Fifth Five-Year Review Report
for
Triana/Tennessee River Site
ALD983166299

Triana/Huntsville
Morgan, Madison and Limestone Counties, Alabama

February 2015

United States Environmental Protection Agency
Region 4
Atlanta, Georgia

Approved by:

Franklin E. Hill
Director, Superfund Division

Date: 2/12/15

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List of Acronyms

ADEM	Alabama Department of Environmental Management
ADPH	Alabama Department of Public Health
ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
DD	Decision Document
DDD	Dichloro-diphenyldichloroethane
DDE	Dichloro-diphenyldichloroethylene
DDT	Dichloro-diphenyl-trichloroethane
DoA	Department of Army
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
FDA	United States Food and Drug Administration
FYR	Five-Year Review
HSB	Huntsville Spring Branch
IC	Institutional Control
µg/L	micrograms per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
ppm	parts per million
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RPM	Remedial Project Manager
RI	Remedial Investigation
RSA	Redstone Arsenal
SAC	Site Access Control
SV	Screening Value
TBC	To-Be-Considered
TVA	Tennessee Valley Authority
USACE	U. S. Army Corps of Engineers
USFWS	United States Fish and Wildlife Service

Executive Summary

The Triana/Tennessee River Superfund site (the Site) is located about 5 miles southwest of Huntsville, Alabama. The Site spans 11 miles of the Huntsville Spring Branch (HSB) and Indian Creek tributaries of the Tennessee River in northern Alabama, also collectively referred to as the HSB-Indian Creek system. The Site area is located within the Wheeler National Wildlife Refuge and the Redstone Arsenal (RSA), which is used by the United States Department of Army's (DoA) Aviation and Missile Command and other defense-related agencies. From 1947 to 1970, the Olin Corporation (Olin), the Site's potentially responsible party (PRP), manufactured dichloro-diphenyl-trichloroethane (DDT) on a portion of the RSA. Site operations discharged wastewater from the plant into the HSB tributary stream channel resulting in contamination of site soil, sediment, surface water and local fish populations. In May 1983, Olin entered into a Consent Decree with the State of Alabama and United States Environmental Protection Agency (EPA) requiring Olin to design and implement a cleanup plan to address contamination at the Site. The cleanup plan included digging a new stream channel; rerouting the old stream channel; backfilling and burying contaminated material in place in the old channel; constructing diversion structures; diverting stormwater runoff; and long-term monitoring. EPA finalized the Site for inclusion on the National Priorities List (NPL) on September 8, 1983.

The remedy is functioning as intended by the Consent Decree by preventing re-suspension of DDT-contaminated sediment into the surface water column, which is the primary source of DDT contamination within the HSB-Indian Creek system. Continued attainment of the performance standard has occurred for channel catfish and largemouth bass in all three HSB reaches and smallmouth buffalo in Reaches B and C. The most contaminated reach, Reach A, is progressing toward achieving continued attainment of the performance standard for the smallmouth buffalo.

The State of Alabama is currently drafting an environmental covenant for the Site to comply with the requirements of the State of Alabama's Uniform Environmental Covenants Act. Although access to Reaches A and B is restricted from the RSA and the Wheeler National Wildlife Refuge, institutional controls are warranted to ensure appropriate authorities are involved in construction projects that may occur within the Site before the covenant is in place.

The Site's remedy remains protective of human health and the environment. Based upon the site visit and document review, the remedial action is functioning as intended by the Consent Decree. All diversion structures and fill areas appear sound. No signs of physical deterioration were noted. Overall, DDT levels in smallmouth buffalo continue to decline and DDT concentrations in the surface water continue to remain less than the established baseline.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Triana/Tennessee River		
EPA ID: ALD983166299		
Region: 4	**State:** AL	**City/County:** Triana and Huntsville/Limestone, Madison, and Morgan

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA
Author name: Claire Marcussen and Eric Marsh (Reviewed by EPA)
Author affiliation: Skeo Solutions
Review period: September 2014 – February 2015
Date of site inspection: 11/19/2014
Type of review: Policy
Review number: 5
Triggering action date: 02/17/2010
Due date *(five years after triggering action date)*: 02/17/2015

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): OU1	Issue Category: Institutional Controls			
	Issue: Institutional controls should be implemented to prevent future disturbance of the remedy.			
	Recommendation: Implement institutional controls prior to termination of the Consent Decree.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Other	EPA	02/17/2020

Sitewide Protectiveness Statement

Protectiveness Determination: Protective

Addendum Due Date (if applicable):

Protectiveness Statement:
The Site's remedy remains protective of human health and the environment. Based upon the site visit and document review, the remedial action is functioning as intended by the Consent Decree. All diversion structures and fill areas appear sound. No signs of physical deterioration were noted. Overall, DDT levels in smallmouth buffalo continue to decline and DDT concentrations in the surface water continue to remain less than the established baseline.

Five-Year Review Summary Form (continued)

Environmental Indicators
- Current human exposures at the Site are under control. *- Current groundwater migration is under control.*

Are Necessary Institutional Controls in Place?
☐ All ☒ Some ☐ None *Redstone Arsenal and Wheeler National Wildlife Refuge restrict access to the Site, however, institutional controls are not in place that clarify who is responsible for revising any future construction plans that may occur on the Site prior to placement of a restrictive covenant.*

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

Has the Site Been Put into Reuse?
☒ Yes ☐ No *The site falls within the Wheeler National Wildlife Refuge and the Redstone Arsenal. Part of the refuge is located onsite and is accessible to the public.*

Fifth Five-Year Review Report
for
Triana/Tennessee River 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 (EPA) prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 121 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA Section 121 states:

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

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

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

Skeo Solutions, an EPA Region 4 contractor, conducted the FYR and prepared this report regarding the remedy implemented at the Triana/Tennessee River Superfund site (the Site) in Triana/Huntsville, Limestone/Madison/ Morgan Counties, Alabama. EPA's contractor conducted this FYR from September 2014 to February 2015. EPA is the lead agency for developing and implementing the remedy for the potentially responsible party (PRP)-financed cleanup at the Site. The Alabama Department of Environmental Management (ADEM), as the support agency representing the State of Alabama, has reviewed the documentation included in the FYR and provided input to EPA during the FYR process.

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

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

2.0 Site Chronology

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

Table 1: Chronology of Site Events

Event	Date
EPA discovered site contamination	July 1, 1980
United States Army Corps of Engineers completed a study of dichloro-diphenyl-trichloroethane (DDT) in portions of the Hunstville Spring Branch (HSB) and Indian Creek, also referred to as the HSB-Indian Creek system	November 1980
EPA filed a complaint against Olin	December 4, 1980
EPA amended the complaint against Olin	February 5, 1982
EPA proposed the Site for the National Priorities List (NPL)	December 30, 1982
Olin completed a remedial investigation for the Site	March 31, 1983
EPA, the State of Alabama and Olin entered into a Consent Decree	May 31, 1983
Review Panel established	June 1983
EPA finalized the Site for the NPL	September 8, 1983
Olin completed a remedial action plan	June 1, 1984
Review Panel issued Decision Document Number 1 (DD#1): Olin Corporation Remedial Action Plan to Isolate DDT from People and the Environment in the HSB-Indian Creek system	August 31, 1984
Olin submitted Remedial Action Alternatives Report for Lower Reach A	August 1, 1985
Remedial activities began at Upper Reach A	April 1, 1986
Review Panel issued DD#2: Baseline Data, Substitute Species, and Interim Goals for Fish and Water	October 28, 1986
Review Panel issued DD#3: Remedial Action Plan to Isolate DDT in Lower Reach A of HSB; Olin began remedy construction	December 9, 1986
Review Panel issued DD#4: Report on DDT in Reach B and Reach C of the HSB-Indian Creek System	April 16, 1987
Review Panel issued DD#5: Substitute Species for Largemouth Bass	July 22, 1987
Olin submitted a long-term monitoring plan	August 1987
Remedial activities completed at Upper Reach A	October 14, 1987
Review Panel issued DD#6: Long-Term Monitoring Program for the Remedial Action in the HSB-Indian Creek System	December 3, 1987
Site designated construction complete, and long-term monitoring and operations and maintenance (O&M) activities began	January 1, 1988
Review Panel issued a revision to DD#6: Modification Long-Term Monitoring Program for the Remedial Action in the HSB-Indian Creek System	December 7, 1989
Review Panel issued DD#7: Quality Assurance and Fish Sample Size; and approved termination of the "far-field" groundwater monitoring program and modification to the "near-field" groundwater monitoring program	June 14, 1990
Review Panel issued DD#8: Groundwater Monitoring	December 6, 1990
EPA signed the Interim Close-Out Report	December 18, 1991
Review Panel issued DD#9: Process for Review of Monitoring Data and Olin Notification of Compliance by the Technical Committee	January 23, 1992
EPA signed the first FYR Report	July 12, 1993
Olin achieved continued attainment performance requirements for largemouth bass samples	1994

