

Wood preservatives were cycled from the storage tanks, to the working tanks, and finally to the treatment cylinders. Once the virgin lumber was sized, seasoned or otherwise made ready for treatment, it was pressure-treated in one of four pressure-treating cylinders. One pressure vessel was dedicated to treating with pentachlorophenol and copper chromium arsenate, and the remaining three were used exclusively for creosote. At the end of the treatment process, the excess preservative was pumped from the cylinder to the working tanks for reuse. A final vacuum was then placed on the treatment cylinder to draw any excess preservative out of the wood. The cylinder door was opened and the trams, loaded with treated wood, were pulled from the cylinder onto the drip tracks. The drip track area

[2] http://gis.charleston-sc.gov/interactive/zoning/

extended from the FTA (in the eastern portion of the Site) approximately two thirds of the way to the Ashley River, parallel to Koppers' southern property boundary. Treated wood was either shipped directly to the customer or stored at the facility.

The treatment process generated wastewater when the operators used steam to remove moisture from the wood and boiler system. The wastewater from the treatment process contained oils, creosote and solids. The wastewater was recovered in a sump pit located adjacent to the treatment cylinders and pumped to a series of six separation tanks located near the FTA just south of Braswell Street. Creosote, which has a density greater than water, would settle to the bottom of the sump pit and separation tanks. The creosote was recovered, pumped to a dehydrator to remove excess moisture and then returned to the working tanks for reuse. Water from the separation tanks was discharged to the Braswell Street drainage ditch, which flows westward to the Ashley River. On occasion, the volume of the separation tanks was not sufficient to handle all the material coming from the sump pit and creosote would overflow into the Braswell Street drainage ditch. Historical aerial photographs and subsequent environmental data indicate that wastewater and surface water runoff transported creosote constituents along the Braswell Street drainage ditch into the old impoundment area (OIA).

After the mid-1960s, wastewater from the separation tanks was discharged to the publicly owned treatment works (POTW). Residues that settled to the bottom of the treatment cylinders were removed periodically when accumulations interfered with the treatment process. Most of the material removed was sand and bark, which were coated with creosote. The creosote residue was transported by rail and deposited in the northwestern corner of the Site. Koppers discontinued this practice in the mid-1960s, when it began to send residue materials off site with a private waste hauler. In addition, from 1953 to 1968, Koppers leased a 4-acre tract of land in the northwestern corner of the Ashepoo Phosphate/Fertilizer Works property (south of Braswell Street) for the stated purpose of depositing sawdust, bark and other wood waste from their wood stripping operations.

After obtaining a permit from the U.S. Army Corps of Engineers, Southern Dredging excavated a barge canal in November 1984 that extended approximately 1,000 feet inward from the Ashley River. Slurry material from the canal dredging was pumped 700 feet east of the barge canal and deposited in a bermed spoils area. Water was allowed to flow over a culvert into the south tidal marsh while solids settled out within the bermed spoils area. As a result of the dredging, South Carolina regulatory personnel responded to the presence of exposed creosote poles, highly turbid water and an oily sheen on the Ashley River adjacent to the barge canal. Approximately 100 dead fish were observed in the Ashley River within 1/4 mile downstream of the canal. It is believed that this barge canal was dredged into the 4-acre area formerly leased by Koppers for the disposal of waste wood products resulting from their wood stripping operations.

3.4 Initial Response

The first area to be investigated at the Site was the Peppers Industries facility at the eastern end of the Site. Peppers Industries used the former creosote working tanks and

wood treatment building. After Peppers Industries abandoned the property in November 1982, Braswell Shipyards notified SCDHEC that the tanks were leaking their contents. Sampling and analysis indicated that the tanks contained various oils, contaminated water and oily sludges. Under an Administrative Order on Consent issued by SCDHEC in August 1983, Pepper Industries began a cleanup operation on the creosote working tanks but later declared bankruptcy and ceased all cleanup activities. In January 1987, Braswell Shipyards performed a cleanup operation at the area formerly used by Peppers Industries, during which they removed all the aboveground storage tanks and containers on the property and arranged for proper disposal of the wastes. Koppers financed half the expense of this cleanup operation.

Historical investigations conducted from 1983 to 1985 by SCDHEC and the EPA revealed numerous releases of waste oil from the aboveground storage tanks in the tank farm area leased by Fed Serv Industries (in the northeastern part of the FTA). Under an Administrative Order on Consent issued by the EPA in March 1985, Fed Serv, Koppers and other entities initiated emergency response actions at the former tank farm area. The removal activities generally involved proper disposal of material in the tanks, demolition of the tanks, and excavation and disposal of impacted soils.

The EPA initiated a site inspection in 1988 to gather the necessary information to propose the Site for listing on the National Priorities List (NPL).

3.5 Basis for Taking Action

The EPA proposed the Site for listing on the NPL in February 1992 and listed the Site on the NPL in December 1994. In January 1993, Beazer initiated a remedial investigation/feasibility study under an Administrative Order on Consent with the EPA.

The January 1995 Final Baseline Risk Assessment calculated potential unacceptable carcinogenic and non-carcinogenic risks for the future industrial and current off-site resident exposure scenarios. A potential carcinogenic risk of 8×10^{-3} and a hazard index of 20 were calculated for the future on-site worker exposed to surface soils and sediment/surface water of the on-site drainage ditches. A potential carcinogenic risk of 3×10^{-4} and hazard index of 5 were calculated for the future on-site utility worker exposed to surface and subsurface soils. Chemicals of concern for the future industrial exposure scenario included polycyclic aromatic hydrocarbons (PAHs), arsenic, dioxin and pentachlorophenol. A potential carcinogenic risk of 1×10^{-1} was calculated for the current off-site resident. Non-cancer hazard indices for the adult and child off-site resident were 10 and 10,000 respectively. The high risks for the current off-site resident exposure scenario were primarily driven by dermal contact exposure with surface water of the Hagood Avenue drainage ditch. Chemicals of concern in the surface water under this exposure scenario were PAHs, arsenic and dioxin. The EPA issued an interim action Record of Decision (ROD) in 1995 to address these potential human health risks in the short-term while a final, sitewide remedy was being developed.

The EPA conducted an ecological risk assessment in 1996 to evaluate potential risks posed to ecological receptors. The ecological risk assessment used multiple lines of evidence, including sediment chemistry, acute/chronic toxicity testing and benthic macroinvertebrate/food chain evaluations. The results of this effort were used to define areas of potential ecological concern, where sediments required potential remediation or further investigation. Sediments within areas of potential ecological concern that demonstrated significant acute toxicity to the selected benthic and aquatic marine invertebrate test species, *Neanthes arenaceodentata* and *Mysidopsis bahia*, respectively, were slated for active remediation. Significant acute toxicity to the test species was noted in the Ashley River near the barge canal confluence, and at the headwaters of the north/south tidal marshes. Although the Site's ecological risk assessment was completed before the EPA finalized its ecological risk assessment guidance document,[3] the assessment is still adequate, given that it included a baseline ecological risk assessment with whole sediment toxicity tests, in addition to a screening level assessment.

[3] "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment," June 1997, available at http://www.epa.gov/oswer/riskassessment/ecorisk/ecorisk.htm.

4.0 Remedial Actions

In accordance with CERCLA and the NCP, the overriding goals for any remedial action are protection of human health and the environment and compliance with applicable or relevant and appropriate requirements (ARARs). A number of remedial alternatives were considered for the Site, and final selection was made based on an evaluation of each alternative against nine evaluation criteria that are specified in Section 300.430(e)(9)(iii) of the NCP. The nine criteria are:

1. Overall Protection of Human Health and the Environment
2. Compliance with ARARs
3. Long-Term Effectiveness and Permanence
4. Reduction of Toxicity, Mobility or Volume through Treatment
5. Short-Term Effectiveness
6. Implementability
7. Cost
8. State Acceptance
9. Community Acceptance

4.1 Remedy Selection

The EPA issued an Interim Action ROD on March 29, 1995. The Interim Action ROD called for a source control effort that involved several components designed to eliminate off-site migration of non-aqueous phase liquid (NAPL) via surface water conveyances and shallow ground water in close proximity to the former treatment area. The performance standards for the interim response action, as specified in the 1995 ROD are:

- Eliminate off-site migration of NAPL to the Milford Street drainage ditch.
- Mitigate the drainage system as a conduit for potential NAPL and constituent migration to the Hagood Avenue drainage ditch.
- Eliminate potential exposure to sediments of the Hagood Avenue drainage ditch.
- Mitigate off-site migration of NAPL in the intermediate water-bearing unit underlying the former treatment area.

The EPA selected the final sitewide remedy in the ROD signed on April 29, 1998. The Final ROD specified a multi-media response action to address surface/subsurface soils, sediments of drainage ditches, ground water/NAPL, surface water contaminant transport pathways, and sediments of the Ashley River, barge canal and north/south/northwest tidal marshes. The EPA issued two Explanations of Significant Differences (ESDs) after the April 1998 ROD. An August 2001 ESD changed the Ashley River remedy from enhanced sedimentation to placement of an engineered, subaqueous cap. An April 2003 ESD changed the barge canal remedy from placement of an engineered subaqueous cap to natural deposition and monitored natural recovery, and changed the ground water/NAPL component for the northwest corner of the Site from active NAPL recovery with extraction wells to immobilization using stabilization and solidification techniques.

The Site's decision documents included performance standards rather than remedial action objectives.

Site Soil and Drainage Ditch Sediments

The EPA determined that five primary constituents contribute unacceptable carcinogenic and non-carcinogenic risks under the future industrial land use scenario. These constituents are referred to as constituents of concern and include: arsenic, benzo(a)pyrene toxicity equivalent (B(a)P-TE), dioxin, lead and pentachlorophenol. B(a)p-TE is a summary parameter that converts concentrations of carcinogenic PAHs to an equivalent benzo(a)pyrene concentration.

The 1998 ROD specified soil and drainage ditch sediment excavation levels that were adequately protective for the future on-site worker (surface soil) and future utility worker (subsurface soil) under a future industrial land use scenario. Surface soil was defined as ground surface to six inches below ground surface. Subsurface soil was defined as six inches below ground surface to the water table. The soil and drainage ditch sediment excavation levels are summarized in Table 2 below. The 1998 ROD stated that, after excavation and off-site disposal, all surface soil with concentrations greater than the capping levels in Table 3 below would be covered.

Table 2: Soil/Sediment Excavation Levels

Constituent of Concern	Surface Soil/Sediment Excavation Level (milligrams per kilogram (mg/kg))	Subsurface Soil/Sediment Excavation Level (mg/kg)
Arsenic	135	1,550
B(a)p-TE[1]	20	275[3]
Dioxin TEQ[2]	0.0015	0.02
Pentachlorophenol	235	4,300

Notes:
[1] - B(a)p-TE (benzo(a)pyrene toxicity equivalent) is a measure of the overall toxicity of all the carcinogenic PAHs.
[2] - Dioxin toxicity equivalent quotient (TEQ) is a measure of the overall toxicity of all the various types of dioxins.
[3] - The subsurface excavation met a cleanup standard of 55 mg/kg for B(a)p-TE (Final Remedial Action Report, p. 7, App. F)

Table 3: Soil/Sediment Capping Levels

Constituent of Concern	Surface Soil Capping Level (mg/kg)
B(a)p-TE	2.0
Lead	1,150

The 1998 ROD specified the following performance standards for the soil cap:

- Eliminate exposure for the future on-site worker to surface soil with concentrations greater than the capping levels (listed in Table 3 above).
- Provide a visible demarcation between cap material and underlying soil.

- Mitigate adverse impacts related to quantity and quality of resultant stormwater runoff.
- Mitigate on-site dust generation during installation and useful life.
- Ensure long-term permanence and effectiveness of installed cap to meet the four performance standards listed above.

The 1998 ROD specified the following performance standards for the South Braswell, West Milford and Central drainage ditches:

- Remove all soil and drainage ditch sediments with concentrations of constituents of concern greater than the excavation levels (listed in Table 2 above).
- Remove and/or control the transport of NAPL and/or dissolved phase constituents from the respective drainage ditch.
- Reconstruct the respective drainage ditch to: 1) eliminate exposure to sediments of the respective drainage ditch; and 2) provide for adequate drainage that is consistent with its future land use. Reconstruction activities shall be in full accordance with the regulations delineated in the *South Carolina Stormwater Management and Sediment Control Handbook for Land Disturbance Activities* (February 1997).

North, South and Northwest Tidal Marsh Sediments

The objectives of the remedy for the north, south and northwest tidal marshes are:

- Physically remove those sediments from the tidal marshes that demonstrated significant acute toxicity to the selected indicator species.
- Manage the remaining sediments that may be a potential risk to ecological receptors in place via bioremediation.

The 1998 ROD required excavation, capping/revegetation and off-site disposal of sediments from the north and south tidal marshes that demonstrated significant acute toxicity to the selected benthic and aquatic marine invertebrate indicator species, *Neanthes arenaceodentata* and *Mysidopsis bahia*, respectively. The ROD stated that the vertical limit of excavation would be the biologically active zone (the upper 1 foot of material at a minimum).

The 1998 ROD specified in-situ bioremediation for the northwest marsh and portions of the south tidal marsh that did not demonstrate significant acute toxicity to the indicator species, but did contain sediment concentrations above benchmarks. The ROD recognized that in-situ bioremediation was an emerging/innovative technology and established a modest performance standard for this particular remedy component. The selected performance standard was reduction of sediment constituent concentrations from observed baseline conditions.

Barge Canal Sediments

The 1998 ROD's selected remedy for the approximately 3.2-acre barge canal was placement of an engineered, subaqueous cap. The remedy's objective for the barge canal

is to eliminate potential exposure to ecological receptors by placing a cap over impacted bottom sediments of the barge canal.

The remedial design determined that natural deposition of sediments in the barge canal would achieve the objectives established in the ROD for the subaqueous cap alternative. The EPA prepared an ESD in April 2003 to present the rationale supporting the revised remedy for the barge canal.

Ashley River Sediments

The performance standards for the Ashley River remedy component established in the ROD include:

- Ensure short-term protection to surrounding environment during construction and installation activities.
- Provide sufficient cover to mitigate exposure to benthic organisms and subsequent adverse impacts to the food chain.
- Ensure long-term effectiveness and permanence by mitigating erosional effects.

The ROD selected enhanced sedimentation for a strip of near-shore sediments of the Ashley River that extended approximately 1,500 linear feet north/south along the Site and approximately 50 to 100 feet west of the shoreline towards the former navigation channel. The conceptual approach to enhanced sedimentation involved capping impacted river sediments by increasing and accelerating natural sedimentation processes. Enhanced sedimentation was to be achieved by decreasing water velocities in the area of interest, resulting in increased deposition of the river's suspended sediment load. The ROD required that modeling studies be conducted to determine the engineering structures to be used to optimize sediment deposition and to predict sediment deposition rates within the area of interest.

During the remedial design phase, numerical sediment transport modeling was conducted to support identification and evaluation of enhanced sedimentation alternatives. The results of this modeling effort indicated that the established performance standards for the Ashley River sediments could best be achieved by the installation of a sheetpile barrier wall system around the area slated for remediation. However, geotechnical analysis for the structural design of the sheetpile wall determined that installation would be technically challenging and cost-prohibitive due to the steep slopes of the Ashley River channel and the depth of soft sediments. Moreover, concerns related to existing derelict dock structures and operational issues of property owners along the Ashley River necessitated a change in the selected remedy for Ashley River sediments. Therefore, the EPA issued an ESD in August 2001 that revised the Ashley River remedy. The ESD called for placing an engineered, subaqueous cap with a minimum thickness of 12 inches over the area of interest.