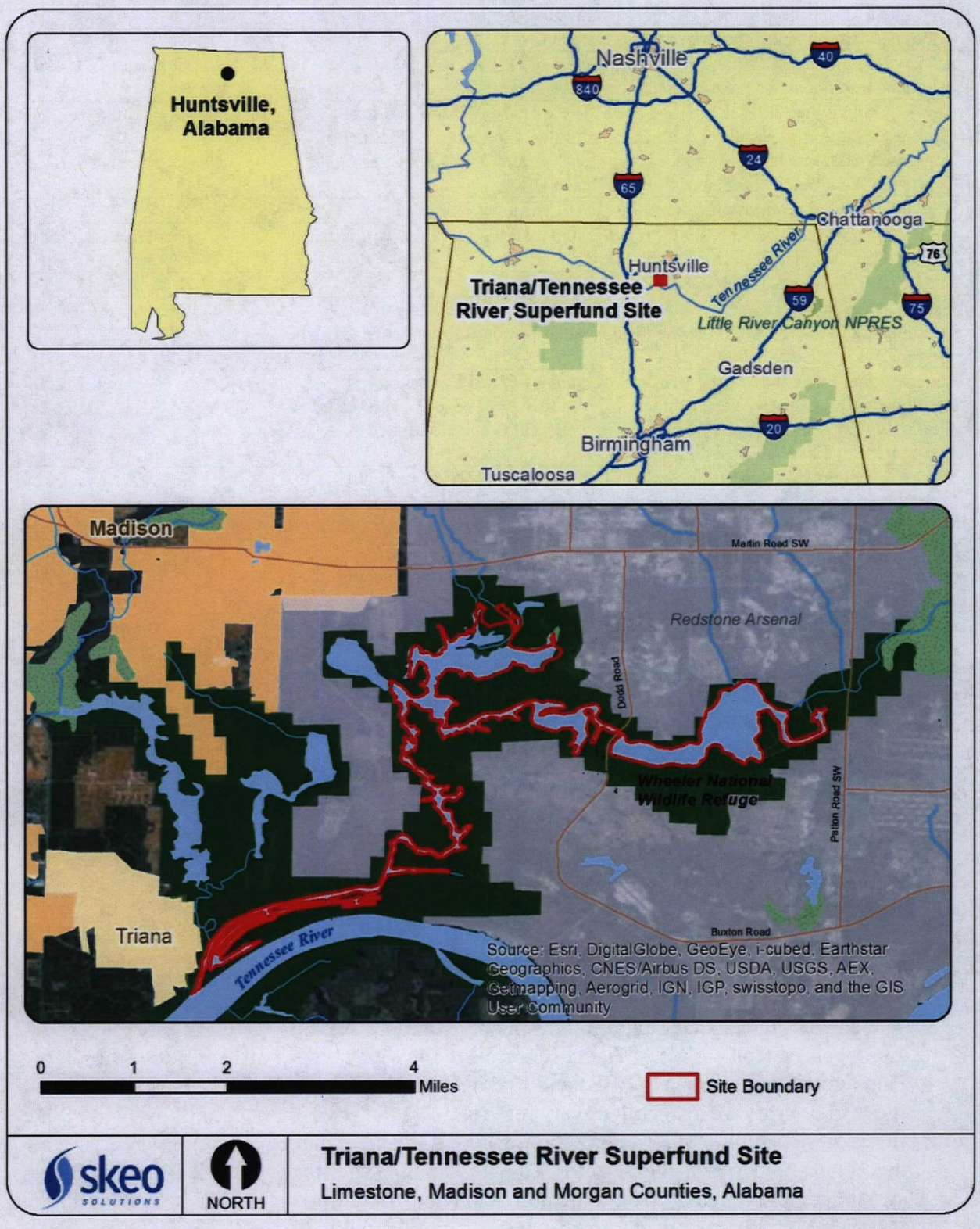
Event	Date
Review Panel issued DD#10: Process for Review of Olin's Notifications of Continued Attainment by the Technical Committee, Appendix A, Finding of Continued Attainment, Largemouth Bass, Reach C	January 19, 1995
Review Panel issued DD#10: Process for review of Olin's notifications of continued attainment by the Technical Committee	January 31, 1995
Review Panel issued DD#10: Process for Review of Olin's Notifications of Continued Attainment by the Technical Committee, Appendix B, Finding of Continued Attainment, Largemouth Bass, Reach A and Appendix C, Finding of Continued Attainment, Largemouth Bass, Reach B	July 20, 1995
Olin discontinued groundwater sampling	1997
Review Panel issued DD#11: Extension of Time for Meeting the Performance Standard for Channel Catfish and Smallmouth Buffalo	December 21, 1998
EPA signed the second FYR Report	June 18, 1999
Review Panel issued DD#12: Monitoring Program, Interim Goals and Contingency Plans for Attaining the Performance Standard for Channel Catfish and Smallmouth Buffalo 1998-2007	September 19, 1999
Review Panel issued DD#10: Process for Review of Olin's Notifications of Continued Attainment by the Technical Committee, Appendix D, Findings of Attainment for Channel Catfish in Reaches A, B, and C and Continued Attainment for Channel Catfish, Reach A	March 2, 2000
Review Panel issued DD#10: Process for Review of Olin's Notifications of Continued Attainment by the Technical Committee, Appendix E, Findings of Continued Attainment for Channel Catfish, Reach C	March 15, 2001
Review Panel issued DD#13: Monitoring Stream Water Levels and Flows	April 3, 2002
Olin achieved continued attainment performance requirements for channel catfish samples	2003
EPA signed the third FYR Report	February 25, 2005
Review Panel issued DD#10: Appendix F: Findings of Continued Attainment for Channel Catfish, Reach B	March 17, 2005
Review Panel issued DD#10: Appendix G: Findings of Continued Attainment for Smallmouth Buffalo, Reach C	June 18, 2007
Olin achieved initial attainment for all three species of fish in all Reaches.	December 31, 2007
Olin achieved continued attainment performance requirements for smallmouth buffalo samples in Reach B	2010
EPA signed the fourth FYR Report	February 17, 2010

3.0 Background

3.1 Physical Characteristics

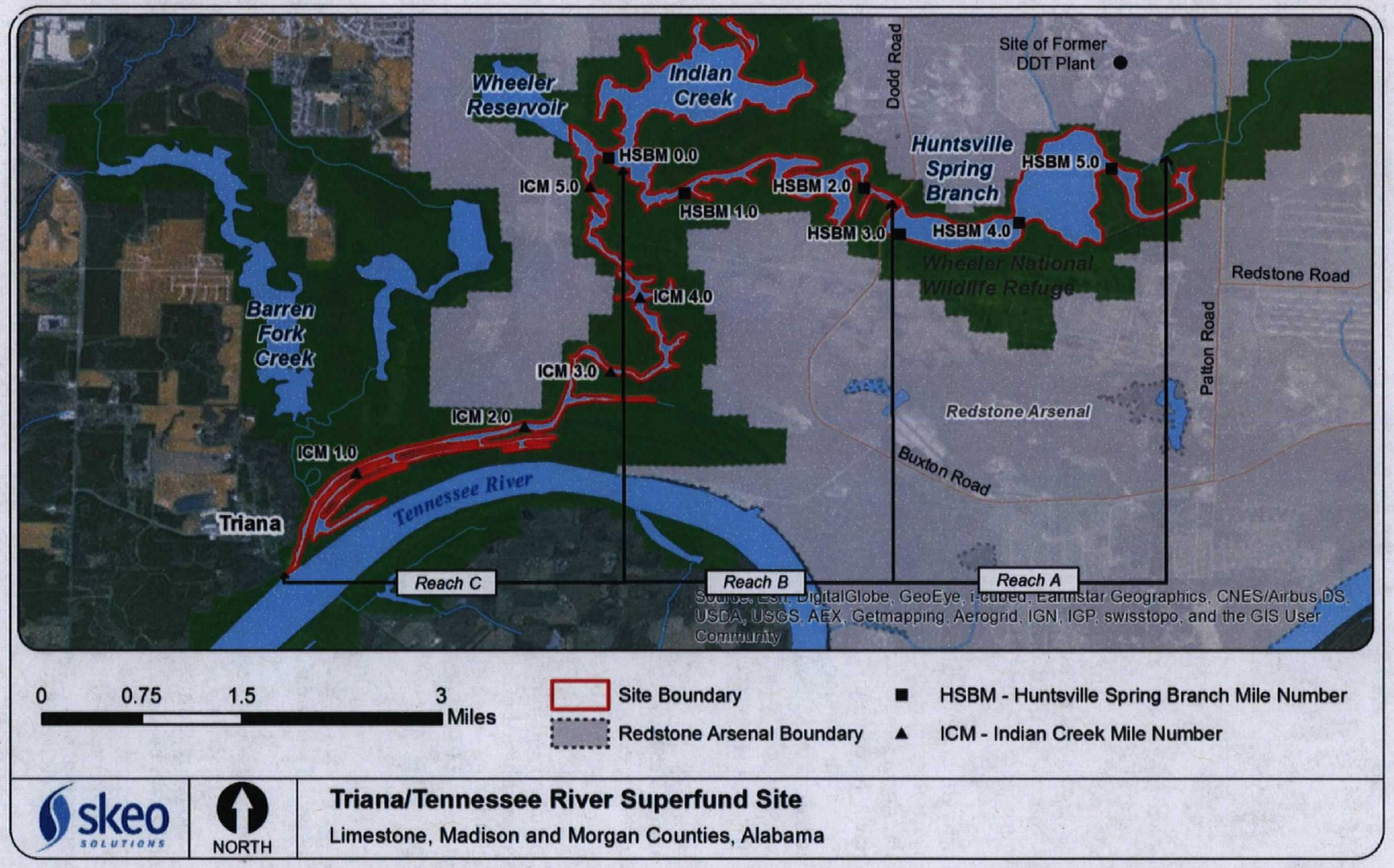
The entire Site is located within the Wheeler National Wildlife Refuge, which is 5 miles southwest of Huntsville, Alabama (Figure 1). The Site consists of 11 miles of the Huntsville Spring Branch (HSB) and Indian Creek tributaries of the Tennessee River; these tributaries are also collectively referred to as the HSB-Indian Creek system. HSB flows in the south-southwest direction, where it meets Indian Creek before emptying into the Tennessee River just east of the Town of Triana. The span of the HSB-Indian Creek system contaminated by Olin's dichloro-diphenyl-trichloroethane (DDT) waste discharge is divided into three portions, or reaches, as summarized in Table 2. Reaches A and B are located within the boundaries of the United States Department of Army's (DoA) Redstone Arsenal (RSA), while Reach C is located outside of RSA (Figure 2).

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 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 EPA's response actions at the Site.

Table 2: Summary of the HSB-Indian Creek System Impacted by Olin

Site Reach	Description
Reach A	HSB mile 5.4 to HSB mile 2.4
Reach B	HSB mile 2.4 to HSB mile 0.0
Reach C	Indian Creek mile 5.6 to Indian Creek mile 0.0

Directly upgradient and north of the Site is the former DDT manufacturing plant area and associated support facilities, which RSA refers to as RSA-117.[1] RSA is also on the NPL and is addressing the cleanup of RSA-117 under a separate cleanup plan under the Resource Conservation and Recovery Act (RCRA) overseen by ADEM. RSA refers to the Site as RSA-101. The location of RSA-117 relative to the RSA-101 is shown in Appendix C, Figure C-1.

The regolith aquifer, composed of unconsolidated surficial materials transported by ancestral streams, lies beneath the Site. Beneath the regolith aquifer is Tuscumbia Limestone, which averages 150 feet in thickness and is underlain by Fort Payne Limestone containing beds of chert. The Fort Payne Chert is 155 to 185 feet thick and serves as the primary aquifer in the area. Water in the regolith aquifer typically discharges to the Fort Payne aquifer.

3.2 Land and Resource Use

Though the Wheeler National Wildlife Refuge complex is open for recreational use and fishing, Reaches A and B of the Site are located on refuge land that lies within the RSA, and public access to the Site area is heavily restricted. Reach C is located outside of RSA and is accessible by the general public at the public boat access in the Town of Triana. RSA is a DoA post with various tenants including the U.S. Army Aviation and Missile Command and other defense-related agencies. The Wheeler National Wildlife Refuge was established in July 7, 1938, to provide protected habitats for a wide variety of wildlife, including migratory waterfowl, fish and amphibians. Future land use at the refuge and RSA is expected to remain the same. Triana is located downstream of the Site and has a population of about 500.

Residents surrounding RSA receive their drinking water from municipal water supply systems, such as the Huntsville Utilities or Madison County Water Works. The City of Huntsville and the County of Madison passed ordinances in the 1970s that prohibit the installation of private wells within the city and county limits. The Tennessee River is the source for potable water provided by these utilities. The primary intake is located on the Tennessee River, located upstream of RSA. Madison Utilities is currently constructing a municipal raw water intake at Tennessee River mile 321.0 in Triana; the surface water intake will be located upstream of where Indian Creek discharges to the Tennessee River.

[1] RSA-117 includes a number of subunits that include the former liquid caustic, chlorine and DDT manufacturing plants, brine processing plant, general analine and film discharge area, ammonia lagoon, thionyl chloride plant, DDT settling ponds, old and new DDT drainage ditches and the new DDT drainage ditch check dams.

The new intake provides additional potable water to the City of Madison residents and the surrounding area.

3.3 History of Contamination

The Calabama Chemical Company leased the former DDT manufacturing plant site from the DoA in 1947. Olin Chemical purchased Calabama and operated the DDT manufacturing plant from 1954 to 1971. The manufacture of DDT and other pesticides resulted in significant amounts of pesticide contamination as waste product at RSA. Thousands of pounds of contaminated wastes were buried in landfills throughout the RSA, which are being addressed under a RCRA permit. In addition to solid waste, Olin and the Calabama Chemical Company discharged large quantities of contaminated wastewater to surface water. Operators at the facility discharged DDT residues and manufacturing wastewater through the RSA drainage system into the HSB-Indian Creek system. Over time, stream sediments became contaminated with an estimated 417 tons of DDT and its breakdown products dichloro-diphenyl-dichloroethylene (DDE) and dichloro-diphenyl-dichloroethane (DDD).[2] Pollution of the tributaries resulted in an increased frequency of fish kills. By 1963, the Public Health Service and Tennessee Valley Authority (TVA) conducted water and sediment sampling to determine the extent of DDT migration and concentrations in HSB-Indian Creek system. TVA's sampling indicated that through bioaccumulation, many fish fillet samples contained elevated levels of DDT.