NAPL/Ground Water

The 1998 ROD identified three source areas of subsurface NAPL on site: the former treatment area, the old impoundment area and the northwest corner. The 1998 ROD did

not identify which ground water contaminants are considered to be constituents of concern. The ROD's cleanup goal for ground water is to achieve the maximum contaminant levels (MCLs) specified by the Safe Drinking Water Act. However, because it may not be technically possible to achieve the MCLs, the ROD established the following performance standards:

- Remove or treat NAPL to the maximum extent practicable.
- Contain potentially non-restorable NAPL source areas.
- Contain and restore aqueous contaminant plumes.

The ROD indicated that these performance standards would be achieved by the recovery of NAPL and impacted ground water by extraction wells installed in the shallow and intermediate water-bearing units underlying the source areas. However, additional data collected from the northwest corner during the remedial design phase indicated that, although NAPL was present, it did not appear to be of sufficient quantity and/or mobility to permit recovery via extraction wells. Subsequent treatability testing demonstrated that NAPL in the northwest corner could be immobilized by in-situ stabilization and solidification (S/S) with portland cement. Therefore, the EPA issued an ESD in April 2003 to revise the ground water/NAPL strategy at the northwest corner to S/S. The ground water and NAPL remediation strategy for the former treatment area and old impoundment area remained extraction via recovery wells.

4.2 Remedy Implementation

The interim action work was completed in 1997. It generally involved physical reconstruction and rehabilitation of the Milford Street and Hagood Avenue drainage systems, installation of six shallow NAPL extraction wells along Milford Street and installation of two intermediate NAPL extraction wells near the former pressure vessels. Beazer implemented the interim action under a Unilateral Administrative Order with the EPA dated May 22, 1995. The EPA and SCDHEC approved remedial design documents for the interim action in April 1996.

Beazer implemented the final remedy through a Unilateral Administrative Order (effective date of January 25, 1999) with the EPA, and pursuant to the January 1999 Remedial Design Work Plan. Design and construction efforts were separated into the following seven distinct packages:

- Site Soil and Drainage Ditch Sediments
- North Tidal Marsh Sediments
- In-Situ Bioremediation of Northwest & South Tidal Marsh Sediments
- Barge Canal Sediments
- Ashley River Sediments
- South Tidal Marsh Sediment Excavation
- NAPL/Ground Water

Initial priority was given to those remedy components that would generate F032, F034

and/or F035 listed wastes and would require off-site disposal prior to the Land Disposal Restriction deadline of May 12, 1999. The north tidal marsh sediments and the majority of the site soils were protectively managed with these waste listings.

The various remedy components were implemented and constructed via three primary mobilization efforts: February 1999 for site soils and drainage ditch sediments, June 2001 for the Ashley River sediments, and March 2003 for the south tidal marsh sediments and NAPL/ground water. The remainder of this section provides a brief description of the construction activities associated with the remedy components described above. The Final Remedial Action Report (URS Corp., August 2003) gives a more detailed account of this subject matter.

Site Soil and Drainage Ditch Sediments

In May 1998, pre-design delineation was performed to determine the volume and extent of soils exceeding the soil remediation goals. The Site was divided into remedial action zones based on historical land use, physical and chemical characteristics, and proposed remediation activities. Results from the pre-design delineation were incorporated into historical site sampling data and examined by geostatistical analyses to compute the most accurate delineation of the excavation and capping areas within the various remedial action zones. Based on the results of the geostatistical analyses, the ROD soil remedial action boundaries were defined and approved by the EPA and SCDHEC prior to field mobilization.

An estimated 22,000 tons of material were excavated and hauled to an on-site materials handling and staging area before being transported off-site to a Subtitle C landfill in Pinewood, South Carolina, for final disposal. This volume estimate also includes sediments excavated from the north tidal marsh (see Section 4.2.2 below). Post-excavation confirmatory sampling was conducted to verify that all remedial action zones met the specified performance standards.

An estimated 3,600 linear feet of drainage ditches were reconstructed to eliminate an important contaminant transport pathway. The Braswell Street drainage system was reconstructed using large-diameter high-density polyethylene (HDPE) pipes and HDPE-lined inlets and manholes. HDPE material was selected as the construction material because joints (pipe to pipe and pipe to inlet) could be welded to ensure a watertight seal. Existing drainage ditches were abandoned. Shallower swales were constructed to direct runoff to the inlets of the newly installed drainage system. The Milford Street drainage system was reconstructed along the existing drainage easement as an open ditch system consisting of a shallow lined ditch. The ditch lining consists of a welded HDPE liner that was overlain by an 8-inch-thick concrete grout mat. The Central Drainage Ditch was reconstructed in the previous drainage ditch alignment as an open ditch system consisting of a shallow, lined ditch similar to the reconstructed Milford Street drainage system.

Approximately 40 acres of the Site were covered with a protective engineered soil cover. An estimated 30 acres of the engineered soil cover were required to comply with the ROD, and Beazer voluntarily capped the remaining area to better integrate the final cap

dimensions with existing land use and property boundaries. Four types of engineered soil covers were constructed; all were underlain by a geotextile barrier for visible demarcation purposes:

- Type IIA - 12-inch vegetated compacted fill
- Type IIB - 8 inches of compacted fill, followed by 4 inches of vegetated topsoil
- Type IIC - 12-inch aggregate base course
- Type IID - 3-inch aggregate base course layer overlain by a 2-inch asphalt pavement

In December 2001, a potential release of creosote-related material was observed at the outfall of the Braswell Street drainage system near the barge canal. Corrective measures were implemented from July 8 through July 23, 2002. The repair consisted of installing a cement-bentonite seepage cutoff wall across the two pipes approximately 190 feet upstream from the outfall headwall and immediately behind the headwall, injecting the gravel pipe bedding with a cement-bentonite grout mixture, and removing and solidifying the impacted sediments within the rip-rap apron downstream of the outfall. The solidified sediments were later transported to Canada for landfill disposal as a listed hazardous waste.

North Tidal Marsh Sediments

Beazer remediated an estimated 1,300-foot reach of the tidal creek channel, extending northwest from the intersection of Hagood Avenue and Doscher Avenue. The horizontal limits of excavation were dictated by field conditions and the material's angle of repose, but generally ranged from 20 to 30 feet in width. Best professional efforts were employed to remove visually impacted material beyond the established vertical/horizontal excavation limits, where practical.

Construction activities were initiated with dewatering and drainage control of the work area. The Hagood Avenue drainage system was temporarily diverted around the work area via a diversion ditch installed along the north side of Hagood Avenue. Ashley River tidal fluctuations were controlled by installing a tidal embankment across the marsh at the most downstream edge of the work area. The tidal embankment was fitted with an outlet structure to bypass water that accumulated in the work area. The original Hagood Avenue drainage system was restored and the tidal embankment was removed following construction.

Two access roads were constructed off Hagood Avenue to provide access to the remediation area. Access to the excavation area was accomplished through the use of a wooden-mat working platform. The mat platform was constructed along the centerline of the tidal creek channel and the excavation proceeded in an upstream to downstream direction to minimize the possibility of recontamination. As discussed previously, implementation of north tidal marsh remedy was coordinated with the upland soils component due to the impacts of the Phase 4 Land Disposal Restrictions on off-site disposal logistics. An estimated 1,500 cubic yards of material were removed from the north tidal marsh, hauled to the on-site material handling and staging area, and blended

with upland soils before being transported off site to a Subtitle C landfill in Pinewood, South Carolina, for final disposal.

Engineering controls were employed during excavation to provide short-term protectiveness and to mitigate the potential release of constituents via suspended sediments, tidal fluctuations and stormwater discharges. As an additional sediment and erosion control measure, hay bales were strategically placed to remove sediment from any bleed water or stormwater runoff prior to discharge at the downstream end. The hay bales were maintained during construction and restoration to assist in stabilizing the backfill and aid in revegetation of the area.

Once the excavations were completed to the required depth, a protective cap consisting of a non-woven geotextile and a minimum of 12 inches of sand was placed over the disturbed areas. The disturbed areas were returned to approximate pre-excavation elevations to avoid disruption of the natural dynamics of the local tidal marsh ecosystem, and were revegetated and restored with native species typical to tidal marshes of the vicinity. A monitoring and contingency plan was adopted to ensure the restored areas returned to functioning and productive habitat.

In-Situ Bioremediation of Northwest and South Tidal Marsh Sediments

After completion of additional characterization work in the south tidal marsh to refine the excavation boundaries, a 12-month pilot test for in-situ bioremediation of sediments in portions of the northwest and south tidal marshes was conducted from April 2000 to April 2001. The pilot study focused on the following three topics:

- Monitoring acute toxicity.
- Monitoring microbial community activity and constituent concentration of sediments in response to nutrient enhancement.
- Monitoring marsh biology (e.g., plants and macroinvertebrates) in response to nutrient enhancement.

The pilot study included fertilization with nitrogen and phosphorus over the entire south marsh study area and the addition of oxygen releasing compounds to three smaller sub-plots. The goal of these treatments was to enhance phytoremediation and to stimulate the catabolic activities of the indigenous microflora with known abilities to biodegrade organic constituents such as PAHs. The accelerated biological activities were intended to reduce constituent concentrations to acceptable levels as measured by a reduction in acute toxicity. The pilot study indicated that in-situ bioremediation did not produce an appreciable reduction in contaminant concentrations or a reduction in acute toxicity. As a result, full-scale implementation was not pursued. No further remedial action is planned for the marsh.

Barge Canal Sediments

This effort consisted of two sampling events to verify that concentrations of PAHs in sediments of the barge canal have decreased over time. A monitoring and contingency plan was adopted to ensure the revised natural deposition remedy meets the performance

standards established in the 1998 ROD. Monitoring results to support the monitored natural recovery for the barge canal are discussed further in Section 6.4 below.

Ashley River Sediments

Construction activities for the Ashley River component began in June/July 2001 with the demolition of the old railroad trestle and pier structures, cutting and removal of the associated timber piles, construction of access roads and construction of a revised central drainage ditch outfall. The cap construction followed the demolition activities and was completed in December 2001. The total area of the Ashley River capped was approximately 132,000 square feet, or roughly 3 acres. The subaqueous cap consisted of two types of caps, each having a minimum thickness of 12 inches:

- An approximately 2-acre sand cap was underlain by a non-woven geotextile to minimize consolidation concerns. Settlement and thickness monitors were placed in the sand cap in a regular grid at 50 foot centers to measure cap integrity over time.
- The remaining area immediately in front of the central drainage ditch outfall and the Parker Marine barge landing area received a cement-stabilized cap due to erosional concerns. This was accomplished by using a tubular mixing device and amphibious excavator to inject and mix cement-based grout into the upper 2 feet of sediments. Approximately 2,450 cubic yards of sediment were solidified to a depth of 2 feet using this technique.

A monitoring program was developed to measure the cap's effectiveness over time in mitigating potential risks to the benthic community and upper trophic level receptors. The results of this monitoring program are discussed further in Section 6.4 below.

South Tidal Marsh Sediment Excavation

Additional refinement sampling conducted during the project's remedial design phase increased the area of excavation to approximately 2 acres.

South tidal marsh construction activities began with mobilization in March 2003 and were finished with revegetation efforts by June 2003. The construction activities and sequencing for this component were performed in a similar fashion to that of the north marsh construction activities. A tide control embankment was installed around the periphery of the work area and a barrel/riser outlet structure was installed to bypass water that accumulated in the excavation area. Sediments from the south tidal marsh were removed by tracked excavators working on marsh mats or from the tide control embankment. Excavated material was hauled to an on-site handling and staging area for stabilization with cement kiln dust, before being hauled off site to the Lee County Subtitle D landfill in Bishopville, South Carolina, for final disposal. Approximately 2,500 tons of material, which included an estimated 600 tons of cement kiln dust, were hauled off site for disposal.

The excavated area was covered with a non-woven geotextile, backfilled with a minimum of 12 inches of sand, and graded to match pre-excavation tidal marsh elevations. The

south tidal marsh was revegetated and restored with native species typical to tidal marshes of the area. A monitoring and contingency plan was adopted to ensure the restored areas returned to functioning and productive habitat.

NAPL/Ground Water

Mobilization for the northwest corner S/S remedial component was initiated in May 2003 and construction was completed by July 2003. The horizontal extent of the S/S area was approximately 17,500 square feet and the vertical extent was 1 foot into the clay-confining unit, which varied in depth across the treatment area, but averaged approximately 14 feet. The S/S remedy was implemented using a slurry trenching technique due to the close proximity to the Ashley River and shallow depths to the observed ground water table. The treatment area was divided into 33 trenches, each being 4.5 feet wide and varying in length and depth. Each adjacent trench overlapped neighboring trenches to ensure complete treatment of the specified area.

Impacted material was excavated from each treatment trench, under bentonite slurry, and was transported to the mix containers for subsequent treatment. A total of 13,199 tons of impacted material were excavated and treated as part of this remedy. Following treatment, the solidified/stabilized material was placed back into the open excavation. At the completion of the solidification/stabilization activities, the surface of the solidified/stabilized soil was graded to promote drainage, and clean aggregate was placed.

NAPL recovery system installation activities were initiated in June 2003 and continued through August 2003. The full-scale recovery system was integrated with relevant components of the Interim Action treatment system, and full-scale recovery operations began in October 2003.

Active NAPL recovery is occurring in the former treatment area (FTA) and old impoundment area (OIA) using a network of NAPL and ground water extraction wells screened within the shallow and intermediate water bearing zones. The NAPL recovery system in the FTA consists of 11 shallow wells and four intermediate wells. In the OIA, the NAPL recovery system consists of three shallow wells and one intermediate well. This is a dual phase recovery system that extracts ground water and NAPL through separate lines. NAPL recovery is accomplished by pumping ground water at a controlled rate to enhance mobilization of NAPL to the extraction well sumps. The accumulation of NAPL in the storage sumps at the bottom of each extraction well is monitored on a weekly basis. When the volume of NAPL in the storage sump approaches capacity, the NAPL is extracted from the well using a surface-mounted air diaphragm pump and stored in an on-site aboveground storage tank. Recovered NAPL is periodically shipped to Giant Cement Company in Harleyville, South Carolina, for use as an energy recovery fuel in rotary cement kilns. Recovered ground water is discharged to the City of North Charleston publicly owned treatment works (POTW) under a Significant Industrial Wastewater Discharge Permit (permit number 2078). The current permit is effective from January 1, 2013, until December 31, 2017. Ground water from the 15 FTA extraction wells is pre-treated prior to discharge to the sewer, in order to meet the POTW permit

limits; the pre-treatment consists of an oil-water separator and addition of caustic to raise the pH. The water is sampled monthly for volatile organic compounds (VOCs), PAHs, arsenic and phenols. Ground water from the four OIA extraction wells is sent directly to the POTW because no pre-treatment is required to meet the POTW permit limits.

A performance monitoring program for the ground water/NAPL recovery and S/S remedies was developed using a network of existing and new monitoring wells across the Site. A monitoring plan was adopted to ensure the long-term permanence and effectiveness of the NAPL recovery systems, the solidification/stabilization remedy, and monitored natural attenuation mechanisms to meet the required performance standards. Operation and maintenance (O&M) reports have been submitted to the EPA and SCDHEC since this recovery system began full scale operation. Results from the monitoring program and annual O&M reports are discussed further in Section 6.4 below.

4.3 Operation and Maintenance (O&M)

The Site's current O&M requirements are:

- Engineered Soil Cover and Drainage Ditches: annual monitoring of the engineered soil cover and the ditch lining system
- Barge Canal: no further sediment monitoring and sampling activities are required
- South Tidal Marsh: no further monitoring is required
- Ashley River Subaqueous Cap: annual monitoring of the subaqueous cap thickness
- Northwest Corner: semi-annual NAPL thickness monitoring and annual chemical monitoring in the vicinity of the solidification/stabilization area
- NAPL Recovery System: monthly and semi-annual monitoring of the performance of the NAPL recovery system in the OIA and FTA
- Ground Water Natural Attenuation: semi-annual and annual monitoring of the effectiveness of the natural attenuation remedy in the OIA and FTA

Engineered Soil Cover and Drainage Ditches

The April 2004 Comprehensive Environmental Monitoring Plan requires annual visual inspections of the engineered soil cover and the reconstructed drainage ditches for structural integrity and performance. Inspections are typically conducted during the first quarter of each year, and have been conducted annually since 2004. A summary memorandum with supporting pictures is submitted to the EPA for proper documentation.

The engineered soil cover was repaired many times to repair depressions likely caused by activities that are no longer occurring on the Site, such as shipping container storage. The cover repair work generally consisted of backfilling the depression with gravel, asphalt or vegetation and grading the area to promote positive drainage. The Milford Street and Central Drainage Ditches were cleaned out in 2008 to remove sediment and vegetation growing in the ditches. The Braswell Street, Milford Street and Central Drainage Ditches were cleaned out in 2009, 2010 and 2011 to remove vegetation growing in the ditches.

The Hagood Avenue drainage ditch is maintained by the City of Charleston. During the January 2013 site inspection, this drainage ditch had substantial sediment accumulation and dense vegetation, including trees and shrubs.

Ashley River Subaqueous Cap

The monitoring program for the Ashley River subaqueous cap requires annual sand cap thickness monitoring and additional thickness measurements after significant storm events with high erosion capacity (e.g., tropical storms/hurricanes). The February 2008 inspection found no locations with a cap thickness less than the 12-inch minimum design standard. The February 2008 monitoring event occurred shortly after the subaqueous cap was repaired in January 2008; the repair work involved adding riprap and sand to areas where the cap was less than 12 inches thick. The 2009 and 2010 inspections found that the cap's thickness was less than 12 inches at two and three locations, respectively. No maintenance was performed. The March 2011 inspection found no locations with a cap thickness of less than 12 inches.

NAPL Recovery System

O&M of the NAPL recovery system is conducted by EFM Inc. During 2008-2011, most of the NAPL recovery wells operated at least 80 percent of each year, except for three OIA wells where tarry residues and mineral deposits accumulated on the well screens. Beazer attempted to redevelop these wells in September 2010 with limited success.

Table 4: Annual O&M Costs

Year	Total Cost
2008	$341,000
2009	$233,000
2010	$233,000
2011	$175,000
2012	$176,000

Annual costs for O&M over the past five years are shown in Table 4. The costs were higher in 2008 due to several activities that occurred that year, including: a RCRA large quantity generator inspection, additional ground water sampling activities, and some incorrectly charged barge canal sampling and reporting. The relatively lower costs shown for 2011 and 2012 are largely the result of some minor system adjustments that Beazer completed in 2010. Beazer replaced an oversized air compressor, which reduced utility costs, and switched from liquid caustic solution to a pelletized form, which reduced acquisition and material management costs.

The 1998 ROD estimated that the Site's O&M costs would be $1.4 million for the ground water/NAPL recovery and treatment systems, $46,000 for the Ashley River subaqueous cap, $75,000 for the barge canal, and $64,000 for bioremediation in the tidal marshes. These were estimates of the total net present worth over a 30-year period. The O&M cost estimate in the 1996 Feasibility Study Report appears to have underestimated the annual

O&M costs associated with the ground water/NAPL recovery and treatment systems at this Site.

5.0 Progress Since the Last Five-Year Review

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

> *The remedy implemented at the Koppers Co., Inc. site in Charleston, SC is currently considered adequately protective of human health and the environment; and human health and ecological exposure pathways that could result in unacceptable risks are being controlled.*

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

Table 5: Progress on Recommendations from the 2008 FYR

Section	Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
5.1	Continue to operate, monitor and maintain NAPL/ground water recovery systems	Beazer	Ongoing	Complete. Beazer continues to operate, monitor and maintain the NAPL/ground water recovery system.	03/25/2009
5.2	Implement EPA- and SCDHEC-approved follow-up actions recommended in the supplemental OIA investigation report	Beazer	12/31/08	None. Additional investigation of the intermediate water-bearing zone at the OIA will be conducted in the future. This issue/recommendation is being carried over into the 2013 FYR.	Not Applicable
5.3	Continue annual monitoring of the Ashley River subaqueous cap	Magnolia	Repairs conducted in January 2008. Next annual event by 03/31/09.	Complete. Beazer continues annual monitoring of the Ashley River subaqueous cap.	03/25/2009
5.4	Clean out Hagood Avenue drainage ditch	City of Charleston	12/31/08	None	Not Applicable
5.5	Continue to inspect and maintain soil cover and drainage ditches	Magnolia	Next annual event by 03/31/09	Complete. Beazer continues to inspect and maintain soil cover and drainage ditches.	03/25/2009
5.6	Discontinue sediment quality and vegetation encroachment monitoring in the barge canal	N/A	N/A	Complete. Beazer has discontinued sediment quality and vegetation encroachment monitoring in the barge canal.	06/04/2008

Section	Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
5.7	Continue to work with Magnolia to integrate redevelopment with site remedy and O&M	EPA	N/A	Complete. Redevelopment has been suspended, but the EPA continues to work with parties interested in the possible future development of the Site.	04/09/2010

5.1 Continue to operate, monitor and maintain NAPL/ground water recovery systems

Beazer continues to operate, monitor and maintain the NAPL/ground water recovery systems, as described in sections 4.2 and 4.3 of this FYR report.

5.2 Implement follow-up actions recommended in the supplemental OIA investigation report

The 2010 annual O&M report recommended additional test borings and installation of observation wells in the intermediate water-bearing zone at the OIA to delineate the northern extent of NAPL. This work has not yet been conducted and is carried over as a recommendation in this 2013 FYR.

5.3 Continue annual monitoring of the Ashley River subaqueous cap

Beazer continues annual monitoring of the Ashley River subaqueous cap, as described in section 4.3 of this FYR report.

5.4 Clean out Hagood Avenue drainage ditch

Based on the condition of the Hagood Avenue drainage ditch at the January 2013 FYR site inspection, it does not appear that the ditch was cleaned out as recommended in the 2008 FYR report. Section 9 of this FYR report recommends that the City of Charleston clean out the ditch in order to allow proper drainage.

5.5 Continue to inspect and maintain soil cover and drainage ditches

Beazer continues to inspect and maintain the soil cover and drainage ditches, as described in section 4.3 of this FYR report.

5.6 Discontinue sediment quality and vegetation encroachment monitoring in the barge canal

Beazer has discontinued sediment quality and vegetation encroachment monitoring in the barge canal, as recommended by the EPA in the 2008 FYR report.

5.7 Continue to work with Magnolia to integrate redevelopment with site remedy and O&M

This recommendation is no longer applicable because the redevelopment has been suspended.

6.0 Five-Year Review Process

6.1 Administrative Components

EPA Region 4 initiated the FYR in September 2012 and scheduled its completion for June 2013. EPA remedial project manager Craig Zeller led the EPA site review team, which also included EPA community involvement coordinator Neema Atashi and contractor support provided to the EPA by Skeo Solutions. The EPA established a review schedule consisting 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

In March 2013, the EPA published a public notice in the Charleston *Post and Courier* newspaper announcing the commencement of the FYR process for the Site, providing contact information for remedial project manager Craig Zeller and community involvement coordinator Neema Atashi and inviting community participation. The press notice is available in Appendix B. One person contacted the EPA as a result of the advertisement; the EPA offered to meet with this person and other community leaders to discuss the Site.

The EPA will make the final FYR Report available to the public. Upon completion of the FYR, the EPA will place copies of the 2013 FYR report, as well as the 2003 and 2008 FYR reports, in the designated site repository: Charleston County Public Library, 68 Calhoun Street, Charleston, South Carolina 29401.

6.3 Document Review

This FYR included a review of relevant, site-related documents including the RODs, ESDs, 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 substance, 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 that are 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, TBCs 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 maximum contaminant levels (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 five-year review for compliance with ARARs, only those ARARs that address the protectiveness of the remedy are reviewed.

Ground Water ARARs
According to the 1998 ROD, the cleanup goal for ground water is restoration to the ARAR-based cleanup levels, which are the MCLs specified by the Safe Drinking Water Act. However, since it may be technically impracticable to achieve the MCLs, the EPA established the following performance standards:

- Removal or treatment of NAPL to the maximum extent practicable.
- Containment of potentially non-restorable NAPL source areas.
- Containment and restoration of aqueous contaminant plumes.

The MCLs from the 1995 Remedial Investigation (RI) Report were compared to the current MCLs (Table 6). The 1995 RI report was used as a reference because the 1998 ROD does not list the MCLs. None of the MCLs have changed, except for arsenic and nickel. The arsenic MCL has become more stringent since the 1998 ROD. The nickel MCL was withdrawn in 1995.

The 1998 ROD stated that "All groundwater recovered via this remedy component shall be treated to the meet the ARARs of the selected discharge option... The water treatment system shall be properly operated and maintained to meet the discharge requirements imposed by the North Charleston POTW." The current permit, which is effective from January 1, 2013, until December 31, 2017, imposes various contaminant limits.

Soil/Sediment ARARs
The 1998 ROD did not specify chemical-specific ARARs for soil. The ROD specified soil/sediment ARARs that were relevant to the disposal of excavated materials; those ARARs are not relevant to the Site's continued protectiveness. Cleanup goals for soil/sediment contaminants were based on a site-specific risk assessment that assumed future industrial land use. See Section 7.2 for a discussion of soil/sediment cleanup goals.

Table 6: ARAR Review for Ground Water

Contaminant	1995 RI MCL (micrograms per liter (µg/L))	Current MCL (µg/L)[a]	MCL Change
Organics			
Benzene	5	5	No change
Benzo(a)pyrene	0.2	0.2	No change
Chlordane	2	2	No change
1,2-Dichlorobenzene	600	600	No change
Dioxins	0.00003	0.00003	No change
Endrin	2	2	No change
Ethylbenzene	700	700	No change
Heptachlor	0.4	0.4	No change
Heptachlor epoxide	0.2	0.2	No change
Lindane (gamma-BHC)	0.2	0.2	No change
Methoxychlor	40	40	No change
Methylene chloride	5	5	No change
Pentachlorophenol	1	1	No change
Styrene	100	100	No change
Toluene	1,000	1,000	No change
Xylenes	10,000	10,000	No change
Inorganics			
Antimony	6	6	No change
Arsenic	50	10	More stringent
Barium	2,000	2,000	No change
Beryllium	4	4	No change
Cadmium	5	5	No change
Chromium	100	100	No change
Copper	1,300	1,300	No change
Cyanide	200	200	No change
Lead	15	15	No change
Mercury	2	2	No change
Nickel	100	MCL removed	Less stringent
Selenium	50	50	No change
Thallium	2	2	No change

a. Current federal MCLs were obtained at: http://water.epa.gov/drink/contaminants/index.cfm (accessed 12/20/2012).

Institutional Controls

In July 2003, Ashley I LLC purchased the parcels of the Site owned by Beazer. The property transfer from Beazer to Ashley I LLC was conveyed by a limited warranty deed that included, among other items, prohibitions on residential development and ground

water use. These prohibitions run with the land, so they apply to all current and future owners and occupiers of the parcels purchased by Ashley I LLC. These institutional controls have been properly executed and recorded with the Charleston County Register of Mesne Conveyance in book W457, pages 722-736. The limited warranty deed is attached as Appendix J and can also be viewed online at the Charleston County Register of Mesne Conveyance's website (http://www2.charlestoncounty.org/). In addition to the parcels owned by Ashley I LLC, other parcels at the Site are currently owned by Ashley II of Charleston LLC, Parker Real Estate LP and South Carolina Electric & Gas Co. (see Figure 3). The prohibitions do not apply to the parcels owned by these other parties.

Tables 7 and 8 below list the institutional controls associated with the Site's ground water and land use. One of the Site's NAPL and ground water plumes extends north of Milford Street, onto an area used by the City of Charleston's Public Service Operations (see Figure 2).

Table 7: Ground Water Institutional Control (IC) Summary Table

Media	ICs Needed?	ICs Called for in the Decision Documents?	Impacted Parcels	IC Objective	Instrument in Place
Area of Interest – Former Treatment Area NAPL Plume (Parcels: 4660000017, 4660000032, 4660000033, 4660000044, 4660000029)[4]					
Ground Water	Yes	No	4660000029	Restrict use of ground water.	July 2003 deed prohibits residential development and ground water use at this parcel and other parcels purchased by Ashley I LLC (see Figure 3).
Ground Water	Yes	No	4660000017, 4660000032, 4660000033, 4660000044	Restrict use of ground water.	None. No IC is in place at parcels owned by parties other than Ashley I LLC (see Figure 3).

[4] Parcel numbers were obtained from the County of Charleston's Property Information System, http://ccgisweb.charlestoncounty.org/website/Charleston/viewer.htm, accessed 2/19/2013.

Media	ICs Needed?	ICs Called for in the Decision Documents?	Impacted Parcels	IC Objective	Instrument in Place
Area of Interest – Old Impoundment Area NAPL Plume (Parcel 4640000012)[5]					
Ground Water	Yes	No	4640000012	Restrict use of ground water.	July 2003 deed prohibits residential development and ground water use at this parcel and other parcels purchased by Ashley I LLC (see Figure 3).
Note: See Appendix J for the July 2003 deed.					

Table 8: Land Use Institutional Control (IC) Summary Table

Area of Interest – Entire On-Site Area					
Media	**ICs Needed?**	**ICs Called for in the Decision Documents?**	**Impacted Parcels**	**IC Objective**	**Instrument in Place**
Soil	Yes	No	4660000029, 4660000028, 4660000030, 4660000031, 4660000019, 4660000049, 4660000035, 4640000012, 4640000029	Prohibit land uses not compatible with remedy.	July 2003 deed prohibits residential development and ground water use at parcels purchased by Ashley I LLC (see Figure 3).
Soil	Yes	No	4660000018, 4660000032, 4660000033, 4660000044, 4660000034, 4660000037, 4660000043	Prohibit land uses not compatible with remedy.	None. No IC is in place at parcels owned by parties other than Ashley I LLC (see Figure 3).
Note: See Appendix J for the July 2003 deed.					

6.4 Data Review

The Site's ground water continues to have contamination at levels above the EPA's MCLs. Due to the magnitude of the ground water contamination, it may not be possible to achieve the MCL cleanup level in NAPL plume areas.

[5] Parcel number was obtained from the County of Charleston's Property Information System, http://ccgisweb.charlestoncounty.org/website/Charleston/viewer.htm, accessed 2/19/2013.

Some contaminants that were present in the ground water at levels exceeding MCLs at the time of the 1995 RI Report, such as dioxins, pentachlorophenol, styrene, antimony, arsenic, cadmium, chromium, copper and lead, are no longer being monitored in the Site's ground water. Ground water monitoring activities are being conducted at the Site in accordance with the EPA-approved Comprehensive Environmental Monitoring Plan and the operations/monitoring modifications described in Beazer's September 4, 2007 Plan, which included a summary of discussions between EPA, SCDHEC and Beazer during a September 4, 2007 meeting and responses to comments/correspondence on the previously submitted Performance Evaluation Report (Key Environmental, Inc., January 2006). Ground water monitoring being implemented at the Site includes an extensive list of representative constituents in accordance with EPA protocols. The ground water monitoring program being implemented at the Site has been deemed appropriate for the Site conditions and approved by the EPA.