The Federal Water Pollution Control Administration sampled water at HSB mile 5.4 on a monthly basis from late 1967 to April 1970. DDT concentrations in surface water during this period ranged from 0.3 to 60 micrograms per liter (µg/L). EPA confirmed the presence of DDT contamination in July 1980.

3.4 Initial Response

Olin ceased the manufacture of DDT in 1971 and the plant was demolished by the DoA in 1971. In 1977, the DoA initiated an extensive DDT abatement program to clean up DDT contamination upgradient and north of the Site at the former DDT manufacturing plant to minimize exposure and migration of DDT from RSA. The DoA excavated highly-contaminated soil and sediment and DDT wastes from the DDT manufacturing area that includes the old DDT drainage ditch, lagoon and former DDT disposal areas and placed the wastes in a clay-lined landfill. The DoA also filled and sealed the DDT settling ponds and installed a new drainage ditch with check dams to divert surface water flow. In addition, the DoA dismantled and demolished the manufacturing plant structures, floor drains, conduits and industrial sewers; plugged industrial sewer manholes with concrete; and demolished manhole structures. The DoA placed a 6-inch compacted clay/6-inch topsoil layer over the former plant area and seeded. The DoA completed DDT abatement activities in August 1982.

[2] Subsequent references to DDT include DDT and breakdown products DDD and DDE.

EPA and the State of Alabama filed a formal complaint against Olin in December 1980 and amended it in February 1982. The complaints alleged that DDT discharged from the manufacturing plant had created an imminent and substantial endangerment to human health and the environment in the HSB-Indian Creek system. EPA proposed the Site for the National Priorities List (NPL) on December 30, 1982 and finalized it on the NPL on September 8, 1983.

3.5 Basis for Taking Action

Based on prior sampling results from the 1960s and 1970s, EPA and the Alabama Department of Conservation and Natural Resources determined that soil, sediment, groundwater, surface water and ingestion of fish could potentially harm people in the area. A baseline risk assessment was not conducted for the Site as CERCLA risk assessment guidance had not yet been established. However, in 1980 the United States Army Corps of Engineers (USACE) prepared an environmental impact statement (EIS) to address issues and environmental impacts associated with the proposed Remedial Action Plan. The EIS examined the distribution of DDT in sediment, the water column and biota and the potential environmental transport of DDT. The findings concluded that nearly 93 percent of the total DDT, including DDT and its metabolites DDE and DDD, in the HSB-Indian Creek system is contained within HSB Reach A, with significantly less, 4 percent, within HSB Reach B and the remaining 3 percent within Indian Creek Reach C. The research also concluded that DDT has accumulated in fish at concentrations exceeding the United States Food and Drug Administration (FDA) action level of 5 parts per million (ppm). In addition, the research determined that DDT is transported with the sediment as suspended particles in surface water in HSB-Indian Creek and that the major source of DDT uptake by fish is through the water column, while fish uptake of DDT through their food was determined to be much less significant. Based on these findings the USACE concluded that reducing DDT concentrations in the water column would significantly reduce DDT concentrations in fish and other organisms.

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. On May 31, 1983, the U.S. District Court entered a Consent Decree, as part of an order settling litigation against Olin, governing remedial action for DDT contamination in the HSB-Indian Creek system. Final remedy selection was made in accordance with the Site's 1983 Consent Decree and based on the review of a remedial plan and supporting documents that was submitted by Olin to the Review Panel. The Review Panel's evaluation criteria for the remedial plan included:

- The nature of the endangerment to human health and the environment, which the remedial action was designed to address.

- The extent to which implementation of the remedial action would reduce or increase endangerment to human health or the environment, or would otherwise affect human health or the environment.
- Whether implementation of such remedies is unnecessary to satisfy or is inconsistent with the goals, objectives and performance standard set forth in the 1983 Consent Decree.
- Whether the remedy chosen was the most cost-effective means of accomplishing the performance standard set forth in the Consent Decree.

The Review Panel selected DDT concentrations in fish fillets as the performance standard for monitoring the effectiveness of the remedy in reducing DDT in the surface water column; the performance standard also served as a metric for evaluating risks to both human health and the environment.

4.1 Remedy Selection

As the Site's PRP, Olin was responsible for implementing remedial work to meet the Site's performance standard and the goals and objectives outlined in the Consent Decree. As part of the Consent Decree, a Review Panel was formed to provide oversight of all remedial plans and actions enacted by Olin; the Review Panel consists of five voting members and two non-voting members. The voting members include EPA, TVA, United States Fish and Wildlife Service (USFWS), USACE and ADEM. The two non-voting members include the Town of Triana and Olin. The Review Panel was established in June 1983, and EPA finalized the Site on the NPL on September 8, 1983.

The Consent Decree did not explicitly set out remedial action objectives for the Site. Nevertheless, the Consent Decree listed the following goals and objectives to be achieved by the remedy:

- Isolate DDT from people and the environment in order to prevent further exposure.
- Minimize further transport of DDT out of the HSB-Indian Creek system.
- Minimize adverse environmental impacts of remedial actions.
- Mitigate effect of DDT on wildlife habitats in the Wheeler National Wildlife Refuge.
- Minimize adverse effects on operations at RSA, Wheeler Reservoir and Wheeler National Wildlife Refuge.
- No increase in flooding, particularly at the City of Huntsville and RSA, except those increases in water levels which can be reasonably expected in connection with the implementation of remedial action, provided Olin takes all reasonable steps to minimize or prevent such increase.
- Minimize effect on loss of storage capacity for power generation, in accordance with the Tennessee Valley Authority Act.

The Consent Decree established that Olin would develop and implement a remedial plan to address DDT contamination at the Site. The Consent Decree also established the role of the Review Panel as a required body to provide technical review and oversight of all

proposals and actions by Olin to ensure that all requirements in the Consent Decree are fulfilled. To date, the Review Panel has issued 13 Decision Documents to which Olin must adhere. These Decision Documents reflect events such as modifications to the remedy and attainment of the performance standard, but they do not supersede or alter the requirements of the Consent Decree.

Olin submitted a proposal for remedial action at the Site to the Review Panel in 1984 that included the need for fish, water and sediment to establish baseline conditions; extensive sediment sampling to define the quantity and distribution of DDT in each reach of the HSB-Indian Creek system; a remedial action plan; and a schedule for remedy implementation. The Review Panel approved the remedial action plan in Decision Document #1 on August 31, 1984 which included the following components:

- Diversion of stream flow around contaminated portions of the tributaries.
- Excavation of new channels.
- Excavation of contaminated portions of sediments.
- Burial of portions of contaminated sediments in place.
- A monitoring plan to monitor concentrations of contaminated portions of the HSB-Indian Creek tributaries.

The remedy facilitated reducing DDT transport as suspended contaminated sediment in surface water in order to achieve the performance standard of 5 ppm of DDT in fish fillet for three species: channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*) and smallmouth buffalo fish (*Ictiobus bubalus*). The Consent Decree required that the fish fillet must meet the performance standard for at least one year (initial attainment) within a 10-year period after construction and implementation of the remedial action. In addition, the Consent Decree allowed for an extension of the 10-year period at the Review Panel's discretion. The Consent Decree defined initial attainment as an average concentration of DDT of 5 ppm or less in the fish fillets for one year for each monitored fish species in each reach of HSB-Indian Creek system.

Consent Decree requirements stipulate that once initial attainment is achieved, Olin must demonstrate "continued attainment," where the performance standard must be met for three consecutive years. Once continued attainment is achieved for all three species in all three reaches, annual fish monitoring is discontinued and the Consent Decree then requires Olin to operate and maintain the remedy for a period of seven years; after this seven year period, a final fish sampling event shall be conducted in which all three species are again sampled in each of the three reaches.

In Decision Document #2, dated on October 28, 1986, the Review Panel established interim cleanup goals for DDT concentrations in fish and surface water to track progress toward achieving the performance standard of 5 ppm of DDT in fish fillets. Studies have indicated that most of the DDT in the water column is attached to suspended sediments. Interim goals for suspended sediment and the water column are expressed in terms of total DDT concentrations in the water column and summarized in Table 3.

Table 3: Interim Goals for DDT in the Water Column of the HSB-Indian Creek System

Monitoring Station Location	Total DDT Concentration (µg/L)[a]
New HSB Mile 5.0[b]	0.0
HSB Mile 4.0	0.5
HSB Mile 2.4	1.5
Indian Creek Mile 4.6	0.25
Indian Creek Mile 0.38	0.10

a. Based on projected total DDT concentrations (sum of DDE, DDD and DDT isomers) in the water column of HSB-Indian Creek following remedial action minus a background level of 0.5 µg/L.
b. Represents the new HSB monitoring location established following the rerouting of stream flow in the new channel.

In Decision Document #3 dated December 9, 1986, the Review Panel accepted Olin's remedial action plans to isolate the DDT-contaminated sediments in Reach A of the HSB-Indian Creek system and required Olin to perform a study further identifying the extent of DDT contamination in Reaches B and C by September 1, 1986. In Decision Document #4 dated April 16, 1987, the Review Panel accepted Olin's Report on DDT in Reach B and Reach C of the HSB-Indian Creek system and agreed with the conclusion that no remedial actions in Reach B and Reach C were necessary to meet the performance standard. The Review Panel accepted the bluegill sunfish (*Lepomis machrochirus*) as a substitute species for largemouth bass in Decision Document #5 on July 22, 1987, concluding that the bluegill sunfish is the best substitute species for largemouth bass based on size, feeding habits, residue levels, abundance and overall similarity to the performance standard fish.

4.2 Remedy Implementation

Remedial activities began in April 1986 and concluded in 1987. Olin addressed Reach A remediation as two sections: Upper Reach A included the most contaminated sediments between HSB miles 5.4 and 4.0, and Lower Reach A included the area between HSB miles 4.0 and 2.4. In Upper Reach A, Olin isolated 308 of 318 tons of DDT-contaminated sediments, effectively isolating more than 95 percent of DDT in this reach. Olin also constructed a new wastewater diversion ditch, a northern diversion ditch, access roads and stream crossings, and north and south staging areas as part of the remedial activities. In July 1986, Olin completed the excavation of the 1,640-foot straight channel (referred to as the salient cut) and the curved 3,250-foot cut (referred to as the oxbow cut); construction of three diversion structures and diversion levee; the blocking off, dewatering and filling of the HSB channel between HSB miles 5.5 and 4.0; and construction of an embayment at HSB mile 4.2 to isolate DDT in Upper Reach A. In addition, Olin covered the dewatered channel with a geotextile fabric and nine inches of crushed rock, soil and topsoil to promote regrowth of vegetation (Appendix C, Figure C-2). Olin did not establish cleanup levels to delineate areas of excavation, since environmental evaluations demonstrated that a majority of the DDT was within the

stream channel with significantly lower concentrations along the stream overbanks. However, to ensure that the lower levels of berm contamination were addressed by the remedy, the Review Panel requested that Olin also include excavation of 25 feet of the overbank areas on both sides of Reach A. Olin completed remedial activities in Upper Reach A on October 14, 1987.

The Review Panel approved the remedial action plan to address contamination in Lower Reach A on December 9, 1986. The plan included bypassing and burying DDT-contaminated sediments; constructing four diversion structures; excavating a new channel between HSB mileposts 3.4 and 2.4; filling three areas; constructing a diversion ditch around the fill areas; and excavating portions of the sediments from the channel. The entire construction area was located within the safety fan of a missile test range at RSA and within the normal fluctuation zone of Wheeler Reservoir. On January 1, 1988, the Review Panel designated the remedy as construction complete.

In December 1987, and with modifications in December 1989, the Review Panel approved of Olin's long-term monitoring program. The plan included monitoring fish, surface water and groundwater in Reaches A, B and C. Monitoring activities began in 1988 following construction of remedial components. In 1997, the Review Panel determined that groundwater monitoring could cease because sampling identified no significant impacts to groundwater following the remedial action. Surface water and fish sampling continue at the Site in order to track progress toward meeting the performance standard and requirements outlined in the Consent Decree. In December 1998, the Review Panel agreed to extend the time to attain the performance standard for channel catfish and smallmouth buffalo considering Olin's achievements in implementing the remedy and acting in good faith with the provisions of the Consent Decree.

4.3 Operation and Maintenance (O&M)

The long-term monitoring program was documented in Decision Document # 6 in December 1987 and modified in 1989 to include sampling of fish fillets and surface water for DDT concentrations. The long-term monitoring program requires annual sampling of fish and biennial sampling of surface water at the Site until the performance standard is attained in all fish species for all three reaches. The average O&M cost for calendar years 2010-2014 was approximately $71,000. For the past five years, Olin submitted an annual report of monitoring efforts and presented findings at an annual Review Panel meeting. O&M costs for calendar years 2010 through 2014 are presented in Table 4.

Table 4: Annual O&M Costs

Year	Total Cost *(rounded to the nearest $1,000)*
2010	$80,000
2011	$88,000
2012	$66,000
2013	$54,000

Year	Total Cost *(rounded to the nearest $1,000)*
2014	$67,000

5.0 Progress Since the Last Five-Year Review

The protectiveness statement from the 2010 FYR for the Site stated the following:

The Site's remedy remains protective of human health and the environment. Based upon the site visit and document review, the remedial action is functioning as intended by the Consent Decree. All diversion structures and fill areas appear sound. No signs of physical deterioration were noted. Overall, DDT levels in smallmouth buffalo continue to decline and DDT concentrations in the surface water continue to remain less than the established baseline.

The 2010 FYR included one recommendation. This report summarizes the recommendation and its current status below in Table 5.

Table 5: Progress on Recommendations from the 2010 FYR

Recommendations	Party Responsible	Milestone Date	Action Taken and Outcome	Date of Action
Update the site repository with past FYRs and Review Panel reports.	EPA	06/30/2010	Completed	6/30/2010

In January 2015, at the request of the community, several documents were added to the site web page. These documents consisted of the 1983 Consent Decree, four Review Panel reports on the Remedial Action and the last seven annual fish sampling reports.

6.0 Five-Year Review Process

6.1 Administrative Components

EPA Region 4 initiated the FYR in August 2014 and scheduled its completion for February 2015. The EPA remedial project manager (RPM) Brian Farrier led the EPA site review team, which also included the EPA site attorney Greg Luetscher, the EPA community involvement coordinator (CIC) L'Tonya Spencer and contractor support provided to EPA by Skeo Solutions. In September 2014, EPA coordinated with the review team to discuss the Site and items of interest as they related to the protectiveness of the remedy currently in place. The review schedule established consisted of the following activities:

- Community notification.
- Document review.
- Data collection and review.
- Site inspection.

- Local interviews.
- FYR Report development and review.

6.2 Community Involvement

On December 5, 2014, EPA published a public notice in the *Huntsville Times* newspaper announcing the commencement of the FYR process for the Site, providing contact information for Brian Farrier and L'Tonya Spencer (EPA) and inviting community participation. The press notice is available in Appendix B. No one contacted EPA as a result of the advertisement.

EPA will make the final FYR Report available to the public. Upon completion of the FYR, EPA will place copies of the document in the designated site repository: Triana Public Library located at 357 Record Street, Triana, Alabama, 35756.

6.3 Document Review

This FYR included a review of relevant, site-related documents including the Consent Decree, remedial action reports, decision documents and recent monitoring data. A complete list of the documents reviewed can be found in Appendix A.

ARARs Review

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

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 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 groundwater 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.

The final remedy selected for this Site was designed to meet or exceed all chemical-specific ARARs and meet location- and action-specific ARARs. The chemical-specific ARARs are the DDT concentrations in channel catfish, largemouth bass and smallmouth buffalo fish fillets that were identified in the selected remedy for the Site (Table 6). The DDT performance standard applies to the edible portions of fish and is consistent with the 2014 recommended Action Levels for Unavoidable Pesticides in Food and Feed Commodities set by the FDA's Compliance and Policy Guides for fish sold in interstate commerce.

Table 6: Summary of ARARs Associated with DDT in Fish Fillets

Fish Species	1983 Consent Decree Performance Standard (ppm)	Current FDA Action Levels[a] (ppm)	ARARs Changed?
Channel catfish Largemouth bass Smallmouth buffalo	5	5	No
a. FDA's Compliance and Policy Guidance Sec. 575.100 Pesticide Residues in Food and Feed - Enforcement Criteria (CPG 7141.01) last accessed on October 15, 2014 at: http://www.fda.gov/ICECI/ComplianceManuals/CompliancePolicyGuidanceManual/ucm123236.htm,			

Chemical-specific ARARs were not established for DDT in surface water or groundwater. Interim goals were represented by baseline conditions established by a number of studies conducted by Olin.

Institutional Controls Review

Site decision documents do not identify institutional controls associated with areas included in the Consent Decree to prevent disturbance of the remedy. The DoA requires all proposed construction activities that occur on DoA property to undergo a review through RSA's Site Access Control program (SAC). The DoA is not responsible for the cleanup at the Consent Decree area; however, any future construction project within this area must be reviewed by the DoA's SAC program. Although the SAC program determines if a project will encounter contamination or disturb a remedy within the Consent Decree area, the DoA is not responsible for how a proposed construction project will be revised to avoid disturbing the remedy. To ensure that an exposure pathway is not created and that protectiveness of human health and environment is maintained, additional institutional controls are necessary to ensure the appropriate authorities are included in construction projects that occur within the Consent Decree area.

ADEM is currently drafting an environmental covenant for the Site to comply with the requirements of the State of Alabama's Uniform Environmental Covenants Act. The restrictive covenant ensures the long-term enforcement of clean-up controls at the Site which will be binding on subsequent purchasers and tenants of the property and be listed in the local land records. ADEM is working with the Review Panel and technical committee to complete and file the covenant ; thus there are currently no institutional

controls in place that prevent disturbance of the remedy. Table 7 describes the institutional control issues associated with areas of interest at the Site.

For the State of Alabama, fish consumption guidelines are set by the Alabama Department of Public Health (ADPH). For the HSB-Indian Creek system, ADPH bases its guidelines on fish collected in Reach C, in Indian Creek approximately 1 mile upstream of the Tennessee River, at latitude-longitude coordinates 34.58431, -86.72915. Using the FDA Action Level of 5 ppm for DDT, ADPH issued a "Do Not Eat" fish advisory for smallmouth and bigmouth buffalo from 2002-2011, for the HSB-Indian Creek system from Redstone Arsenal to the Tennessee River. In 2012, ADPH revised the advisory and issued a "no restriction" advisory for all species in the HSB-Indian Creek system based on fish sampling conducted by ADPH which showed levels of DDT below the detection limit of 0.46 ppm in channel catfish and largemouth bass.

Table 7: Institutional Controls Summary Table

Area of Interest – Huntsville Spring Branch-Indian Creek System						
Media	**Institutional Controls Needed**	**Institutional Controls Called for in the Decision Documents**	**Impacted Parcel(s)**	**Institutional Control Objective**	**Instrument in Place**	**Notes**
Sediment	Yes	No	NA[a]	Prevent disturbance of waste in place	None	Isolated DDT contaminated sediments should not be disturbed. The DoA requires all construction projects that occur on DoA property to undergo a review in the SAC program to determine whether a project could disturb known contaminated areas. ADEM requires a restrictive covenant on the Site; however, there are currently no controls in place to prevent disturbance of the remedy.
a. Parcel information for the Site is not publicly available because it is located within federal property of the Wheeler National Wildlife Refuge and RSA.						

6.4 Data Review

Fish Fillets

By 1998, 10 years after the completion of the cleanup action in 1988, only largemouth bass attained the performance standard of continued attainment of 5 ppm in all three reaches, which occurred in 1994. In December 1998, the Court allowed Olin a five- and 10-year extension to attain the performance standard for channel catfish and smallmouth buffalo fish species, respectively. In 2003, channel catfish met the continued attainment requirement in all three reaches (Table 8).

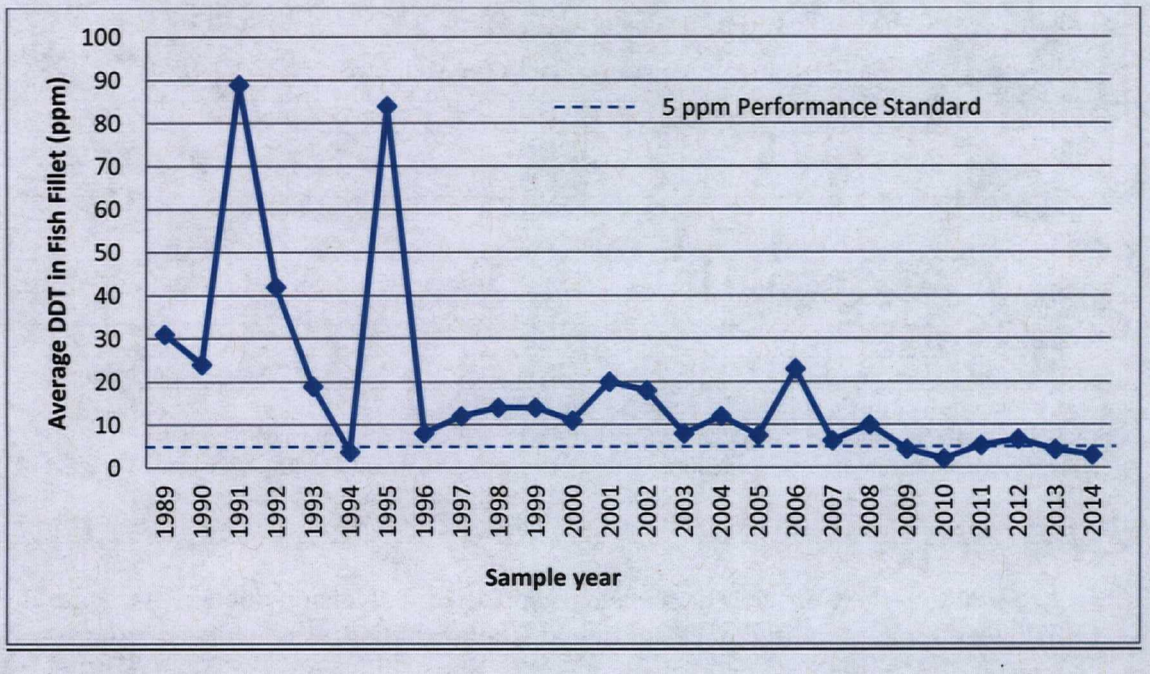
Table 8: Summary of Initial and Continued Attainment of the Performance Standard

Species	Reach	DDT Concentration (ppm) in Fish Fillet			First Year of Attainment[b]	Year of Continued Attainment[c]
		Baseline[a]	Average	Last Year Monitored		
Channel Catfish	A	95	3.3	1999	1997	1999
	B	69	5.0	2003	1999	2003
	C	66	4.4	2000	1996	2000
Largemouth Bass	A	7.1	0.4	1998	1989	1994
	B	37	0.5	1998	1988	1990
	C	8.2	0.2	1998	1988	1992
Smallmouth Buffalo	A	140	3.0[d]	2014	1994	TBD
	B	180	3.6	2009	2007	2009
	C	110	3.5	2006	1996	2006

a. Baseline represents data collected from 1982-1985.
b. Initial attainment represents achieving the performance standard for one year.
c. Continued attainment represents achieving the performance standard for three consecutive years.
d. Data collected in 2014 have not yet undergone EPA quality assurance and quality control.
Average = annual average TBD = to be determined; continued attainment possible in 2015.