The lateral extent of NAPL at the FTA and the OIA has been stable over the past five years. The NAPL recovery system has removed approximately 14,000 gallons and 9,600 gallons of NAPL from the FTA and OIA, respectively, from system startup in October 2003 through the end of 2011. The most recent annual O&M report, for 2011, states that the NAPL capture zones are sufficient. The 2008 annual O&M report stated that the shallow recovery wells at the OIA had annual NAPL recovery efficiencies (defined as gallons of NAPL collected per gallon of ground water extracted) greater than 3 percent. The FTA recovery wells and the deeper recovery well at the OIA had efficiencies below 1 percent. An efficient NAPL recovery system operates in the 1 to 3 percent range. NAPL recovery efficiencies less than 0.1 percent are considered inefficient. The 2009-2011 annual O&M reports found that all of the wells had annual NAPL recovery efficiencies below 1 percent. However, most of the wells had recovery efficiencies greater than 0.1 percent.

Conditions in the ground water continue to be favorable for biodegradation of the dissolved contaminants at the Site. The trend analysis presented in the 2011 annual O&M report found that benzene and naphthalene concentrations are decreasing or stable at all of the 15 locations evaluated in the shallow water bearing zone. In the intermediate water bearing zone, concentrations are decreasing or stable at 12 locations and increasing at three locations. The three locations with increasing trends are spread across the Site, with two locations at the FTA and one at the OIA.

Recovered ground water is discharged to the City of North Charleston publicly owned treatment works (POTW) under a Significant Industrial Wastewater Discharge Permit (permit number 2078). The permit has various contaminant limits and requires monthly reports to be submitted to the POTW. This FYR reviewed the 60 monthly reports submitted over the past five years (2008-2012). With the exception of four monthly reports, no exceedances were reported. The discharge limits were exceeded once for arsenic and three times for zinc.

6.5 Site Inspection

The FYR site inspection was conducted on January 17, 2013. The attendees were:

- Craig Zeller, EPA Region 4 remedial project manager
- Von Keisler, Greg Cassidy and Chuck Williams, SCDHEC
- Mike Slenska, Beazer
- Michael Costa, EnviroSmart (representing Ashley I)
- Sonny Chestnut and Andrew Wertz, S&ME Inc. (engineering firm working for lender)
- Jack Smith, Nelson Mullins Riley & Scarborough (law firm representing investor lender)
- Gerald Pouncey, Morris, Manning & Martin (law firm representing lender)
- Treat Suomi and Hagai Nassau, Skeo Solutions

The site inspection attendees conducted a walking/driving tour of the Site, including the FTA, OIA, barge canal, south marsh, northwest corner, Ashley River cap, central drainage ditch, Milford Street drainage ditch and Hagood Avenue drainage ditch. At the FTA, attendees viewed the ground water treatment trailer, chemical storage shed, NAPL storage tank and an extraction well. The Site Inspection Checklist is included in Appendix D of this FYR report. Photographs from the site inspection are provided in Appendix E.

Site inspection attendees noted no deficiencies in the Site's engineered soil cover. Site inspection attendees noted that the Milford Street drainage ditch contained sediment and shrubs, and that the Hagood Avenue ditch contained sediment, trees and shrubs. Following the site inspection, EnviroSmart cleaned out the Milford Street ditch in January 2013. Section 9 of this FYR report recommends that the City of Charleston clean out the Hagood Avenue ditch in order to allow proper drainage.

On January 16, 2013, Skeo Solutions staff visited the designated site repository, the Charleston County Public Library at 68 Calhoun Street, Charleston, South Carolina, as part of the site inspection. Site documents were easily accessible; however, no documents after the 2003 ESD were present. The EPA will update the document repository after this FYR report is finalized.

6.6 Interviews

The FYR process included interviews with the PRP and SCDHEC. The purpose was to document the perceived status of the Site and any perceived problems or successes with the remedy. The interviews are summarized below. Appendix C provides the complete interviews.

Craig Zeller, the EPA remedial project manager, stated that the project cleanup was comprehensive and was a proper blend of cost-effective remediation techniques to meet

the established Performance Standards. The successful cleanup work has improved the environmental condition of the area, and removed any obstacles for potential reuse. The EPA will work to implement institutional controls on those parcels that still need them.

Charles Williams, the SCDHEC project manager, stated that the remedy is protective of human health and the environment. The remedy is performing as expected, the institutional controls are adequate, and the goals of the ROD are being met.

Mike Slenska, the Beazer project manager, stated that the remedy is performing as designed with Site reuse being pursued. O&M personnel are on Site approximately one to two days per week inspecting and maintaining the NAPL collection system that runs continuously. There have been no significant O&M difficulties or unexpected costs over the past five years. Beazer is not aware of any complaints or inquiries regarding environmental issues or the remedial action from residents since completion of Site remedial action activities.

7.0 Technical Assessment

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

In general, the remedial action continues to operate and function as designed. The Site's soil and drainage ditch sediments were excavated and capped as specified in the ROD. Tidal marsh sediments were excavated as specified in the ROD. The barge canal sediments were covered by natural deposition as called for in the 2003 ESD. A subaqueous cap was placed over the Ashley River sediments as called for in the 2001 ESD. The northwest corner NAPL was immobilized using in-situ stabilization and solidification as called for in the 2003 ESD. The NAPL/ground water recovery systems in the FTA and OIA continue to remove NAPL from the subsurface.

The ROD's cleanup goal for ground water is to achieve the MCLs specified by the Safe Drinking Water Act. However, because it may not be technically possible to achieve the MCLs, the ROD established performance standards. The NAPL/ground water remedy is meeting these performance standards. Some contaminants that were present in the ground water at levels exceeding MCLs at the time of the 1995 RI Report are no longer being monitored in the Site's ground water. Therefore, it is not known whether their current levels exceed MCLs.

Institutional controls restricting land and ground water use have been implemented for some, but not all, of the Site's parcels. Land and ground water use restrictions are needed, given that the Site was cleaned to industrial levels and ground water contamination exists. The July 2003 limited warranty deed transferring some of the Site parcels from Beazer East Inc. to Ashley I LLC does contain restrictive covenants prohibiting residential use and use of ground water, for all current and future users of those parcels. The 2003 deed is included as Appendix J of this FYR report. The 2003 deed applies only to the parcels owned by Ashley I (see Figure 3). Other parts of the Site, owned by Ashley II of Charleston LLC, Parker Real Estate LP and South Carolina Electric & Gas Co, as well as the municipal property north of Milford Street, are not subject to the restrictive covenants in the 2003 deed.

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 and remedial action objectives used at the time of remedy selection are still valid. The Site was cleaned to industrial levels, except for the Hagood Avenue drainage ditch, which was cleaned to residential levels. Ground water affected by the Site is not used for residential or industrial supply. The Site is currently vacant except for the Parker Marine property. Part of the Site is used for parking by employees of the adjacent City of Charleston Public Service Operations. Individuals also trespass onto the Site to skateboard. Most of the Site is not fenced.

The 1998 ROD calculated cleanup goals for soil/sediment contaminants based on a site-specific risk assessment that assumed future industrial land use. This FYR compared the

contaminants' current toxicity values with their previous toxicity values that were used to calculate the cleanup goals. This comparison is presented in Appendix F. Except for lead, all of the contaminants have at least one toxicity value that has changed to indicate increased toxicity. As shown in Table 9 below, a comparison to current, generic screening levels indicates that each contaminant's surface soil cleanup level is still within the EPA's acceptable cancer risk range (10^{-4} to 10^{-6}). However, the dioxin cleanup level is associated with a non-cancer hazard index of 2.5, which is above the EPA's threshold value of 1. Also, summing the cancer risks from the four contaminants yields a cumulative cancer risk of 3×10^{-4}, which is above the acceptable risk range. Therefore, the surface soil cleanup levels are no longer valid based on the risk associated with exposure to soil or sediment containing a level of contamination equal to the cleanup levels. However, the actual remaining contaminant concentrations at the Site are well below the cleanup levels. The most heavily contaminated soil and sediment was excavated and disposed of off site, and areas with less contamination were capped with clean material. The levels of contaminants remaining in the Site's uncapped areas correspond to risk levels within the EPA's acceptable range (10^{-4} to 10^{-6}) based on current toxicity values. In addition, except for the Parker Marine property, the Site is currently vacant, so receptors are not frequently present on site.

The Site's subsurface cleanup levels are still protective. The feasibility study found that the residual risk from subsurface soil would be less than the residual risk from surface soil. The subsurface excavation met a cleanup standard of 55 mg/kg for B(a)p-TE, which is more stringent than the 275 mg/kg subsurface cleanup level selected in the ROD.

The EPA calculated the Site's soil lead cleanup goal (1,150 mg/kg) using the EPA's 1996 adult lead methodology, based on protectiveness for a future pregnant on-site worker. The 1998 ROD used a value of 1.9 for the geometric standard deviation, and a value of 2.2 µg/dL for the baseline blood lead concentration (p. 33). The EPA reviewed the current adult lead methodology,[6] and found that these parameter values are still appropriate. This FYR also used the current version of the adult lead methodology to re-calculate the lead cleanup goal, and found that the cleanup goal is still protective. See Appendix G.

[6] The current adult lead methodology, titled *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil* and dated January 2003, is available at http://www.epa.gov/superfund/lead/products/adultpb.pdf.

Table 9: Review of Surface Soil Cleanup Levels

Contaminant[a]	Industrial Soil RSL (mg/kg)[b]	1998 ROD Surface Soil Cleanup Level (mg/kg)	Risk Associated with 1998 ROD Surface Soil Cleanup Level[c]
arsenic	1.6	135	8×10^{-5}
benzo(a)pyrene	0.21	2	1×10^{-5}
dioxin			
cancer	1.8×10^{-5}	0.0015	8×10^{-5}
non-cancer	6.0×10^{-4}	0.0015	Hazard index = 2.5
pentachlorophenol	2.7	235	9×10^{-5}

a. This table presents cancer risks for each of the contaminants. For dioxin, the non-cancer hazard is also presented, because the 1998 ROD cleanup goal is associated with a hazard index greater than 1, which indicates that exposure to contamination at that level may be harmful.

b. The EPA's Regional Screening Levels (RSLs) are generic values; they are not based on site-specific conditions. The current RSLs, dated November 2012, are available at http://www.epa.gov/region9/superfund/prg/index.html (accessed 2/19/2013).

c. The cancer risks were calculated using the following equation, based on the fact that RSLs are derived based on 10^{-6} risk:

Cancer risk = (1998 ROD Cleanup Level ÷ Industrial Soil Cancer RSL) × 10^{-6}

The non-cancer hazard index was calculated using the following equation:

Hazard index = (1998 ROD Cleanup Level ÷ Industrial Soil Non-cancer RSL)

On February 17, 2012, the EPA released a new non-cancer toxicity value for dioxin that results in a commercial/industrial soil screening level of 0.6 µg/kg. The Site's dioxin cleanup goals of 1.5 µg/kg for surface soil/sediment and 20 µg/kg for subsurface soil/sediment are less stringent than this new screening level. Therefore, this FYR conducted a preliminary analysis of existing dioxin sampling data to identify whether there are areas at the Site with dioxin above the current industrial screening level that were not excavated or capped. The analysis included data presented in the 1998 ROD (Figure 10) and the August 20, 1998 *Draft Soils and Sediment Pre-Design Data Collection Report*. The analysis found that all of the areas that had dioxin levels above the current screening level have been excavated and/or capped. One location (SB-18) that is outside of the areas that were excavated and/or capped had a dioxin toxicity equivalent quotient (TEQ) concentration of 0.7 µg/kg reported in the 1998 ROD (Figure 10), which is above the current industrial screening level (0.6 µg/kg). However, using the current dioxin toxicity equivalence factors,[7] this location's dioxin TEQ concentration is 0.5

[7] EPA Regional Screening Table – User's Guide, dated November 2012, available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm, accessed 2/22/2013.

µg/kg, which is below the current screening level (see Appendix H). Therefore, there are no known dioxin surface soil concentrations above the current industrial screening level.

The Site's Baseline Risk Assessment and RODs did not evaluate the potential for vapor intrusion. However, some vapor intrusion assessment was conducted as part of the property's redevelopment process, which has been suspended. One of the Site's VOC plumes extends north of Milford Street, onto an area used by the City of Charleston's Public Service Operations (see Figure 2). This area has a number of buildings in use. A Vapor Intrusion Screening Assessment, conducted by ERM and dated February 20, 2008, estimated a risk of 1×10^{-5} for commercial use, based on a maximum benzene concentration detected in ground water (590 µg/L). The results of the 2008 evaluation indicated that benzene was the primary contaminant of concern for VI in the areas of the Public Service Operations and the northwest corner of the Site. The 2008 screening assessment recommended that a passive soil gas survey be conducted.

The February 10, 2010 *Passive Soil Gas Survey Report: Magnolia Development Site*, prepared by ERM for Ashley II of Charleston, LLC, found that potential vapor intrusion conditions existed at various locations on the Site property, as well as extending onto the Charleston Public Works area. The report recommended that active soil gas sampling be conducted in the identified locations, to assess more precisely the potential for vapor intrusion. Alternatively, the report stated that pre-emptive mitigation measures could be conducted. In a letter dated April 9, 2010, SCDHEC agreed with these recommendations and requested that Ashley II propose measures for implementing the recommendations. The additional vapor assessment requested by SCDHEC was not conducted because the Magnolia development efforts were suspended.

The EPA currently recommends the use of multiple lines of evidence to evaluate the vapor intrusion pathway. This FYR conducted a screening-level VI evaluation to assess the protectiveness of the remedy (see Appendix I). Using the most recent benzene concentrations in ground water, the indoor air risk is 3×10^{-5} for both the public service buildings and the currently vacant on-site area. This risk is within the EPA's risk management range. Using naphthalene concentrations, the non-cancer hazard is above the EPA's threshold of 1 for the public service buildings. These results are likely an underestimate of VI exposure, because they include only benzene and naphthalene. Therefore, the remedy may not be protective unless it can be demonstrated that indoor air concentrations are within acceptable limits. The EPA will conduct air sampling to assess the potential for vapor intrusion at the existing, occupied buildings above the ground water plume. At areas where buildings may be constructed in the future, the EPA will require additional vapor intrusion assessment or mitigation prior to future construction.

The MCLs for the Site's ground water contaminants have not changed, except for arsenic and nickel. The arsenic MCL has become more stringent since the 1998 ROD. The nickel MCL was withdrawn in 1995. The toxicity equivalence factors for carcinogenic PAHs have not changed since the Site's cleanup levels were selected. Although the Site's ecological risk assessment was completed before the EPA finalized its ecological risk assessment guidance document, the assessment is still adequate, given that it included a

baseline ecological risk assessment with whole sediment toxicity tests, in addition to a screening level assessment.

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

In general, the remedial action continues to operate and function as designed. The exposure assumptions and remedial action objectives used at the time of remedy selection are still valid. Some of the Site's constituents of concern now have more stringent toxicity values. The cumulative cancer risk associated with the surface soil cleanup levels is above the EPA's acceptable risk range for industrial use, as is the non-cancer hazard associated with the dioxin cleanup level. This does not affect the soil's protectiveness, because the level of contamination remaining on the Site corresponds to risk levels within the EPA's acceptable range (10^{-4} to 10^{-6}). Vapor intrusion may be a concern at occupied off-site buildings above the ground water plume. No remediation was conducted in the portions of the tidal marshes for which in-situ bioremediation was selected, because the bioremediation pilot tests were not successful. The arsenic MCL has become more stringent since the 1998 ROD. Additional land and ground water use restrictions are needed, given that the Site was cleaned to industrial levels and ground water contamination exists.

8.0 Issues

Table 10 summarizes the current site issues.

Table 10: Current Site Issues

Issue	Affects Current Protectiveness?	Affects Future Protectiveness?
Some of the Site's parcels do not have land use restrictions in place.	No	Yes
Some of the on-site and off-site parcels above the NAPL/ground water plume do not have ground water use restrictions in place.	No	Yes
The arsenic MCL has become more stringent since the 1998 ROD.	No	Yes
Vapor intrusion may pose an unacceptable risk for the existing buildings in use at the Charleston Public Service area, and for potential future uses of on-site areas.	Yes	Yes
Additional investigation is needed to delineate the northern extent of NAPL at the OIA.	No	Yes

9.0 Recommendations and Follow-up Actions

Table 11 provides recommendations to address the current site issues.