According to the Consent Decree and as specified in decision documents, sampling of fish is no longer required once continued attainment has been achieved in each reach. As a result, largemouth bass and channel catfish have not been sampled since 1998 and 2003, respectively. Average annual DDT concentrations in smallmouth buffalo fillets between 1988 and 2013 are presented in Appendix D. To date, smallmouth buffalo have met the continued attainment performance standard in Reaches B and C in 2009 and 2006, respectively, concluding the sampling for this species in these reaches. Annual fish monitoring since 2010 has consisted of smallmouth buffalo in Reach A. This fish species met the performance standard in Reach A in 2009, 2010 and 2013, but not in 2011 or 2012 (Figure 3).

Figure 3: Average DDT Concentrations in Smallmouth Buffalo Fish Fillets in Reach A (1989-2014)



Surface Water

DDT concentrations for the four surface water samples collected from 2009 to 2013 were primarily below the detection limit of 0.10 µg/L, with the exception of DDT concentration at HSB mile 2.4 (Reach A), which was detected at 0.17 µg/L in one sample and below the detection limit in a duplicate sample (Table 9). DDT concentrations in all surface water samples collected in 2009 through 2013 were below the interim cleanup goals, demonstrating that the remedy continues to be effective in minimizing the transport of DDT in the HSB-Indian Creek system. The Review Panel decided on May 22, 2013, that the water column sampling should be reduced from annual to biennial (every other year) and that the sampling should be reduced to one river mile location, HSB mile 2.4. If DDT is detected at this location, the succeeding sampling event would occur at the four water column sampling locations. The next surface water sampling event will occur in 2015 at HSB 2.4.

Table 9: Summary of HSB-Indian Creek System Surface Water Data Collected Between 2010 and 2013

Sample Location[a]	Interim Goal[b]	2009	2010	2011	2012	2013
HSB mile 5.9	0.0	0.1U	0.1U	0.1U	0.1U	0.12U
HSB mile 2.4	1.5	0.14[c]	0.1U	0.1U	0.1U	0.12U
Indian Creek mile 4.6	0.25	0.1U	0.1U	0.1U	0.1U	0.12U
Indian Creek mile 0.38	0.10	0.1U	0.1U	0.1U	0.1U	0.12U

a. Unfiltered sample to include water and suspended solids.
b. Decision Document #2, Baseline Data, Substitute Species, and Interim Goals for Fish and Water, dated October 28, 1986.
c. Average of detected value 0.17 µg/L and duplicate sample detection limit of 0.10 µg/L.

Groundwater

Groundwater monitoring was discontinued in 1997 because long-term monitoring indicated that DDT was below detection.

Sediment

In 2004 and 2005, Olin conducted a 2-year sediment distribution study on bottom sediments of Reach B of HSB (HSB mile 0 to 2.4) and sediment core sampling in Reach B and Reach C located in Indian Creek. The 2004 and 2005 results were compared to the baseline survey data. In addition, Olin evaluated sediment profiles in 17 sections of Reach B to determine the rate of erosion and deposition of channel sediments. The Review Panel concluded that the DDT concentrations were considerably lower than the baseline data and that natural attenuation was occurring to include covering of the sediments with lower concentrations of DDT, mixing and dilution, and degradation. Based on the review of the sediment data, the Review Panel determined that no additional remediation or further investigation of sediments was necessary.

6.5 Site Inspection

On November 19, 2014, Brian Farrier, EPA, Claire Marcussen and Eric Marsh, Skeo Solutions, participated in the Review Panel's Technical Committee meeting for the Site. Other participants included representatives from the PRP (Olin), ADEM, RSA, USACE, USFWS, TVA and a consultant for TVA. The Review Panel itself met later on December 2, 2014 and Eric Marsh, Skeo Solutions, attended via a conference call. During the November 19, 2014 meeting, the group discussed a range of issues related to the Site including the following:

- Latest results from fish fillet monitoring in smallmouth buffalo in the HSB-Indian Creek system.
- Process for closing out the Site if monitoring results from the first seven-year monitoring event (which will take place after continued attainment is met for all monitored species on all reaches) indicate that the performance standard continues to be met.
- Status of the Site's ongoing FYR.

- Process for placing the equivalent of a state Uniform Environmental Covenants Act restrictive covenant on the Site.
- Obtaining access agreements for Olin.

The group observed the locations of remedial action, including remedial components in Upper Reach A and Lower Reach A. The group observed diversion structures, including diversion structures associated with the oxbow and the salient cuts, sheet piling and embayment areas. The Site was well maintained and vegetation has been established on the filled channel. A sign was posted at the access gate identifying the area as a DDT Abatement Area. Other signs throughout Reach A of the Site also indicated that the Site was located in an RSA environmental investigation site and provided a telephone number to call prior to performing any work in the area. The Site appeared to be in good condition. One set of monitoring wells was located. The wells were capped and locked. None of the monitoring wells are currently in use. The site inspection checklist is located in Appendix E and photographs obtained during the inspection are located in Appendix F.

Skeo also visited the Site document repository as part of the FYR process. Relevant site documents included the 2010 FYR, monitoring reports through 2002, and all four remedial action summary reports published by EPA. Annual monitoring reports beyond 2002 should also be included for completeness. Skeo Solutions staff also observed and accessed a public documents computer at the library primarily dedicated to the RSA installation's cleanup. Various documents related to the Site are included on the computer along with the larger collection of cleanup documents related to RSA.

6.6 Interviews

The FYR process included interviews with parties affected by the Site, including local residents, state and federal agencies, and the PRP. The purpose was to document the perceived status of the Site and any perceived problems or successes with the phases of the remedy implemented to date. All of the interviews took place before or during the site inspection on November 19, 2014. The interviews are summarized below. Appendix G provides the complete interviews.

Interviews with the Review Panel generally were in agreement that the project is progressing and is nearing attainment according to the Consent Decree. The Review Panel has indicated that there has been good cooperation among the Review Panel, Olin and the Town of Triana. The USFWS believes that a more comprehensive characterization of residual DDT is needed to fully evaluate the ecological risks and assess implications to the management of the Wheeler National Wildlife Refuge. USFWS also supports taking additional measures, such as spot removal of highly contaminated sediments to reduce the threat of DDT in the system and suggests that more stringent guidelines be used for the project. TVA indicated that the courts continue to use the FDA fish consumption guidelines even though there are other methods for establishing endpoints in fish.

Interviews with two residents indicated that they are well aware of the environmental issues and have recognized that the remedy has achieved some success, but raised concerns that that the remedy may not have attained all of the goals and objectives as outlined in the Consent Decree. Both residents were concerned about contaminant releases from RSA's chemical storage areas. One resident requested that announcements of the public meeting be broadcasted in more news media and would like to see all supporting scientific studies included in the FYR; in addition, two telecom calls were held with this resident. On November 21, 2014, a telecom was held with the resident, EPA's Brian Farrier, Review Panel Chairwoman Ntale Kajumba, and Review Panel counsel Greg Luetscher. This resident also participated in the Review Panel meeting of December 2, 2014, held via a conference call.

7.0 Technical Assessment

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

Yes. The remedy is preventing re-suspension of DDT-contaminated sediment into the surface water column, which historically has been demonstrated as the primary release source of DDT contamination at the Site. Long-term monitoring of groundwater, surface water and sediment has demonstrated that the remedy is effective in preventing ongoing releases of DDT from contaminated sediment. Groundwater monitoring was discontinued in 1997 because long-term monitoring indicated that DDT was below detection. Surface water concentrations (including contamination in suspended sediments) have shown that the remedy has significantly reduced DDT transport from sediment into the water column. Fish fillets of channel catfish and largemouth bass achieved continued attainment of the performance standard in all three reaches in 2003 and 1994, respectively. Smallmouth buffalo have met the continued attainment performance standard in Reaches B and C in 2009 and 2006, respectively, concluding the annual sampling for this species in these reaches. The most contaminated reach, Reach A, is progressing toward achieving attainment of the performance standard for the smallmouth buffalo. The performance standard was achieved in 2009, 2010 and 2013, but not in 2011 or 2012. DDT levels in 2011 and 2012 were 5.2 ppm and 6.6 ppm, respectively; DDT levels are showing a long-term steady decline.

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

Access to Reaches A and B is restricted from the RSA and the Wheeler National Wildlife Refuge. The DoA requires all proposed construction or repair activity plans that occur on DoA property to undergo a review through RSA's SAC program to ensure that future construction or repair projects do not encounter or disturb contaminated areas. However, the DoA is not responsible for how a proposed construction project at the Site will be implemented to avoid disturbing the remedy. To ensure that an exposure pathway is not created and that protectiveness of human health and environment is maintained ADEM requires a restrictive covenant to be placed on the property to ensure long-term enforcement of clean-up controls at the Site, which will be binding on subsequent

purchasers and tenants of the property and be listed in the local land records. ADEM is currently drafting an environmental covenant for the Site to comply with the requirements of the State of Alabama's Uniform Environmental Covenants Act. ADEM is working with the Review Panel and technical committee to complete and file the covenant; therefore, additional institutional controls are warranted to ensure appropriate authorities are included in construction projects that occur within the Site before the covenant is in place.

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

RAOs were not formally established in the Consent Decree, and CERCLA human health and ecological risk assessment guidance had not yet been developed prior to lodging of the 1983 Consent Decree. Thus, toxicity values and exposure factors were not used to establish a risk-based performance standard. Instead, the Consent Decree established the performance standard of 5 ppm of DDT in skinless fish fillets of channel catfish, largemouth bass and smallmouth buffalo to monitor the effectiveness of the remedy. The performance standard was based on fish consumption guidelines issued by the FDA to protect the national food supply as a whole. Subsequent to the 1983 Consent Decree being lodged, EPA's fish consumption guidance[3] has noted that EPA and FDA have determined that the use of FDA Action Levels for the purpose of making local fish advisory determinations is inappropriate.

Therefore, in order to determine if the FDA action level of 5 ppm remains valid and protective for human consumption at this Site, the FYR compared the action level to EPA's current health and risk-based screening values (SVs) in fish for recreational fishers as the recreational fisher is believed to be the most reasonable scenario for this Site. The analysis demonstrated that for recreational fishers, the FDA action level for DDT in fish exceeds the EPA screening values based on a 10^{-4} risk and a noncancer hazard index of 1.0 (1.17 ppm and 2.0 ppm, respectively, see Appendix H).

Also evaluated was the 3.5 ppm DDT concentration in smallmouth buffalo that achieved continued attainment in Reach C in 2006. The 1998 and 2000 continued attainment concentrations in largemouth bass and channel catfish were not evaluated since Alabama's more recent fish samples showed DDT levels at or below the detection limit of 0.46 ppm, which is lower than EPA's screening values. Reach C is the reach that is accessible to the general public. The year 2006 concentration for smallmouth buffalo is equivalent to a cancer risk of 3.0×10^{-4}. This cancer risk exceeds EPA's upper-bound risk of 1×10^{-4} that is generally used to set performance standards under the Superfund program. Since the recreational fisher exposure scenario used to develop EPA's screening values assumes a fish consumption of 17.5 grams per day (or 1.2 pounds per month), it can be stated alternatively that for smallmouth buffalo in Reach C, an acceptable carcinogenic risk would be achieved with a daily consumption of 5.8 grams per day (or 0.4 pounds per month). This daily consumption is considered reasonable for the

[3] Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories Volume 1 Fish Sampling and Analysis. Third Edition. EPA Office of Water. EPA 823-B-00-007. November 2000.

smallmouth buffalo which is not considered a game fish commonly pursued for sport or consumption.