Table 11: Recommendations to Address Current Site Issues

Issue	Recommendation / Follow-Up Action	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness?	
					Current	Future
Some of the Site's parcels do not have land use restrictions in place.	Issue decision document to select land use restrictions where needed. Implement selected restrictions.	EPA	EPA	06/04/2014	No	Yes
Some of the on-site and off-site parcels above the NAPL/ground water plume do not have ground water use restrictions in place.	Issue decision document to select ground water use restrictions where needed. Implement selected restrictions.	EPA	EPA	06/04/2014	No	Yes
The arsenic MCL has become more stringent since the 1998 ROD.	Determine whether the NAPL/ground water system should be modified to address arsenic.	EPA	EPA	06/04/2014	No	Yes
Vapor intrusion may pose an unacceptable risk for the existing buildings in use at the Charleston Public Service area, and for potential future uses of on-site areas.	Conduct air sampling to further assess the potential for vapor intrusion at existing buildings. Require additional vapor intrusion assessment or mitigation prior to future construction.	EPA	EPA	06/04/2014	Yes	Yes
Additional investigation is needed to delineate the northern extent of NAPL at the OIA.	Conduct additional investigation at the OIA to delineate the northern extent of NAPL. Determine if the existing recovery system for the intermediate water-bearing zone at the OIA is adequate.	Beazer	EPA	06/04/2014	No	Yes

The following additional items, though not expected to affect protectiveness, warrant additional follow-up:

- The Hagood Avenue drainage ditch contains sediment, trees and shrubs. The EPA recommends that the City of Charleston clean out the ditch to promote proper drainage.
- The EPA recommends that Beazer ensure that all monitoring wells are properly locked.
- The Site's local document repository is not up to date. The EPA will update the document repository after this FYR report is finalized.

10.0 Protectiveness Statement

A protectiveness determination of the Site's remedy cannot be made at this time until further information is obtained. Further information will be obtained by conducting active soil gas sampling to assess more precisely the potential for vapor intrusion. It is expected that these actions will take approximately one year to complete, at which time a protectiveness determination will be made. In order for the remedy to be protective in the long term, the EPA will issue a decision document to select land and ground water use restrictions where needed, and implement the selected restrictions.

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

Beazer East, Inc. *Remedial Investigation Report: Former Koppers Site*. January 1995.

Beazer East, Inc. *Feasibility Study Report: Former Koppers Site*. December 1996.

Beazer East, Inc. *Final Remedial Action Report: Final Remedial Action, Charleston Plant Site*. Prepared by URS. August 2003.

Beazer East, Inc. *2008 Annual Operations and Monitoring Report, Former Koppers Company, Inc. Superfund Site, Charleston, South Carolina*. Prepared by Field & Technical Services, LLC. March 25, 2009.

Beazer East, Inc. *2009 Annual Operations and Monitoring Report, Former Koppers Company, Inc. Superfund Site, Charleston, South Carolina*. Prepared by Field and Technical Services, LLC. March 31, 2010.

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Beazer East, Inc. *2011 Annual Operations and Monitoring Report, Former Koppers Company, Inc. Superfund Site, Charleston, South Carolina*. Prepared by Field and Technical Services, LLC. March 30, 2012.

Dames & Moore Group and NewFields, Inc. *Draft Soils and Sediment Pre-Design Data Collection Report*. August 20, 1998.

Environmental Resources Management. *Koppers Vapor Intrusion Screening Assessment*. February 20, 2008.

Environmental Resources Management. *Passive Soil Gas Survey Report: Magnolia Development Site*. Prepared for Ashley II of Charleston, LLC. February 10, 2010.

EPA Region 4. *Final Baseline Risk Assessment for Koppers Company, Inc. (Charleston Plant)*. Prepared by Black & Veatch Waste Science, Inc. January 18, 1995.

EPA Region 4. *Interim Action Record of Decision for the Koppers Co., Inc. (Charleston Plant) NPL Site*. March 1995.

EPA Region 4. *Record of Decision Declaration for Koppers Co., Inc. (Charleston Plant) NPL Site*. April 29, 1998.

EPA Region 4. *Explanation of Significant Difference to the Final Record of Decision: Koppers Co., Inc. (Charleston Plant) NPL Site*. August 8, 2001.

EPA Region 4. *Explanation of Significant Difference to the Final Record of Decision: Koppers Co., Inc. (Charleston Plant) NPL Site*. April 24, 2003.

EPA Region 4. *Second Five Year Review for the Koppers Co., Inc (Charleston Plant) NPL Site, Charleston, Charleston County, South Carolina*. June 4, 2008.

SCDHEC. Letter from Angela Gorman, Hydrogeologist, SCDHEC, to Scott Freeman, Cherokee Investments, Re: SCDHEC review of: Passive Soil Gas Survey Report, dated February 10, 2010, Ashley II Magnolia Development Properties. April 9, 2010.

Appendix B: Press Notice

The U. S. Environmental Protection Agency, Region 4
Announces a Five-Year Review for
the Koppers Co., Inc. (Charleston Plant) Superfund Site,
Charleston City, Charleston County, South Carolina

Purpose/Objective: The U.S. Environmental Protection Agency (EPA) is conducting a Five-Year Review of the remedy for the Koppers Co., Inc. (Charleston Plant) Superfund site (the Site) in Charleston, South Carolina. The purpose of the Five-Year Review is to ensure that the selected cleanup actions effectively protect human health and the environment.

Site Background: The Koppers Co., Inc. (Charleston Plant) site is approximately 102 acres and is located in northern Charleston. From 1940 to 1978, the Koppers Company operated a wood treatment facility on an area of the Site generally bounded on the north by Milford Street, on the south by Braswell Street, on the east by the King Street Extension, and on the west by the Ashley River. Wood-treating operations consisted primarily of treating raw lumber and utility poles with creosote. On-site soils are contaminated with polynuclear aromatic hydrocarbons and pentachlorophenol, with trace amounts of dioxin, arsenic and lead. Creosote is present in the ground water under the Site. The sediments and surface waters of drainage ditches leading from the Site contained creosote. Sediments in the Ashley River and neighboring tidal marshes contained contaminants harmful to the environment. EPA proposed the Site for inclusion on the National Priorities List (NPL) in 1992; the Site was finalized on the NPL in 1994.

Cleanup Actions: In 1998, EPA issued a Record of Decision (ROD) describing the final cleanup approach for the Site. EPA later modified the cleanup approach by issuing two Explanations of Significant Differences (ESDs). All cleanup components were completed by September 2003, at an estimated cost of $20.4 million. These include the following:

- Excavation and off-site disposal of 22,000 tons of impacted soils.
- Installation of a 40-acre protective cap over surface soils.
- Reconstruction of 3,600 feet of surface water drainage ditches.
- Excavation and restoration of tidal marshes.
- Installation of a 3-acre cap over Ashley River sediments.
- Monitored natural recovery for barge canal sediments.
- Active recovery of ground water and creosote in the ground water.

The full-scale recovery of impacted ground water and creosote in the ground water was initiated in October 2003. Nearly 24,000 gallons of creosote have been removed from the Site's ground water. A comprehensive environmental monitoring program is being conducted to ensure the cleanup approach remains adequately protective of human health and the environment. Site cleanup activities are being led primarily by potentially responsible parties with oversight by EPA.

Five-Year Review Schedule: The National Contingency Plan requires that 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 be reviewed every five years to ensure the protection of human health and the environment. The third of the Five-Year Reviews for the Site will be completed by June 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 ensure that the remedy remains protective of human health and the environment. As part of the Five-Year Review process, EPA staff 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:

Craig Zeller, EPA Remedial Project Manager
Phone: (404) 562-8827
E-mail: zeller.craig@epa.gov

Neema Atashi, EPA Community Involvement Coordinator
Phone: (404)317-9885
Email: atashi.neema@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 Charleston County Public Library, 68 Calhoun Street, Charleston, South Carolina 29401,
and online at: http://www.epa.gov/region4/superfund/sites/npl/southcarolina/kopchsc.html. R34-936701 1

Appendix C: Interview Forms

Koppers Co., Inc. (Charleston Plant) Superfund Site **Five-Year Review Interview Form**

Site Name:	Koppers Co., Inc. (Charleston Plant)	**EPA ID No.:**	SCD980310239
Interviewer Name:	Hagai Nassau	**Affiliation:**	Skeo Solutions
Subject Name:	Craig Zeller	**Affiliation:**	EPA
Subject Contact Information:	zeller.craig@epa.gov		
Time:	3:58 p.m.	**Date:**	3/28/2013
Interview Location:	N/A		

Interview Format (circle one): **In Person** **Phone** **Mail** **Other: email**

Interview Category: **EPA Remedial Project Manager**

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   I believe the project cleanup was comprehensive and was a proper blend of cost-effective remediation techniques to meet the established Performance Standards. O&M activities have been conducted sufficiently to ensure the remedy remains protective of human health and the environment.

2. What have been the effects of this Site on the surrounding community, if any?

   This Site reached construction completion in 2003, and I believe the successful cleanup work has improved the environmental condition of the area, and removed any obstacles for potential reuse.

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities since the implementation of the cleanup?

   I am not aware of any complaints or inquiries regarding site-related environmental issues or remedial activities since the cleanup was finished.

4. What is your assessment of the current performance of the remedy in place at the Site?

   I am satisfied with the remedy performance and O&M activities.

5. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?

   I acknowledge that only the formerly owned Beazer properties have institutional controls that limit land use to industrial, and prohibit ground water use. Through this Five-Year Review process, I will work with EPA legal counsel and owners of the other properties to get proper ICs recorded on those parcels.

6. Are you aware of any community concerns regarding the Site or the operation and management of its remedy? If so, please provide details.

   I am not aware of any community concerns at this Site.

7. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   No.

Koppers Co., Inc. (Charleston Plant) Superfund Site — Five-Year Review Interview Form

Site Name:	Koppers Co., Inc. (Charleston Plant)	**EPA ID No.:**	SCD980310239
Interviewer Name:	Hagai Nassau	**Affiliation:**	Skeo Solutions
Subject Name:	Charles Williams	**Affiliation:**	South Carolina Department of Health and Environmental Control

Subject Contact Information: williacj@dhec.sc.gov
Time: 7:30 a.m. **Date:** 1/25/2013
Interview Location: N/A

Interview Format (circle one): In Person | Phone | Mail | **Other: email**

Interview Category: State Agency

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   The project is moving forward and the goals of the ROD are being met. Reuse of the site is occurring where it is physically and economically available.

2. What is your assessment of the current performance of the remedy in place at the Site?

   The remediation system is performing as expected.

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years?

   I do not recall any complaints in the last 5 years of the Site.

4. Has your office conducted any site-related activities or communications in the past five years? If so, please describe the purpose and results of these activities.

   SCDHEC will perform periodic site visits and we review the Annual Groundwater Report.

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy?

   We are not aware of any changes.

6. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?

   We are comfortable with the ICs at the Site at this time.

7. Are you aware of any changes in projected land use(s) at the Site?

   We are not aware of any changes in site use.

8. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

   The site remedy is still being protective of human health and the environment.

Koppers Co., Inc. (Charleston Plant) Superfund Site **Five-Year Review Interview Form**

Site Name: Koppers Co., Inc. (Charleston Plant) **EPA ID No.:** SCD980310239

Interviewer Name: Hagai Nassau **Affiliation:** Skeo Solutions

Subject Name: Mike Slenska **Affiliation:** Beazer

Subject Contact Information: mike.slenska@trmi.biz

Time: 9:38 a.m. **Date:** 2/27/2013

Interview Location: N/A

Interview Format (circle one): In Person Phone Mail **Other: email**

Interview Category: **Potentially Responsible Parties (PRPs)**

1. What is your assessment of the current performance of the remedy in place at the Site?

   The remedy is performing as designed.

2. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   The remedy is performing as expected with Site reuse being pursued.

3. What are the findings from the monitoring data? What are the key trends in contaminant levels that are being documented over time at the Site?

   This information is documented in the Annual Operations and Monitoring Reports submitted to USEPA.

4. Is there a continuous on-site O&M presence? If so, please describe staff responsibilities and activities. Alternatively, please describe staff responsibilities and the frequency of site inspections and activities if there is not a continuous on-site O&M presence.

   O&M personnel are on Site approximately one to two days per week inspecting and maintaining the dense nonaqueous-phase liquid (DNAPL) collection system that runs continuously. Additional inspection and monitoring activities are conducted in accordance with the Comprehensive Environmental Monitoring Plan for the Site and the operations/monitoring modifications described in Beazer's September 4, 2007 meeting summary and responses to comments/correspondence on the January 24, 2006 Performance Evaluation Report submitted to USEPA.

5. Have there been any significant changes in site O&M requirements, maintenance schedules or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

   There have been no significant changes to the operation, maintenance or monitoring requirements or routines over the past five years.

6. Have there been unexpected O&M difficulties or costs at the Site since start-up or in the last five years? If so, please provide details.

   There have been no significant O&M difficulties or unexpected costs over the past five years.

7. Have there been opportunities to optimize O&M activities or sampling efforts? Please describe changes and any resulting or desired cost savings or improved efficiencies.

   With regard to the relatively high costs in 2008, there were several "one-off" activities that occurred that year that drove up our OM&M costs, including: a RCRA Large Quantity generator inspection (this includes additional field time and numerous follow-up meetings, calls and correspondence); additional groundwater sampling activities related to the "Response to Comments for the Performance Evaluation Report & Subsequent Correspondence" letter dated September 4, 2007; and some incorrectly charged Barge Canal Sampling and Reporting. If you take out the costs associated with these activities, 2008's costs would be more in line with the $233K cost reported for 2009 and a $251K cost for 2007 (not provided in the table we previously sent).

   The relatively lower costs shown for 2011 and 2012 are largely the result of some minor system adjustments that we completed in 2010. We replaced an oversized air compressor (from 25Hp to 5Hp) that helped us reduce our utility costs, and we also switched from liquid caustic solution to a pelletized form helping us to save on acquisition costs as well as material management costs.

8. Do you feel well-informed regarding the Site's activities and remedial progress? If not, how might the EPA convey site-related information in the future?

   Beazer remains well informed concerning its Site activities.

9. Are you aware of any complaints or inquiries regarding environmental issues or the remedial action from residents since implementation of the cleanup?

   Beazer is not aware of any complaints or inquiries regarding environmental issues or the remedial action from residents since completion of Site remedial action activities.

10. What have been the effects of this Site on the surrounding community, if any?

    No. To the best of our knowledge there have been no effects from the Site on the surrounding community. Redevelopment of the Site would be a dramatically positive benefit to the surrounding community.

11. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

    No.

Appendix D: Site Inspection Checklist

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST	
I. SITE INFORMATION	
Site Name: Koppers Co., Inc. (Charleston Plant)	**Date of Inspection:** January 17, 2013
Location and Region: Charleston, South Carolina; Region 4	**EPA ID:** SCD980310239
Agency, Office or Company Leading the Five-Year Review: EPA	**Weather/Temperature:** 75°F, clear
Remedy Includes: (Check all that apply) ☒ Landfill cover/containment ☐ Access controls ☒ Institutional controls ☒ Ground water pump and treatment ☐ Surface water collection and treatment ☒ Other: excavation and off-site disposal	☒ 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** Mike Slenska (Name) — senior environmental manager (Title) — 02/27/2013 (Date) Interviewed ☐ at site ☐ at office ☐ by phone Phone: by email Problems, suggestions ☐ Report attached: yes	
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 South Carolina Department of Health and Environmental Control
Contact Charles Williams (Name) | project manager (Title) | 1/25/2013 (Date) | _____ (Phone No.)
Problems/suggestions ☐ Report attached: yes

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: _____				
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: $1.6 million total net present worth over 30-year period (1996 dollars)
☐ Breakdown attached

Total annual cost by year for review period if available

From: 01/01/2008 Date	To: 12/31/2008 Date	$341,195.34 Total cost	☐ Breakdown attached
From: 01/01/2009 Date	To: 12/31/2009 Date	$233,259.08 Total cost	☐ Breakdown attached
From: 01/01/2010 Date	To: 12/31/2010 Date	$232,532.36 Total cost	☐ Breakdown attached
From: 01/01/2011 Date	To: 12/31/2011 Date	$175,327.36 Total cost	☐ Breakdown attached
From: 01/01/2012 Date	To: 12/31/2012 Date	$175,643.01 Total cost	☐ Breakdown attached

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

Describe costs and reasons: 1996 Feasibility Study Report seems to have underestimated O&M costs.

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

A. Fencing

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

Remarks: Site is unfenced, except for the area that contains the ground water treatment trailer, NAPL storage tank and storage buildings.

B. Other Access Restrictions

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

Remarks: Site has no signs

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

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

Remarks: The institutional controls in place apply to some, but not all, of the Site's parcels.

D. General

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

Remarks: Skateboarding was observed on the Site during the site inspection.

2. **Land Use Changes On Site** ☒ N/A

Remarks: Site is vacant, except for Parker Marine. Redevelopment plans have been suspended.

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: seams are present at the edges of the concrete slabs

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: Parts of the engineered soil cover were designed to be vegetated. Grass growth is sporadic. Grass is growing in some of the seams at the edges of the concrete slabs.

6. **Alternative Cover** (e.g., armored rock, concrete) ☐ N/A
   Remarks: parts of the engineered soil cover consist of aggregate base course

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: _____

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: Milford Street ditch contained sediment and shrubs. Hagood Avenue ditch contained sediment, trees and shrubs.

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☒ Vegetation does not impede flow
   Area extent: _____ Type: _____
   Remarks: Milford Street ditch contained sediment and shrubs. Hagood Avenue ditch contained sediment, trees and shrubs.

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): caustic to raise pH

☐ 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: some wells are missing locks

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 remedy was designed to eliminate unacceptable human and ecological exposure to soil and sediment contamination, manage some marsh areas using bioremediation, remove or treat NAPL, and contain NAPL and aqueous contaminant plumes. In general, the remedy is effective and functioning as designed. However, the bioremediation was not successful. Vapor intrusion may be a concern at existing off-site buildings above the ground water plume. Additional land and ground water use restrictions are needed, given that the Site was cleaned to industrial levels and ground water contamination exists.

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.

In general, the O&M is adequate. However, some contaminants that exceeded MCLs at one time are no longer being monitored. Therefore, it is not known whether their current levels exceed MCLs.

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.

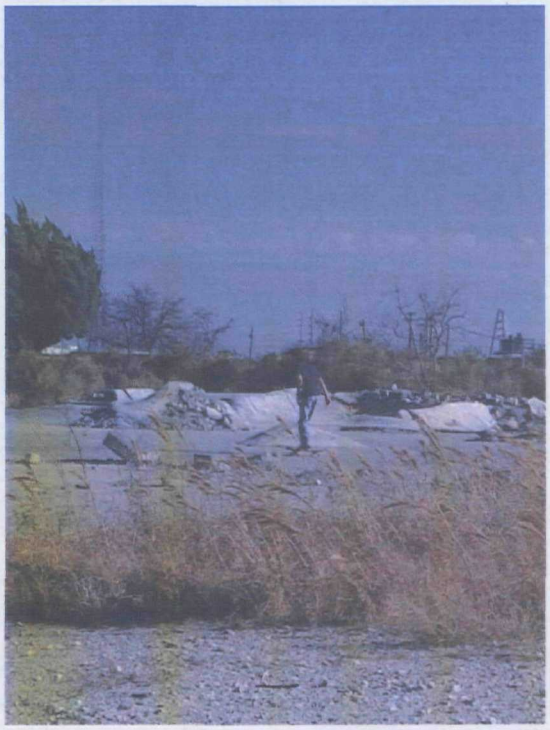
See Sections 8 and 9 of the FYR report. There are no other indicators of potential remedy problems.

D. Opportunities for Optimization

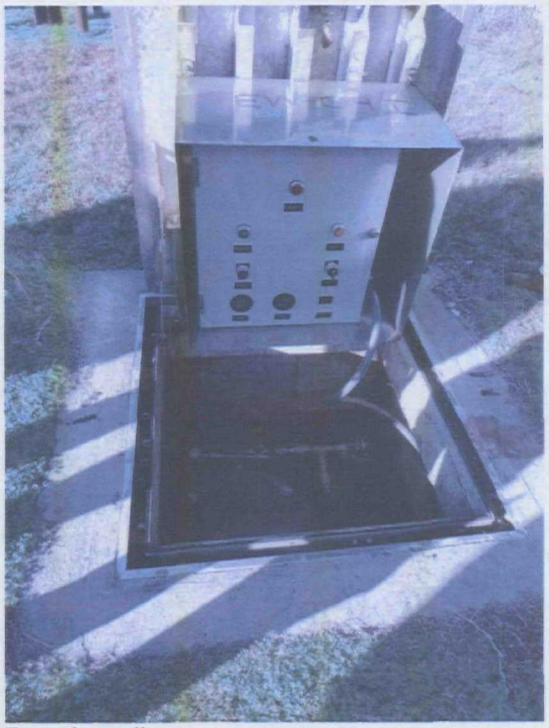
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

None noted.

Appendix E: Photographs from Site Inspection Visit

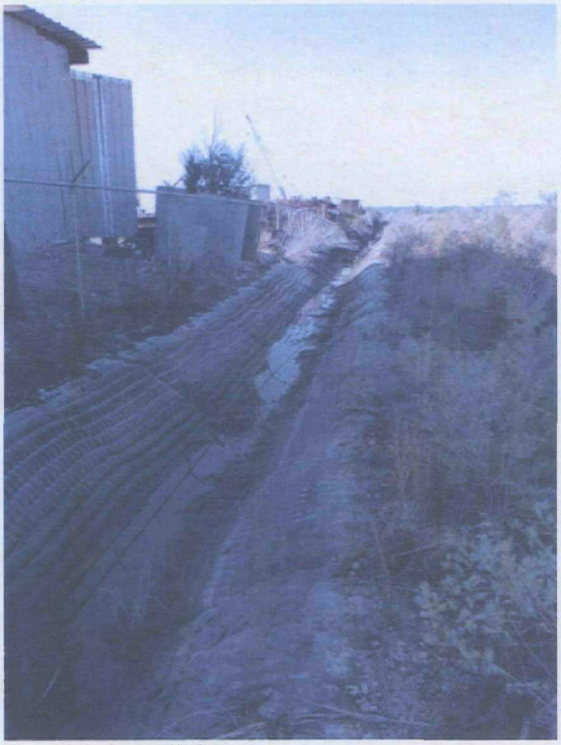


Trespasser skateboarding on Site



Extraction well

Unlocked monitoring well



Central drainage ditch

Milford Street drainage ditch

Hagood Avenue drainage ditch

Appendix F: Toxicity Review

	Carcinogenic toxicity changes							Non-carcinogenic toxicity changes						
	Oral Cancer Slope Factor			Inhalation Unit Risk (IUR)				Oral Reference Dose (RfD)			Inhalation Reference Concentration (RfC)			
Contaminant	1995 BRA Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	2013 Oral Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Change in Oral CSF	1995 BRA Inhalation Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Unit Risk Calculated Using 1995 BRA Value* $(\mu g/m^3)^{-1}$	2013 Inhalation Unit Risk Value $(\mu g/m^3)^{-1}$	Change in IUR	1995 BRA Oral RfD Value (mg/kg-d)	2013 Oral RfD Value (mg/kg-d)	Change in Oral RfD	1995 BRA Inhalation RfD Value (mg/kg-day)	Inhalation RfC Calculated Using 1995 BRA Value* (mg/m^3)	2013 Inhalation RfC Value (mg/m^3)	Change in Inhalation RfC
arsenic	1.7	1.5	less stringent	15	4.3E-03	4.3E-03	no change	3E-04	3.0E-04	no change	N/A	N/A	1.5E-05	more stringent
benzene**	0.029	0.055	more stringent	0.029	8.3E-06	7.8E-06	less stringent	3E-04	4.0E-03	less stringent	2E-03	7E-03	3.0E-02	less stringent
benzo(a)pyrene	7.3	7.3	no change	N/A	N/A	1.1E-03	more stringent	N/A	N/A	no change	N/A	N/A	N/A	no change
dioxin	1.0E+05	1.3E+05	more stringent	1.5E+05	43	38	less stringent	1E-09	7.0E-10	more stringent	N/A	N/A	4.0E-08	more stringent
pentachlorophenol	0.12	0.4	more stringent	N/A	N/A	5.1E-06	more stringent	3E-02	5.0E-03	more stringent	N/A	N/A	N/A	no change
lead	N/A	N/A	no change	N/A	N/A	N/A	no change	N/A	N/A	no change	N/A	N/A	N/A	no change

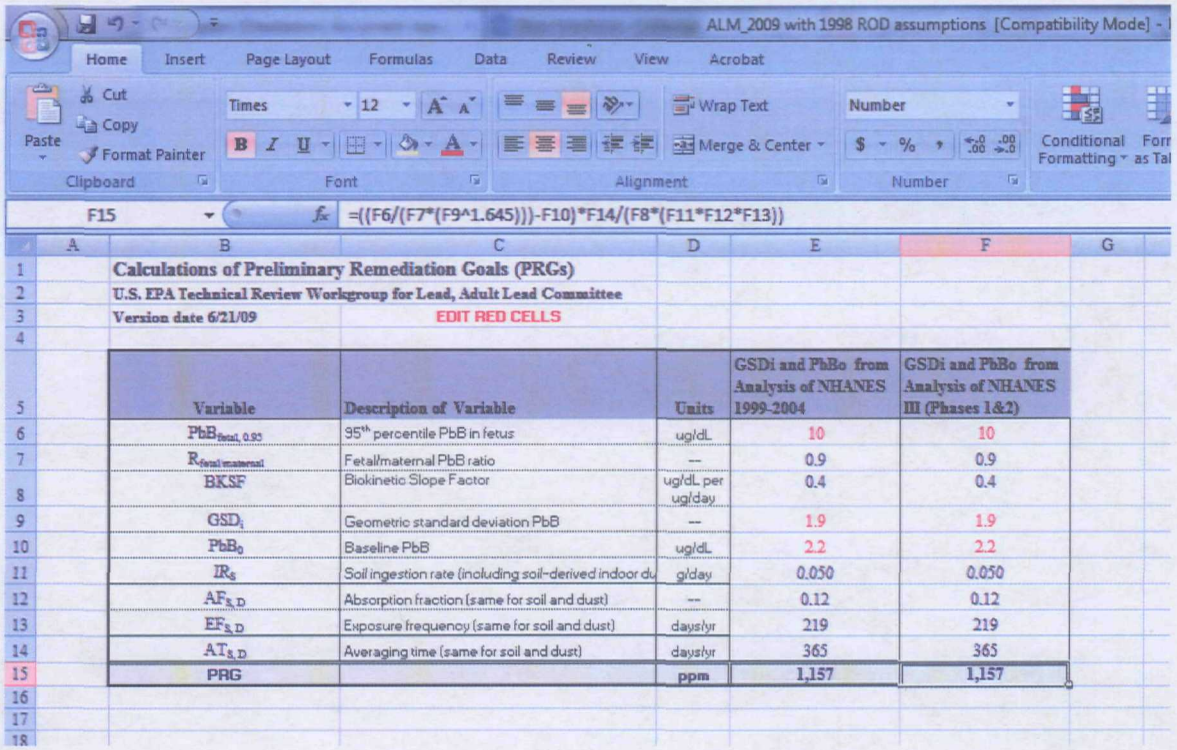
Notes

* - The units of the 1995 inhalation cancer slope factors and the inhalation reference dose were converted using assumptions of a body mass of 70 kg and a daily respiration of 20 m^3, in accordance with EPA's "Risk Assessment Guidance for Superfund."

** - This table includes benzene due to its relevance to vapor intrusion. The other contaminants in this table are soil/sediment contaminants with risk-based cleanup levels.

N/A - toxicity value not available for this substance

Appendix G: Verification of Lead Cleanup Level



ALM_2009 with 1998 ROD assumptions [Compatibility Mode]

Home | Insert | Page Layout | Formulas | Data | Review | View | Acrobat

Cut | Copy | Format Painter | Paste | Clipboard | Times | 12 | Font | Wrap Text | Merge & Center | Alignment | Number | Conditional Formatting

F15 =((F6/(F7*(F9^1.645)))-F10)*F14/(F8*(F11*F12*F13))

Calculations of Preliminary Remediation Goals (PRGs)

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee

Version date 6/21/09 EDIT RED CELLS

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004	GSDi and PbBo from Analysis of NHANES III (Phases 1&2)
$PbB_{fetal,\ 0.95}$	95th percentile PbB in fetus	ug/dL	10	10
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.9	1.9
PbB_0	Baseline PbB	ug/dL	2.2	2.2
IR_S	Soil ingestion rate (including soil-derived indoor du	g/day	0.050	0.050
$AF_{S,D}$	Absorption fraction (same for soil and dust)	--	0.12	0.12
$EF_{S,D}$	Exposure frequency (same for soil and dust)	days/yr	219	219
$AT_{S,D}$	Averaging time (same for soil and dust)	days/yr	365	365
PRG		ppm	1,157	1,157

Appendix H: Recalculation of Dioxin Toxicity Equivalence Quotient at Location SB-18

Recalculation of Dioxin Toxicity Equivalence Quotient at Location SB-18 Using Current Toxicity Data

	1995 Remedial Investigation Report			Calculation Based on Current TEFs	
	Concentration (parts per trillion)	Toxicity Equivalence Factor (TEF)	Toxicity Equivalence Quotient (TEQ)[a]	Current TEF[b]	Current TEQ[a]
2,3,7,8-TCDD	1.8	1	1.8	1	1.8
1,2,3,7,8-PeCDD	28	0.5	14	1	28
1,2,3,4,7,8-HxCDD	110	0.1	11	0.1	11
1,2,3,6,7,8-HxCDD	570	0.1	57	0.1	57
1,2,3,7,8,9-HxCDD	200	0.1	20	0.1	20
1,2,3,4,6,7,8-HpCDD	23000	0.01	230	0.01	230
OCDD	300000	0.001	300	0.0003	90
2,3,7,8-TCDF	3.4	0.1	0.34	0.1	0.34
1,2,3,7,8-PeCDF	10	0.05	0.5	0.03	0.3
2,3,4,7,8-PeCDF	23	0.5	11.5	0.3	6.9
1,2,3,4,7,8-HxCDF	160	0.1	16	0.1	16
1,2,3,6,7,8-HxCDF	41	0.1	4.1	0.1	4.1
2,3,4,6,7,8-HxCDF	29	0.1	2.9	0.1	2.9
1,2,3,7,8,9-HxCDF	3.3	0.1	0.33	0.1	0.33
1,2,3,4,6,7,8-HpCDF	3800	0.01	38	0.01	38
1,2,3,4,7,8,9-HpCDF	220	0.01	2.2	0.01	2.2
OCDF	28000	0.001	28	0.0003	8.4
Total TEQ			**738**		**517**

Notes

a. TEQ = concentration × TEF

b. Current TEFs were obtained from "EPA's Regional Screening Table – User's Guide," dated November 2012, available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm, accessed 2/22/2013.