Fish monitoring conducted pursuant to the 1983 Consent Decree continues to demonstrate the remedy effectiveness in reducing DDT levels in fish, and it is anticipated that this will continue. Following continued attainment of smallmouth buffalo in Reach A, which could occur as early as the year 2015 sampling event, the Consent Decree then requires a final fish sampling event after seven years, in which all three fish species will be sampled in Reaches A, B and C. When this data is available, the remedy effectiveness will be re-evaluated.

Human health-based cleanup goals were not established in the Consent Decree to identify contaminated sediment requiring excavation. However, human exposure pathways to sediment within Reaches A, B and C are considered incomplete based on EPA Region 4 risk assessment guidance, since the sediments are covered year-round by water.

Ecological-based performance standards or cleanup goals were also not established in the Consent Decree to identify contaminated sediment requiring excavation. CERCLA ecological risk assessment guidance had not yet been established at the time the Consent Decree was prepared. An ecological risk assessment has not been done, however, as part of the Consent Decree; Olin was required to complete a number of ecological studies to evaluate exposures of a number of ecological receptors to DDT contamination (Appendix I). These studies demonstrate that the remedy continues to be protective of ecological receptors. The studies support that isolating a majority of the DDT in Reach A presents a significant environmental improvement over dredging of any residual localized areas of DDT. In December 2003, the Review Panel determined that sediment studies would be valuable in monitoring the effectiveness of the remedial action within Reach B where lower concentrations of DDT remain in localized areas. A review of sediment levels was completed in 2004 and sediment sampling for DDT was completed in 2005. The sediment sampling results indicated that no additional sediment remediation was required since DDT concentrations were considerably lower than the baseline data demonstrating that natural recovery was occurring through significant deposition of sediments over any residual concentrations of DDT, as well as mixing and dilution, and degradation. Based on the review of the sediment data, the Review Panel determined that no additional remediation or further investigation of sediments was necessary. Further, the Review Panel concluded that additional dredging of Reach B would cause habitat destruction and release any localized residual DDT in deeper sediments into the water column.

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

Yes. Since the Consent Decree was issued, risk assessment guidance has become available that allows for estimating cancer risks and noncancer hazards associated with recreational fishing. This has been acknowledged in interviews from the USFWS and the public with respect to continued protectiveness of the remedy, and is discussed in Section 7.2 and Appendix H.

Although the RSA is implementing a separate cleanup plan under a RCRA permit, community members have raised the concern that environmental releases from sources outside of the Consent Decree area (e.g., releases from chemical weapons storage at RSA) are not being considered in ensuring their protection. This community concern suggests that educational materials (e.g., fact sheets) may be warranted to help the local community understand how environmental releases are being managed under different regulatory programs that are outside the purview of the Review Panel set up under the 1983 Consent Decree. This issue was discussed during the Review Panel meeting of December 2, 2015, in which one of these community members participated.

7.4 Technical Assessment Summary

The remedy is functioning as intended by the Consent Decree by preventing re-suspension of DDT-contaminated sediment into the surface water column, which is the primary source of DDT contamination within the HSB-Indian Creek system. Continued attainment of the 5 ppm performance standard has occurred for channel catfish and largemouth bass in all three HSB reaches, and smallmouth buffalo in Reaches B and C. Smallmouth buffalo in Reach A has achieved the performance standard for the last two years, and could reach continued attainment with the year 2015 sampling event.

Although public access to Reaches A and B is restricted from the RSA and the Wheeler National Wildlife Refuge, institutional controls are warranted to ensure appropriate authorities are included in construction projects that may occur within the Site before the restrictive covenant is in place. In addition, for the recreational fisher exposure scenario, DDT levels in fish fall outside the upper bound risk level generally used for Superfund performance standards, and the remedy effectiveness should be re-evaluated upon the final fish sampling event required by the 1983 Consent Decree.

Ecological-based performance standards or cleanup goals were also not established in the Consent Decree for identifying contaminated sediment requiring excavation. However, as part of the Consent Decree, Olin was required to complete multiple ecological studies to evaluate exposures of a number of ecological receptors to DDT contamination. These studies indicate that ecological habitat continues to recover and the remedy continues to be protective of ecological receptors.

8.0 Issues, Recommendations and Follow-up Actions

Table 10: Issues and Recommendations Identified in the Five-Year Review

OU(s): OU1	Issue Category: Institutional Controls			
	Issue: Institutional controls should be implemented to prevent future disturbance of the remedy.			
	Recommendation: Implement institutional controls prior to termination of the Consent Decree.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Other	EPA	02/17/2020

The following additional items, though not expected to affect protectiveness, warrant additional follow-up: consider providing the adjacent communities with additional educational materials (e.g., fact sheets) that clarify how they are being protected from environmental releases managed under different regulatory programs outside of the Olin Consent Decree.

9.0 Protectiveness Statements

The Site's remedy remains protective of human health and the environment. Based upon the site visit and document review, the remedial action is functioning as intended by the Consent Decree. All diversion structures and fill areas appear sound. No signs of physical deterioration were noted. Overall, DDT levels in smallmouth buffalo continue to decline and DDT concentrations in the surface water continue to remain less than the established baseline.

10.0 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

19th Annual Huntsville Spring Branch-Indian Creek Long Term Monitoring Report for the Huntsville DDT Project. Prepared by Olin Corporation. June 15, 2007.

20th Annual Huntsville Spring Branch-Indian Creek Long Term Monitoring Report for the Huntsville DDT Project. Prepared by Olin Corporation. June 3, 2008.

21st Annual Huntsville Spring Branch-Indian Creek Long Term Monitoring Report for the Huntsville DDT Project. Prepared by Olin Corporation. June 25, 2009.

22nd Annual Huntsville Spring Branch-Indian Creek Long Term Monitoring Report for the Huntsville DDT Project. Prepared by Olin Corporation. June 4, 2010.

23rd Annual Huntsville Spring Branch-Indian Creek Long Term Monitoring Report for the Huntsville DDT Project. Prepared by Olin Corporation. March 30, 2011.

24th Annual Huntsville Spring Branch-Indian Creek Long Term Monitoring Report for the Huntsville DDT Project. Prepared by Olin Corporation. May 23, 2012.

25th Annual Huntsville Spring Branch-Indian Creek Long Term Monitoring Report for the Huntsville DDT Project. Prepared by Olin Corporation. May 14, 2013.

26th Annual Huntsville Spring Branch-Indian Creek Long Term Monitoring Report for the Huntsville DDT Project. Prepared by Olin Corporation. May 7, 2014.

Biological Assessment of Impacts Upon Endangered Species by Olin Chemical Corporation Remedial Action Plan to Isolate DDT from People and the Environment. Prepared by Water, Air and Research, Inc. for the USACE. October 1985.

Consent Decree: United States of America, Plaintiff, v. Olin Corporation, A Virginia Corporation, Defendant, Town of Triana, Intervenor, State of Alabama ex rel Charles A. Graddick, Attorney General, et al., Plantiffs, v. Olin Mathieson Chemical Corporation, a Virginia Corporation, Defendant. 1983.

Decision Document Number 1. Olin Corporation Remedial Plan to Isolate DDT from People and the Environment in Huntsville Spring Branch-Indian Creek System. August 31, 1984.

Decision Document Number 2. Baseline Data, Substitute Species, and Interim Goals for Fish and Water. October 28, 1986.

Decision Document Number 3. Remedial Action Plan to Isolate DDT in Lower Reach A of Huntsville Spring Branch. December 9, 1986.

Decision Document Number 6. Long-Term Monitoring Program for the Remedial Action in the Huntsville Spring Branch-India Creek System. December 3, 1987..

Decision Document Number 6. Modification of Long-Term Monitoring Program for the Remedial Action in the Huntsville Spring Branch-India Creek System. December 7, 1989.

Decision Document Number 12. Monitoring Program, Interim Goals and Contingency Plans for Attaining the Performance Standard for Channel Catfish and Smallmouth Buffalo 1998-2007. September 19, 1999.

Field and Laboratory Investigations of the Huntsville Spring Branch — Indian Creek System. Prepared by Olin Corporation. July 1, 1985.

Final Environmental Impact Statement for Regulatory Actions Associated with the Olin Corporation Remedial Action Plan to isolate DDT from the People and the Environment in the Huntsville Spring Branch-Indian Creek System, Wheeler Reservoir, Alabama. February 1986.

Fourth Five-Year Review Report. Triana/Tennessee River Site, Triana, Madison County, Alabama. Prepared by E^2 Inc. for EPA Region 4. February 2010.

Fourth Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System, Wheeler Reservoir. Alabama, Review Panel Activities (United States v. Olin Corporation Consent Decree), April 23, 1999 – December 2008. Vols. 1-2. 2000. Atlanta. U.S. Environmental Protection Agency, Region IV.

Huntsville Spring Branch-Indian Creek Post Remedial Action Interim Goals. Prepared by Olin Corporation. August 1, 1985.

Permit Application for the Huntsville Remedial Action Plan at Huntsville, Alabama, Lower Reach A, 404/26A Prepared by Waldemar S. Nelson and Company Incorporated for Olin Corporation. September 1986.

Report on DDT in HSBM 4.0 to 2.4 (Lower Reach A). Prepared by Olin Corporation's Environmental Affairs Department. Charleston, Tennessee. August 1, 1985.

Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System, Wheeler Reservoir, Alabama, Review Panel Activities (United States v. Olin Corporation Consent Decree), May 31. 1983 - June 30, 1986. Prepared by the U.S. Environmental Protection Agency, Region 4.

Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System, Wheeler Reservoir, Alabama, Review Panel Activities (United States v. Olin Corporation Consent Decree), May 31, 1983 - June 30, 1986. Prepared by EPA Region 4.

Second Five-Year Review Report. Triana/Tennessee River Site, Triana, Madison County, Alabama. Prepared by Roy F. Weston, Inc. for EPA Region 4. June 18, 1999.

Second Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System, Wheeler Reservoir, Alabama, Review Panel Activities (United States v. Olin Corporation Consent Decree), July 1, 1986 - June 30, 1990. Prepared by EPA Region 4.

Third Five-Year Review Report. Triana/Tennessee River Site, Triana, Madison County, Alabama. Prepared by the U.S. Army Corps of Engineers (Mobile District) for EPA Region 4. February 25, 2005.

Third Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System, Wheeler Reservoir. Alabama, Review Panel Activities (United States v. Olin Corporation Consent Decree), July 1 1986 - June 30, 1990. Vols. 1-2. 2000. Atlanta. U.S. Environmental Protection Agency, Region IV.

Fourth Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System, in Wheeler Reservoir, Alabama. Review Panel Activities. April 23, 1999 – December 2008.

Appendix B: Press Notice

The U.S. Environmental Protection Agency, Region 4
Announces the Fifth Five-Year Review for
the Triana/Tennessee River Superfund Site,
Triana, Morgan/Limestone/Madison Counties, Alabama

Purpose/Objective: EPA is conducting a Five-Year Review of the remedy for the Triana/Tennessee River Superfund site (the Site) in Triana, Alabama. The purpose of the Five-Year Review is to make sure the selected cleanup actions effectively protect human health and the environment.

Site Background: The Site is located about five miles southwest of Huntsville, Alabama. It consists of an 11-mile stretch of two tributaries, the Huntsville Spring Branch and Indian Creek, which empty into the Tennessee River near the town of Triana. The area is located within Wheeler National Wildlife Refuge and the RSA. From 1947 to 1970, the Olin Corporation (Olin) operated a dichlorodiphenyllrichloroelhane (DDT) manufacturing plant within RSA and discharged wastewater into Huntsville Spring Branch. Fish in the area became contaminated with DDT from contaminated stream sediments. EPA placed the Site on the Superfund program's National Priorities List (NPL) in September 1983.