Appendix I: Vapor Intrusion Supporting Information

The EPA currently recommends the use of multiple lines of evidence to evaluate the vapor intrusion pathway. In the absence of current paired ground water and soil gas data, this FYR conducted a screening-level VI evaluation to assess the protectiveness of the remedy, using the following available lines of evidence:

- Modeling indoor air concentrations in the public service buildings located off site, as well as the currently vacant on-site area, using the most current ground water concentrations,
- Evaluating the historical levels of VOC concentrations in ground water and passive soil gas to identify the greatest potential for VI to occur, and
- Evaluating historical remediation activities conducted at the site.

The EPA has developed an online Johnson and Ettinger model (JEM) calculator that replicates the implementation that the EPA Office of Solid Waste and Emergency Response used in developing its draft vapor intrusion guidance (EPA 2002), but includes a number of enhancements that are facilitated by web implementation: temperature dependence of Henry's Law Constants, automatic sensitivity analysis of certain parameters, and others.[8] The online calculator was used assuming that benzene remains as the primary chemical of concern for VI using the same site-specific parameters previously used in the 2008 Vapor Intrusion Screening Assessment, such as soil type and ground water temperature to predict the indoor air concentrations both off site and on site.

The most recent available ground water concentration data were used (from December 2011 sampling). When using the JEM it is important to use the ground water zone closest to the building foundation or area of interest. At the Site, the shallow water-bearing zone and the intermediate water-bearing zone act as one hydrologic unit because the clay layer between them is discontinuous. Therefore, to be conservative, the maximum observed ground water concentration was used, including both the shallow and the intermediate zone wells closest to the potential exposure areas of concern. The wells also correspond to the locations where the 2010 passive soil gas (PSG) survey indicated elevated levels of benzene. The closest shallow well to a building at the Public Service Operations is MW-105 while the closest intermediate well is MW-202I; MW-202I is also close to PSG survey location #8, where elevated benzene was detected. For on-site exposure, shallow well MW-100A was used because this well had the highest benzene concentration and is close to PSG survey location #19, where elevated benzene was detected; the intermediate well, MW-100B, had much lower concentrations and therefore was not used.

The JEM model was also used to calculate the cancer risk and non-cancer hazard indices. For the current commercial exposure scenario, an exposure frequency of 50 days per year was assumed, because the affected public service buildings are used for storage rather than daily work. For the future residential exposure scenario, an exposure frequency of 350 days per year was assumed.

[8] http://www.epa.gov/athens/learn2model/part-two/onsite/JnE_lite_forward.html

Table I-1. Screening-Level VI Evaluation for Ground Water

Contaminant	December 2011 Ground Water Concentration (µg/L)	Modeled Indoor Air Concentration ($\mu g/m^3$)[a]	Modeled VI Evaluation[b]			
			Current Commercial Exposure Scenario[c]		Future Residential Exposure Scenario[d]	
			Cancer Risk	Non-Cancer HQ	Cancer Risk	Non-Cancer HQ
Off-site Public Service Operations (MW-202I)						
Benzene	454	67	3×10^{-5}	0	2×10^{-4}	0
Naphthalene	11,600	108	0	5	0	35
On-site Area (MW-100A)						
Benzene	412	61	3×10^{-5}	0	2×10^{-4}	0
Naphthalene	1,790	17	0	0.8	0	5

Notes:

a. The EPA online JEM calculator was used: http://www.epa.gov/athens/learn2model/part-two/onsite/JnE_lite_forward.html with the following assumptions:
Depth to ground water (measured in 11/2011): MW-202I: 4.4 feet.; MW-100A: 3.92 feet. Used – 4.0 feet.
Soil type: Sand with default soil properties
Building air exchange rate: 0.25 exchange per hour
Ground water temperature: 20 degrees Celsius
Soil gas flow rate into building (Qc): default value of 5 liters per minute per EPA guidance.
Building dimensions: 300 square meters

b. Risk and hazard numbers were calculated by the JEM calculator.

c. Exposure frequency = 50 days per year

d. Exposure frequency = 350 days per year

As shown in Table I-1 above, using the most recent available ground water concentrations for benzene (measured in 2011), the modeled indoor air concentrations correspond to an indoor air risk of 3×10^{-5} for both off-site and on-site commercial exposure; this risk is within the EPA's risk management range of 10^{-6} to 10^{-4}. For the future residential scenario, the modeled risk is 2×10^{-4}, which is above the EPA's acceptable risk range.

If naphthalene concentrations are used in the JEM model, the non-cancer HQ would exceed 1 in the commercial exposure scenario (for the off-site location) and the residential exposure scenario (for both off-site and on-site).

Uncertainties still remain with these VI risk and HI conclusions, since the assumption is that benzene and naphthalene are the only contaminants for VI concern. Thus, these results likely represent an underestimate of VI exposure.

The 2011 annual O&M report found that the benzene and naphthalene concentrations in these two wells are stable, with the exception of a decreasing trend for benzene in the on-site well (MW-100A). However, the remedy may not be protective unless it can be demonstrated through the use of paired ground water and soil vapor data that indoor air concentrations are within acceptable limits.

LIMITED WARRANTY DEED

KNOW ALL PERSONS BY THESE PRESENTS that **BEAZER EAST, INC.,** a Delaware corporation having an address c/o Three Rivers Management, Inc., Suite 3000, One Oxford Centre, Pittsburgh, PA 15219 (the "Grantor") for valuable consideration paid, does hereby give, grant, bargain, sell and confirm with limited warranty covenants unto **ASHLEY I, LLC, a South Carolina limited liability company**, having an address c/o Clement, Crawford & Thornhill, Inc., 476 Meeting Street, Suite E, Charleston, SC 29403 (the "Grantee"), the following described premises (the "Property"):

ALL THOSE CERTAIN PARCELS OF LAND containing 86.196 acres, more or less, situated in the City and County of Charleston, State of South Carolina, bounded and described as follows:

TRACT A/B-1

ALL that piece, parcel or lot of land, together with all the buildings and improvements thereon, situate, lying and being in the City of Charleston, State of South Carolina, and shown and designated as "TRACT 'A' 1.16 ACRES MILFORD STREET ASSOC." and as "B-1 0.30 ACRE" on a plat by Sigma Engineers Inc., dated October 14, 1980, entitled in part "PLAT OF THE RESUBDIVISION OF TRACTS "A", "B" AND "C" AS SHOWN. LOCATED IN THE CITY OF CHARLESTON, SOUTH CAROLINA" and recorded at Plat Book AR, Page 85, RMC Office for Charleston County, South Carolina.

Said lot have such size, shape, dimensions, buttings, boundings and location as will by reference to said plat more fully and at large appear.

The above described property having been conveyed to Beazer East, Inc. by deed of Milford Street Associates, I, a general partnership, dated October 28, 1993 and recorded October 28, 1993 at Book W-233, Page 626, RMC Office for Charleston County, South Carolina.

TMS #466-00-00-028

2001-2438

TRACT B/C-1

ALL that piece, parcel or lot of land, together with all the buildings and improvements thereon, situate, lying and being in the City of Charleston, State of South Carolina, and shown and designated as "TRACT 'B' 1.49 ACRES CHARLESTON PUBLIC WORKS" on a plat by Sigma Engineers Inc., dated October 14, 1980, entitled in part "PLAT OF THE RESUBDIVISION OF TRACTS "A", "B" AND "C" AS SHOWN. LOCATED IN THE CITY OF CHARLESTON, SOUTH CAROLINA" and recorded at Plat Book AR, Page 85, RMC Office for Charleston County, South Carolina.

Said lot have such size, shape, dimensions, buttings, boundings and location as will by reference to said plat more fully and at large appear.

The above described property having been conveyed to Beazer East, Inc. by deed of Commissioners of Public Works of the City of Charleston, dated May 23, 1997 and recorded June 24, 1997 at Book Y-285, Page 601, RMC Office for Charleston County, South Carolina.

ALSO

ALL that piece, parcel or lot of land, together with all the buildings and improvements thereon, situate, lying and being in the City of Charleston, State of South Carolina, and shown and designated as "TRACT C-1 0.29 ACRE" on a plat by Sigma Engineers Inc., dated October 14, 1980, entitled in part "PLAT OF THE RESUBDIVISION OF TRACTS "A", "B" AND "C" AS SHOWN. LOCATED IN THE CITY OF CHARLESTON, SOUTH CAROLINA" and recorded at Plat Book AR, Page 85, RMC Office for Charleston County, South Carolina.

Said lot have such size, shape, dimensions, buttings, boundings and location as will by reference to said plat more fully and at large appear.

The above described property having been conveyed to Beazer East, Inc. by deed of The Commissioners of Public Works of the City of Charleston dated March 5, 2003 and recorded March 7, 2003 in Book K-439, Page 859, RMC Office for Charleston County, South Carolina.

TMS #466-00-00-029

TRACT C

ALL that piece, parcel or tract of land, together with all buildings and improvements thereon, situate, lying and being in the City and County of Charleston, State of South Carolina, containing Three and 77/100 (3.77) acres, more or less, and shown and designated as "TRACT 'C' 3.77 ACRES, CITY OF CHARLESTON" on a plat entitled; "PLAT OF THE RE-SUBDIVISION OF TRACTS "A", "B" AND "C" AS SHOWN. LOCATED IN THE CITY OF CHARLESTON, S.C.", by Harold J. LeaMond, dated October 14, 1980 and recorded December 12, 1980, in Plat Book AR, Page 85, R.M.C. Office for Charleston County, S.C.

SAID TRACT having such size, shape, dimensions, buttings and boundings as will by reference to said plat more fully and at large appear.
The above described property having been conveyed to Beazer East, Inc. by deed of The City Council of Charleston, acting on behalf of The City of Charleston, dated November 24, 1998 and recorded December 29, 1998 at Book G-317, Page 133, RMC Office for Charleston County, South Carolina.

TMS #466-00-00-030

TRACT D

All that piece, parcel or tract of land, together with all buildings and improvements thereon, situate, lying and being in the City and County of Charleston, State of South Carolina, containing Ten and No/100 (10.00) acres, more or less, and shown and designated as "TRACT "D" 10.0 AC.", on a plat entitled: "PLAT OF THE ENLARGEMENT OF TRACT D FROM 5 AC. TO 10 AC., PROPERTY OF UNIVERSAL ENTERPRISES, INC. LOCATED OFF INTERSTATE NO. 26, CITY OF CHARLESTON, CHARLESTON COUNTY, SOUTH CAROLINA", by Harold J. LeaMond, dated March 17, 1982, and recorded April 28, 1982 in Plat Book AV, Page 52, R.M.C. Office for Charleston County, South Carolina.

SAID tract having such size, shape, dimensions, buttings and boundings as will by reference to said plat more fully and at large appear.

BEING a portion of the property conveyed to Grantor herein by deed of Paul A. Davis dated May 19, 1995 and recorded May 22, 1995 at Book P-255, Page 308, RMC Office for Charleston County, South Carolina.

TMS #466-00-00-031

TRACT I

ALL that certain piece, parcel or tract of land, together with all buildings and improvements thereon, situate, lying and being in the City and County of Charleston, State of South Carolina, containing one (1.0) acre, more or less, and shown and designated as "TRACT "I", 1.0 ACRE", on a plat entitled: "PLAT OF THE SUBDIVISION OF A 43.95 ACRE TRACT,. THE PROPERTY OF BRASWELL SHIPYARD, INCORPORATED, LOCATED ON U.S. INTERSTATE HIGHWAY NO. 26, CITY OF CHARLESTON, CHARLESTON COUNTY, S.C.", by Harold J. LeaMond, dated August 8, 1979, and recorded August 14, 1979, in the R.M.C. Office for Charleston County, S.C., in Plat Book AO, Page 11.

SAID tract having such size, shape, dimensions, buttings and boundings as will by reference to said plat more fully and at large appear.

BEING a portion of the property conveyed to Grantor herein by deed of Paul A. Davis dated May 19, 1995 and recorded May 22, 1995 at Book P-255, Page 308, RMC Office for Charleston County, South Carolina.

TMS #466-00-00-036

TRACT A-1

ALL that piece, parcel and tract of land, together with the buildings and improvements thereon, located in the City of Charleston, County of Charleston, State of South Carolina, containing 4.272 acres, more or less, and shown as Parcel A on a plat thereof entitled "Plat Showing the Subdivision of a 12.176 Acre Tract Owned by Hetafi, Inc., City of Charleston, Charleston County, S.C." by Engineering, Surveying and Planning, Inc. dated November 4, 1986, and recorded in the RMC Office for Charleston County in Plat Book BL at page 84, and together with concrete pier showing on said Plat, subject to the restrictions hereinafter contained, said conveyance made subject, in all respects, to easements and rights of way of record or shown on said Plat.

ALSO, the above-described 4.272 acre tract designated as PARCEL A is conveyed herein together with the fifty (50') foot access easement designated as "50' INGRESS/EGRESS EASEMENT" across "PARCEL B" and across the tract designated as "BRASWELL SHIPYARDS, INC., TAX MAP NUMBER 466-0-0, PARCEL 19" as said easement and two burdened parcels are shown on said Plat recorded in Plat Book BL, Page 84.

The 4.272 acre tract known as Parcel A is sold subject to, the restriction that the existing concrete pier shall not extend beyond a continuation of the southernmost east/west boundary of the property described herein and subject to this conveyance, which line constitutes a boundary line between the property referred to herein and other lands now or formerly of John T. Parker and Nina K. Parker.

BEING a portion of the property conveyed to Grantor herein by deed of Braswell Services Group, Inc., f/k/a Braswell Shipyards, Inc., dated June 24, 1994 and recorded June 24, 1994 at Book S-244, Page 549, RMC Office for Charleston County, South Carolina.

TMS #466-00-00-049

TRACT A-2

ALL that piece, parcel and tract of land located in the City of Charleston, County of Charleston, State of South Carolina, shown as "BRASWELL SHIPYARDS, INC., TAX MAP NUMBER 466-0-0, PARCEL 19" on a plat thereof entitled, "PLAT SHOWING THE SUBDIVISION OF A 12.176 ACRE TRACT OWNED BY HETAFI, INC., CITY OF CHARLESTON, CHARLESTON COUNTY, S.C." by Engineering, Surveying and Planning, Inc., dated November 4, 1986, and recorded in the R.M.C. Office for Charleston County in Plat Book BL, at Page 84, together with the buildings and improvements located thereon; said tract butting and bounding as shown on said Plat as follows: to the North on property now or formerly owned by Columbia Nitrogen Corp. (TMS Parcel 466-00-00-018); to the East on property now or formerly owned by Paul A. Davis (TMS Parcel 466-00-00--31); to the South and West on "PARCEL A" as

shown; subject to the easements and rights-of-way as shown on said Plat. Said parcel also is described and designated as parcel "5.20 ac. Owner Braswell Shipyards, Inc." on a plat prepared by Harold J. LeaMond, P.E. & R.L.S. S.C. Registration No. 2507 entitled "Plat Showing the Subdivision of a 17.87 Acre Tract The Property of Braswell Shipyards, Inc." dated July 29, 1982 and recorded in the RMC Office for Charleston County in Plat Book AW, Page 15 said property having such metes, bounds, buttings and boundings as will by reference to said plat more fully and at large appear.

ALSO the above-described tract is conveyed herein together with the fifty (50') foot access easement designated as "50' INGRESS/EGRESS EASEMENT" across "PARCEL B" as said easement and burdened parcel is shown on said Plat recorded in Plat Book BL, Page 84.

BEING a portion of the property conveyed to Grantor herein by deed of Braswell Services Group, Inc., f/k/a Braswell Shipyards, Inc., dated June 24, 1994 and recorded June 24, 1994 at Book S-244, Page 549, RMC Office for Charleston County, South Carolina.

TMS #466-00-00-019

TRACT F

All that piece, parcel and tract of land, together with the improvements thereon if any located in the City of Charleston, County of Charleston, State of South Carolina, containing 2.10 acres, more or less, and designated as Tract F on a plat by Harold J. LeaMond, P.E. and L.S., S.C. Registration No. 2507, entitled "Plat of Tracts K & F Located on U.S. Interstate Highway No. 26 City of Charleston" recorded in the RMC Office for Charleston County on April 30, 1982 in Plat Book AV at Page 62 and said property having such metes, bounds, buttings and boundings as will by reference to said plat more fully and at large appear.

BEING a portion of the property conveyed to Grantor herein by deed of Braswell Services Group, Inc., f/k/a Braswell Shipyards, Inc., dated June 24,. 1994 and recorded June 24, 1994 at Book S-244, Page 549, RMC Office for Charleston County, South Carolina.

TMS #466-00-00-035

TRACT M-2

ALL that certain lot, piece or parcel of land, together with all buildings and improvements thereon, situate, lying and being in the City and County of Charleston, State of South Carolina, and containing 8.25 acres, more or less (being 5.35 acres of highland and 2.90 acres of marsh and lowland), and more particularly described as TRACT M-2 on a plat prepared by Sigma Engineers, Inc., entitled "PLAT SHOWING THE SUBDIVISION OF TRACT M INTO TRACTS M-1 AND M-2, THE PROPERTY OF BRASWELL SHIPYARDS, INC.", dated January 7, 1985, and duly recorded in the RMC Office for Charleston County, S.C., in Plat Book BC, Page 150. Reference to said plat

is hereby craved for a complete description as to distances, courses, metes and bounds.

BEING a portion of the property conveyed to Grantor herein by deed of Ashley Realty Co., Inc. dated December 30, 1993 and recorded January 7, 1994 at Book G-237, Page 689, RMC Office for Charleston County, South Carolina.

TMS #464-00-00-029

TRACT N

ALL that piece, parcel or tract of land, together with all buildings and improvements thereon, situate, lying and being in the City and County of Charleston, South Carolina, and being shown and designated as "Tract N", containing 48.41 acres total, more or less, on a plat by Harold J. LeaMond of Sigma Engineers, Inc., dated January 21, 1983, and entitled "PLAT OF TRACTS M & N, THE PROPERTY OF BRASWELL SHIPYARDS, INC., CITY OF CHARLESTON, CHARLESTON COUNTY, SOUTH CAROLINA", and recorded at Plat Book AW, Page 181, R.M.C. Office for Charleston County, South Carolina, and having such size, shape, buttings, boundings, dimensions and location as will appear by reference to said plat which is incorporated herein by reference, be all the dimensions and measurements shown thereon a little more or less.

Butting and Bounding according to said plat north on property now or formerly of Carolina Dry Docks, Inc.; to the east on Tract M; to the south on property now or formerly of The Charleston Oil Company; and to the west on the edge of marsh of the Ashley River.

Together with all right, title and interest of the Grantor in and to the "pier" shown on the above said plat extending from the within described real property into the Ashley River.

BEING a portion of the property conveyed to Grantor herein by deed of Ashley Realty Co., Inc. dated December 30, 1993 and recorded January 7, 1994 at Book G-237,Page 689, RMC Office for Charleston County, South Carolina.

TMS #464-00-00-012

It is the intention of Grantor to convey all interest of Grantor in real property at each of the locations which are described herein, however acquired, including but not limited to all rights of access, commercial rights, transferable easements (of whatever nature), appurtenances and rights in and to adjacent streets, roads and ways, whether public or private. It is the intention of Grantor to convey all interest in real property in the Neck area of Charleston County, S.C. and located in the area of Braswell Street and Milford Street, however acquired.

UNDER AND SUBJECT to all reservations, encumbrances and restrictions set forth on **Exhibit "A"** attached hereto and made a part hereof, and the following restrictive covenants:

GRANTEE COVENANTS, on behalf of itself, its affiliates and related companies, as well as its and their successors and assigns, as well as all current and future owners and occupiers of the Property (all of the above-listed persons whom are hereinafter collectively referred to as the "Site Occupiers"), that it and the Site Occupiers will limit the use of the Property to any commercial or industrial uses (but specifically excluding any residential use), or parking, that the Property shall not be used for any other purpose, that no groundwater wells of any kind or nature shall be installed in, or used at, the Property, and that Grantee will comply with the use and other restrictions set forth in Exhibit "A" hereto, the provisions of which Exhibit shall inure to and be binding on the heirs, successors and assigns of Grantor and Grantee and run with the land; provided, however, that violation of any covenant or limitation of use shall not cause a forfeiture or reversion of title.

TOGETHER with all and singular the rights, members, hereditaments and appurtenances thereunto belonging, incident or appertaining.

TO HAVE AND TO HOLD the above granted and bargained premises, with the privileges and appurtenances thereof, unto the Grantee, its successors and assigns forever, to its and their own proper use and behalf, in fee simple.

AND FURTHERMORE, the Grantor, does by these presents bind itself, its successors and assigns forever, to warrant and defend the above granted and bargained premises to the Grantee, and to its successors and assigns, against the claims and demands made or suffered by the Grantor, and by successors and assigns

of Grantor, lawfully claiming or to claim the same or any part thereof, except as aforesaid, but against none other.

IN WITNESS WHEREOF, the undersigned has hereunto set his hand on behalf of the Grantor this 15TH day of July, 2003.

WITNESSES:

~~Asst. Secretary~~

Sally M. Karanzas ~~Asst. Secy.~~

GRANTOR:

BEAZER EAST, INC.*

By: Jill M. Blundon

Name: Jill M. Blundon, Vice President

Title:

ACKNOWLEDGMENT

STATE OF PENNSYLVANIA)
COUNTY OF ALLEGHENY)

I, SALLY M. KALANZAS a Notary Public within and for the STATE of PENNSYLVANIA, duly commissioned and acting, do hereby certify that on this 15TH day of JULY, 2003, personally appeared before me JILL M. BLUNDON, to me personally known to be the person who signed the foregoing Limited Warranty Deed on behalf of Beazer East, Inc. being duly sworn and being informed of the contents of said instrument, stated and acknowledged under oath that ~~he~~/she is the VICE PRESIDENT of Beazer East, Inc.* a Delaware corporation and, as such, is a duly certified individual who may enter into agreements on behalf of each entity. Moreover, he/she has acknowledged that the entity has executed the same as its free act and deed and was voluntarily executed by himself/herself, on behalf of said entity, for the purposes and consideration therein mentioned and set forth.

WITNESS my hand and seal as such Notary Public the day and year above written.

Sally M. Karanzas (SEAL)

My Commission Expires: 4-27-07

Notary Public for Allegheny Co., PA

Notarial Seal
Sally M. Keranzas, Notary Public
City Of Pittsburgh, Allegheny County
My Commission Expires Apr. 27, 2007
Member, Pennsylvania Association Of Notaries

EXHIBIT "A" to Limited Warranty Deed

EXCEPTIONS TO TITLE AND USE RESTRICTIONS

1. The lien of real property ad valorem taxes for the year of closing, not yet due and payable; Charleston County User fees, if any, for the year of closing, not yet due and payable.

2. Encumbrances, easements and restrictions of record.

3. Water, sewer, gas, electric, cable television, telephone and railroad lines as currently installed.

4. Unrecorded easements, discrepancies or conflicts in boundary lines, shortages in areas and encroachments which a complete and accurate survey would disclose.

5. Limitations of use currently in effect or imposed in the future by a governmental authority.

6. Taxes and sewer use charges for periods subsequent to the date hereof.

7. Riparian rights of others to any water courses in, on, crossing or bounding said Property.

8. The following leases in effect as of the Closing Date.

   a) Lease to Parker Marine Contracting Corp. dated October 25, 2002. [4.5 acres located on Tracts A-1 and A-2]

   b) Lease to Superior Transportation, Inc. dated July 16, 2001. [6.18 acres located on Tracts A/B-1, B/C-1 and C]

   c) Lease to Kirkman Broadcasting, Inc. dated February 1, 2000. [0.75 acres located on Tract N]

   d) Lease to Boasso America Corporation dated January 25, 2000. [6.11 acres located on Tract M-2 and N]

9. Grantee acknowledges and understands that Grantor operated a wood treating plant on the Property, that the Property was used for other industrial purposes, that Grantor and others utilized numerous chemicals, materials and compounds in the operation of such facilities on the Property and that hazardous substances and chemical residues, constituents, materials and compounds exist in, on and about the Property. Grantee also acknowledges that the Property is the subject of a Unilateral Administrative Order ("UAO") between Beazer East, Inc. and the U.S. Environmental Protection Agency ("EPA").

10. Grantee will use the Property only for commercial or industrial purposes (specifically excluding residential uses).

11. Grantee will not use groundwater at the Property for any use whatsoever.

12. Grantee's use of the Property shall be restricted in that Grantee shall not destroy, damage or interfere with any monitoring wells, piezometers, or other

environmental remediation equipment, installations or other work on the Property relating directly to groundwater, including the cap on sediment in a portion of the Ashley River adjacent to or near the Property ("the Sediment Cap"), now or in the future without the prior written consent of the Grantor, which consent will not be unreasonably withheld. Grantee will be responsible for repairing or replacing, at its expense, any environmental remediation equipment, installations or other work relating to soils or groundwater, including the Sediment Cap, that Grantee damages or destroys.

13. If Grantee conducts any construction work on the Property involving excavation of site soils, Grantee will obtain all necessary permits and regulatory approvals for such work, including any required approval from the EPA, and Grantee will conduct all such work in compliance with such permits and approvals, the UAO and all applicable laws, rules and regulations, all at Grantee's sole cost and expense. Grantee will be solely responsible for all costs associated with the excavation of site soils.

14. Grantee will release Grantor from, and defend and indemnify Grantor from and against any claims and damages Grantor suffers arising from Grantee's work on the Property, including the Sediment Cap.

15. Grantee shall be and remain responsible for operating, maintaining, monitoring and reporting on all environmental equipment, features, and remedial work constructed or installed by Grantor on or relating to the surface of the Property, including but not limited to the Sediment Cap, drainage systems, soil caps and

soil covers, but not including such equipment or work as is intended to address groundwater conditions. In operating, maintaining, monitoring and reporting on such systems, Grantee shall comply with the UAO and all applicable local, state or federal laws, rules, regulations and orders. Grantee shall copy Grantor on any reports on such systems that it files with a governmental authority. Grantee's obligations as set forth in this paragraph shall terminate at such time as no further action by Grantee as contemplated by this paragraph is required of either Grantor or Grantee by the UAO and applicable local, state and federal laws, rules, regulations and orders. Such termination may be evidenced by Grantor, Grantee or Grantee's successors in title, recording in the land records of Charleston County, South Carolina, official action of the EPA and applicable South Carolina regulatory authorities confirming that no such further or continuing action by Grantor or Grantee is required with respect to the Property under applicable laws, rules, regulations or orders; provided, however, that there shall be no requirement of any such recordation as a condition to the termination of Grantee's obligations.

16. Grantee shall cooperate with Grantor in Grantor's performance of any and all environmental investigations, removals and remediation work on the Property that is required by the UAO or applicable local, state or federal laws, rules, regulations or orders. Such cooperation will include, but not be limited to, reasonable access to and through all portions of the Property by Grantor, Grantor's contractors and consultants, the governmental authorities and their employees, agents or representatives, all at no cost to Grantor. Grantor shall use its best efforts to exercise its access rights under this paragraph so as to

minimize interference with the operation of any business or activities of Grantee on the Property.

17. In fulfilling Grantor's obligations under the UAO or other order relating to the Property, Grantor shall have the sole and exclusive right to negotiate and deal as it sees fit with the EPA and any other governmental authorities.

18. Grantor will not enter into any agreement or settlement with the U.S. EPA or other governmental authorities that may affect Grantee's obligations with respect to the Property or Grantee's right to use the Property as contemplated by this Deed without the prior written consent of Grantee, which consent shall not be unreasonably withheld.

19. The provisions of the Deed and this exhibit thereto shall inure to and be binding on the heirs, successors and assigns of Grantor and Grantee.

STATE OF SOUTH CAROLINA)
COUNTY OF CHARLESTON) **AFFIDAVIT**

Date of Transfer of Title
Closing Date: July 10, 2003

PERSONALLY appeared before me the undersigned, who being duly sworn, deposes and says:

1. I have read the information on this Affidavit and I understand such information.

2. The property is being transferred **BY** BEAZER EAST, INC. **TO** ASHLEY I, LLC, a South Carolina limited liability company **ON** July 10, 2003.

3. Check one of the following: ***The DEED is***
   (a) ___x___ subject to the deed recording fee as a transfer for consideration paid or to be paid in money or money's worth.
   (b) _____ subject to the deed recording fee as a transfer between a corporation, a partnership, or other entity and a stockholder, partner, or owner of the entity, or is a transfer to a trust or as a distribution to a trust beneficiary.
   (c) _____ EXEMPT from the deed recording fee because (exemption #_____) (Explanation, if required)_____
   (If exempt, please skip items 4-6, and go to item 7 of this affidavit.)

4. Check one of the following if either item 3(a) or item 3(b) above has been checked.
   (a) ___x___ The fee is computed on the consideration paid or to be paid in money or money's worth in the amount of $4,611,000.00.
   (b) _____ The fee is computed on the fair market value of the realty which is $_____
   (c) _____ The fee is computed on the fair market value of the realty as established for property tax purposes which is $_____.

5. Check YES _____ or NO ___✓___ the following: A lien or encumbrance existed on the land, tenement, or realty before the transfer and remained on the land, tenement, or realty after the transfer. If "YES," the amount of the outstanding balance of this lien or encumbrance is $_____.

6. The DEED Recording Fee is computed as follows:
   (a) $4,611,000.00 the amount listed in item 4 above
   (b) 0 the amount listed in item 5 above (no amount place zero)
   (c) $4,611,000.00 Subtract Line 6(b) from Line 6(a) and place the results.

7. As required by Code Section 12-24-70, I state that I am a responsible person who was connected with the transaction as: Grantee.

8. Check if Property other than Real Property is being transferred on this Deed.
   (a) _____ Mobile Home
   (b) _____ Other

9. _____ DEED OF DISTRIBUTION – ATTORNEY'S AFFIDAVIT: Estate of _____ deceased CASE NUMBER _____. Personally appeared before me the undersigned attorney who, being duly sworn, certified that (s)he is licensed to practice law in the State of South Carolina; that (s)he has prepared the Deed of Distribution for the Personal Rep. in the Estate of _____ deceased and that the grantee(s) therein are correct and conform to the estate file for the above named decedent.

10. I understand that a person required to furnish this affidavit who willfully furnishes a false or fraudulent affidavit is guilty of a misdemeanor and, upon conviction, must be fined not more than one thousand dollars or imprisoned not more than one year, or both.

SWORN this 11th day of July, 2003

William J. Baker (SEAL)
Notary Public for South Carolina
My Commission Expires: 10-7-2007

SIGNED: _____
Grantor, Grantee, or Attorney that prepared this form

Robert L. Clement III Manager
Type or Print Name here

BK W457PG736

RECORDER'S PAGE

This page Must remain with the original document.

Recording Fee 20.00
State Fee 11,988.60
County Fee 5072.10

Postage _____

TOTAL 17,080.70
A

YOUNG, CLEMENT, RIVERS, & TISDALE LLP

RECEIVED FROM RMC
AUG 04 2003
PEGGY A. MOSELEY
CHARLESTON COUNTY AUDITOR

FILED
W457-722
2003 JUL 17 AM 9:33
CHARLIE LYBRAND
REGISTER
CHARLESTON COUNTY SC

PID VERIFIED BY ASSESSOR
REP MMG
DATE 8/1/03

(843) 958-4800 2 Courthouse Square Charleston, SC 29401