Cleanup Actions: To address the contamination, the State of Alabama, EPA and Olin entered into a Consent Decree in May 1983. The Consent Decree required that Olin implement a remedial plan and meet a performance standard of five parts per million of DDT in fillets of channel catfish, largemouth bass and smallmouth buffalo fish within 10 years from the date of the remedy's construction completion. The Consent Decree also provided for a Review Panel responsible for technical review of Olin's proposals to meet the performance standard. Remedial actions consisted of diverting stream flow around contaminated portions of the tributaries, excavating new channels, excavating some contaminated sediments and burying other contaminated sediments in place. These remedial actions began in April 1986 and finished in January 1988. An extension of the fish monitoring has been granted to ensure achievement of the DDT performance standard in fish fillets. Continued attainment of the performance standard has been achieved in both largemouth bass and channel catfish. Olin no longer monitors these species. Progress continues toward meeting the performance standard in smallmouth buffalo fish.

Five-Year Review Schedule: For NPL sites, a review is required every five years for cleanups where contaminants remain above levels that allow for unlimited use and unrestricted exposure. This is the fifth Five-Year Review for this Site and is scheduled for completion by February 2015.

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 is 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:

Brian Farrier, EPA Remedial Project Manager
Phone: (404) 562-8952
Email: farrier.brian@epa.gov

L'Tonya Spencer, EPA Community Involvement Coordinator
Phone: (404) 562-8463 | (877) 718-3752 (toll-free)
Email: spencer.latonya@epa.gov

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

Additional information is available at the Site's local document repository, located at Triana Public Library, 357 Record Street, Madison, Alabama 35756, and online at:
http://www.epa.gov/region04/superfund/sites/npl/alabama/triatenval.html.

Appendix C: Maps Depicting DoA Sites and the Olin Consent Decree Remedial Action Plan

Figure C-1: Location of RSA-117 Relative to the Olin Consent Decree Site.

Legend

RSA-117 Site Boundary

Environmental Site Boundaries

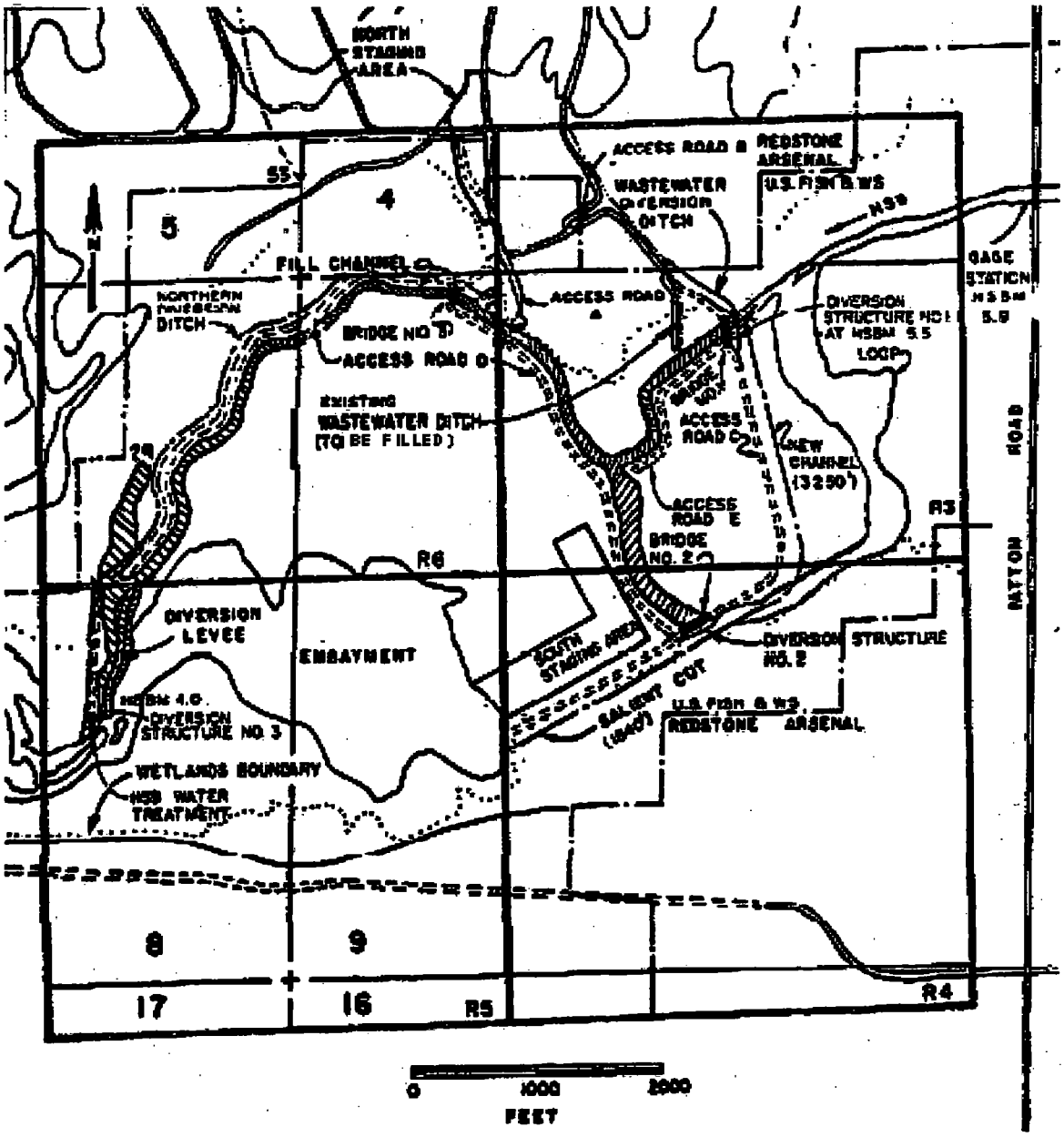
New DDT ditch

Abandoned DDT ditch

Former DDT Manufacturing Plant

Adapted from the "Site-Specific Field Sampling Plan for a RCRA Facility Investigation at RSA-117, Operable Unit 7. U.S. Army Garrison-Redstone, Madison County, Alabama U.S. EPA ID No. AL7 210 020 742 November 2011" http://edocs.adem.alabama.gov/eFile/default.aspx

Figure C-2: Overview of the Remedial Action



Source: Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System, Wheeler Reservoir, Alabama, Review Panel Activities (United States v. Olin Corporation Consent Decree), May 31, 1983 - June 30, 1986. Prepared by EPA Region 4.

Appendix D: Summary of DDT Concentrations in Smallmouth Buffalo Fish Fillets

Year	Reach A			Reach B			Reach C		
	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
Baseline	140	1.8	600	180	2.4	620	110	1.4	470
Year 1, 1988	--	--	--	82	3	250	89	7	360
Year 2, 1989	31	9.3	70	55	2.6	240	50	0.2U	140
Year 3, 1990	24	--	--	41	0.56	120	41	0.39	140
Year 4, 1991	89	3.2	170	37	5.7	130	45	1	190
Year 5, 1992	42	0.36	290	41	0.45	300	34	0.37	170
Year 6, 1993	19	0.34	90	35	0.05	190	34	0.46	250
Year 7, 1994	3.7	2.9	5.1	38	0.7	150	13	0.5U	51
Year 8, 1995	84	7.6	230	48	4.3	210	17	0.7	79
Year 9, 1996	8.1	1.1	14	29	0.06	100	3	0.8	4
Year 10, 1997	12	0.66	40	21	2.1	120	9.4	0.3	23
Year 11, 1998	14	1.4	52	17	0.95	84	5.4	0.87	21
Year 12, 1999	14	0.57	38	7.2	0.5U	18	9.3	0.5U	29
Year 13, 2000	11	0.12	35	12	2.3	57	6.5	0.25	31
Year 14, 2001	20	0.64	83	13	0.06	53	6.2	0.42	40
Year 15, 2002	18	6	44	39	4.6	110	7.5	0.83	21
Year 16, 2003	7.9	1	45	11	0.6	49	7.7	0.05U	55
Year 17, 2004	12	0.5	63	15	0.83	54	4.4	0.51	15
Year 18, 2005	7.5	0.02U	20	7.5	0.62	44	3.8	0.02U	20
Year 19, 2006	23	0.02U	58	8.8	0.79	24	3.5	0.02U	21
Year 20, 2007	6.3	0.02U	23	3.4	0.02U	17	--	--	--
Year 21, 2008	10	0.25U	98.40	2.9	0.25U	14.06	--	--	--
Year 22, 2009	4.3	0.25U	19.55	3.6	0.25U	14.84	--	--	--
Year 23, 2010	2.04	0.13U	6.7	--	--	--	--	--	--
Year 24, 2011	5.2	0U	21.61	--	--	--	--	--	--
Year 25, 2012	6.6	0.97	47.8	--	--	--	--	--	--
Year 26, 2013	4.2	0.34	11.2	--	--	--	--	--	--
Year 27, 2014	3.0	BDL	13.45	--	--	--	--	--	--

Notes:
avg = average DDT concentration (ppm) of samples analyzed
min = minimum DDT concentration (ppm) analyzed
max = maximum DDT concentration (ppm) analyzed
U = material was analyzed but not detected. The number is the minimum quantitation limit.
BDL = below detection limit; detection limit not available.

Appendix E: Site Inspection Checklist

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Triana/Tennessee River	**Date of Inspection: 11/19/2014**
Location and Region: Huntsville, AL (Region 4)	**EPA ID: ALD983166299**
Agency, Office or Company Leading the Five-Year Review: EPA Region 4	**Weather/Temperature: Sunny/50°F**

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☒ Access controls
- ☐ Institutional controls
- ☐ Ground water pump and treatment
- ☐ Surface water collection and treatment
- ☐ Monitored natural attenuation
- ☐ Ground water containment
- ☒ Vertical barrier walls
- ☒ Other: Diversion of stream flow around contaminated portions of the HSB-Indian Creek tributaries; excavation of new channels; excavation of contaminated portions of sediments; burial of portions of contaminated sediments in place; a monitoring plan.

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** — Keith Roberts (Name) — Director, Environmental Remediation (Title) — 10/23/2014 (Date)

Interviewed ☐ at site ☒ at office ☐ by phone Phone: (423) 336-4388
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 Alabama Department of Environmental Management

Contact	Jason Wilson Name	Facilities Engineering Section, Chief, Governmental Hazardous Waste Branch, Land Division Title	10/23/2014 Date	(334) 271-7789 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: Yes

Barry Hodges, US Army Garrison - Redstone

Travis Henry, Tennessee Valley Authority

Bruce A. Brye, Consultant to Tennessee Valley Authority

Dwight Cooley, U.S. Fish and Wildlife Service

William L. James, U.S. Army Corps of Engineers

Resident 1

Resident 2

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: The PRP performs annual site inspections of site remedial components. These are documented in annual reports. Site inspections evaluate security controls, former DDT ditch, diversion ditches, filled channel, fill areas, oxbow cut channel, salient cut channel, the embayment and diversion structures.				
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: The last groundwater sampling occurred in 1997.				
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: The PRP has access to the Site to conduct routine inspections. Prior to accessing the Site, Olin must go through RSA's security processes.				
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: $130,000/year ☐ Breakdown attached

Total annual cost by year for review period if available

From: 01/01/2010	To: 12/31/2010	$80,000	☐ Breakdown attached
Date	Date	Total cost	
From: 01/01/2011	To: 12/31/2011	$88,000	☐ Breakdown attached
Date	Date	Total cost	
From: 01/01/2012	To: 12/31/2012	$66,000	☐ Breakdown attached
Date	Date	Total cost	
From: 01/01/2013	To: 12/31/2013	$54,000	☐ Breakdown attached
Date	Date	Total cost	
From: 01/01/2014	To: 12/31/2014	$67,000	☐ Breakdown attached
Date	Date	Total cost	

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

Describe costs and reasons: ____

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

A. Fencing

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

Remarks: ____

B. Other Access Restrictions

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

Remarks: Sign posted on entrance gate to Reach A indicates DDT abatement area. Signs within the Site indicate that Site falls within a RSA environmnetal investigation site with a phone number to call prior to any work.

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 Consent Decree does not require institutional controls for the Site. The Site is within the Wheeler National Wildlife Refuge/Redstone Arsenal. Alabama Department of Environmental Management is pursuing a restrictive covenant for the Site. The Site area falls within the RSA site access control plan. The U.S. Army Corps of Engineers requires a permit before any constructive activities. Nearly the entire Site is off limits to the public. Fishing is only allowed in part of the Site which falls within Reach C.

D. General

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

Remarks: Some trash and debris is located on Site.

2. **Land Use Changes On Site** ☒ N/A

Remarks: _____

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

Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

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

Remarks: _____

B. Other Site Conditions

Remarks: _____

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

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: Visual observations are made to ensure sheet piling along the oxbow cut has not been compromised.

☐ Performance not monitored

Frequency: _____ ☐ Evidence of breaching

Head differential: _____

Remarks: _____

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

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

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

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

Remarks: _____

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

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

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

Remarks: _____

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

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

☐ Good condition ☐ Needs maintenance

Remarks: _____

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

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

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

Remarks: _____

C. Treatment System ☐ Applicable ☒ N/A

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

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☐ Air stripping ☐ Carbon adsorbers

☐ Filters: _____

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

☐ Others: _____

☐ Good condition ☐ Needs maintenance

☐ Sampling ports properly marked and functional

☐ Sampling/maintenance log displayed and up to date

☐ Equipment properly identified

☐ Quantity of ground water treated annually: _____

☐ Quantity of surface water treated annually: _____

Remarks: _____

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

☐ N/A ☐ Good condition ☐ Needs maintenance

Remarks: _____

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

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

Remarks: _____

4. **Discharge Structure and Appurtenances**

☐ N/A ☐ Good condition ☐ Needs maintenance

Remarks: _____

5. **Treatment Building(s)**

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

☐ Chemicals and equipment properly stored

Remarks: _____

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

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

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

Remarks: _____

D. Monitoring Data

1. **Monitoring Data**

☐ Is routinely submitted on time ☐ Is of acceptable quality

2. **Monitoring Data Suggests:**

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

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

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

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

Remarks: Groundwater monitoring wells remain in place but not in use.

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.

The major components of the remedial action plan as required by the Consent Decree included: diversion of stream flow around contaminated portions of the HSB-Indian Creek tributaries; excavation of new channels; excavation of contaminated portions of sediments; burial of portions of contaminated sediments in place; a monitoring plan to monitor concentrations of contaminated portions of the HSB-Indian Creek tributaries.

The PRP's remedial action plans for isolation of the DDT-contaminated sediments focused on Reach A of the HSB-Indian Creek System. The Review Panel agreed that no remedial actions in Reach B and Reach C were necessary to meet the Site's performance standard.

The PRP addressed Reach A remediation as two sections: Upper Reach A, which included the most contaminated sediments between HSB miles 5.4 and 4.0, and Lower Reach A, which included the area between HSB miles 4.0 and 2.4. In Upper Reach A, Olin isolated about 308 out of 318 tons of DDT-contaminated sediments. Effectively, this isolated more than 95 percent of DDT in Upper Reach A. Additionally, Olin constructed a wastewater diversion ditch, a northern diversion ditch, access roads and stream crossings, and north and south staging areas as part of remedial activities. In 1986, the PRP completed the excavation of the 1,640-foot salient cut and the 3,250-foot oxbow cut; construction of three diversion structures and diversion levee; the blocking off, dewatering and filling of the HSB channel between HSB miles 5.5 and 4.0; and construction of an embayment at HSB mile 4.2 to isolate DDT in Upper Reach A. Additionally, the PRP covered the dewatered channel with a geotextile fabric and nine inches of crushed rock, soil, and topsoil to promote regrowth of vegetation. Olin completed remedial activities in the Upper Reach A in 1987. In 1988, the Review Panel designated the remedy as construction complete.

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 Site's remedy appeared to be in good condition.

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.
Bulk of the O&M requirements are fish fillet and surface water sampling. PRP also conducts annual inspections of the Site. O&M requirements are adequate for the Site.

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.
None observed.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
None identified.

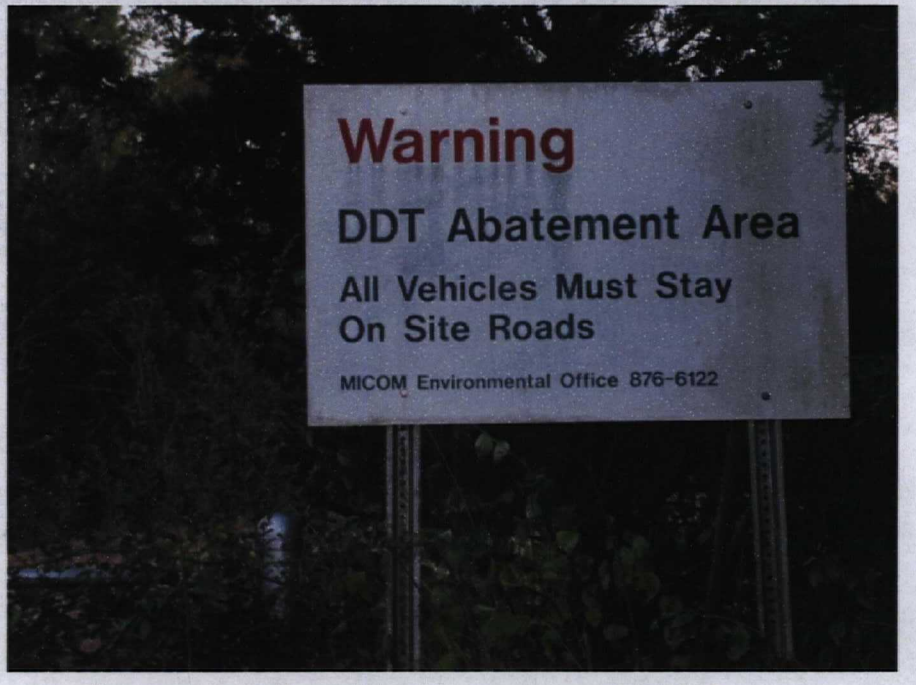
Site Inspection Roster:

Bruce A. Brye, Consultant to Tennessee Valley Authority

Keith Roberts, Olin (PRP)
Curt Richards, Olin (PRP)
Julie Irwin, Olin (PRP)
Barry Hodges, US Army Garrison - Redstone
Travis Henry, Tennessee Valley Authority
Dwight Cooley, U.S. Fish and Wildlife Service
William L. James, U.S. Army Corps of Engineers
Brian Farrier, US EPA Region 4 (RPM)
Jason Wilson, Alabama Department of Environmental Management
Eric Marsh, Skeo Solutions
Claire Marcussen, Skeo Solutions

Appendix F: Photographs from Site Inspection Visit

Locked gate providing access to Reach A.



Sign near locked gate providing access to Reach A.

Sheet piling and rip-rap that are part of Diversion Structure 1 within Upper Reach A, which follows the oxbow cut.

Sedimentation along the salient cut in Upper Reach A.

Filled and capped ditch area in Upper Reach A.

Small embayment area near Lower Reach A.

Secured site groundwater monitoring wells.

Signage within the Site indicating that the Site is also within an RSA environmental investigation site.

Appendix G: Interview Forms

Triana/Tennessee River Superfund Site Five-Year Review Interview Form

Site Name: Triana/Tennessee River **EPA ID No.:** ALD983166299

Interviewer Name: _____ **Affiliation:** _____

Subject Name: Barry Hodges **Affiliation:** US Army Garrison - Redstone

Subject Contact Information: barry.a.hodges.civ@mail.mil

Time: NA **Date:** 09/30/2014

Interview Location: NA

Interview Format (select one): In Person Phone Mail Other: Email

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Interview Category: Federal Agency

1. What is your overall impression of the project?
   The project as defined is nearing attainment (via the 1980's the Consent Decree).

2. How well do you believe the remedy currently in place is performing?
   It is/has worked, but the consent decree area in no way covers all of the DDT contaminated areas of the creek basin. As such even a 100 percent success is a qualified success.

3. Are you aware of any complaints or inquiries regarding environmental issues or remedial action from residents in the last five years?
   No. We have a public meeting biannually to solicit for a RAB. We consistently spend an evening socializing among ourselves with the possibility of some curios kids from the local university. Otherwise by and large we have a very open relationship with our surrounding public and heretofore they have extended a high level of trust in the Garrison handling the issues. We end up giving an interview or two to the local news about our program when we have "interesting" information. I do get a number of question when off duty but they are not fearful, more curios.

4. Has your office conducted any site-related activities or communications in the last five years? If so, please describe the purpose and results of these activities.
   For the communications we do public notices twice on any site during the actions chosen for that site, for other communications see #3. It should be noted that under RCRA ADEM requires a Yearly review rather than a 5 year period.

5. Are you aware of any changes to federal or state laws that might affect the protectiveness of the Site's remedy? Are you aware of any changes in projected land use at the Site?
   No to any of these with the exception to note that the interaction with CERCLA/RCRA is not always smooth and thus far all that has been discussed is the CERCLA world. I am unsure how ADEM views it through RCRA glasses.

6. Please describe the level of cooperation between agencies (USEPA, ADEM, TVA, USFWS, and the DoA).

From what I have seen in the last 2 years they level of cooperation is remarkably high. That noted there in in process a major changeover of the persons on the board and that may rock the boat or may not, jury is still out. All that said there is are remarkably good relationships in this team.

7. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?
Only that it seems obvious that this is not the final answer for DDT in the Huntsville Spring Branch. There is still a lot of ground to deal with out there. As said responsibility seems a lil' gray for this more widely dispersed material.

We will be happy to help answer any questions this individual may have about our program and can meet with him if necessary. We do occasionally get a "spooked" neighbor and have been very successful a calming concerns. I will be running his email around the office so we can be better prepared to handle the issue.

Triana/Tennessee River Superfund Site **Five-Year Review Interview Form**

Site Name: Triana/Tennessee River **EPA ID No.:** ALD983166299
Interviewer Name: _____ **Affiliation:** _____
Subject Name: William L. James **Affiliation:** U.S. Army Corps of Engineers
Subject Contact Information: (615) 369-7508, william.l.james@usace.army.mil
Time: 3:00 p.m. **Date:** 11/04/2014
Interview Location: Nashville, TN
Interview Format (select one): **In Person** **Phone** **Mail** **Other:** Email

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Interview Category: **Federal Agency**

1. What is your overall impression of the project?
   The project is performing well. The Review Panel structure that was established in the Consent Decree to govern implementation and monitoring of the remedy is an effective governance method for these types of activities that involve multiple agencies and participants.

2. How well do you believe the remedy currently in place is performing?
   DDT concentrations have decreased greatly since implementation of the remedy. While it has taken channel catfish longer to meet the Consent Decree performance standard than the Review Panel had hoped, there has been, and continues to be, steady progress toward attainment.

3. Are you aware of any complaints or inquiries regarding environmental issues or remedial action from residents in the last five years?
   Strictly speaking - no. (I am aware of an individual recently expressing concerns to EPA but he does not appear to be a resident of Triana.)

4. Has your office conducted any site-related activities or communications in the last five years? If so, please describe the purpose and results of these activities.
   I have been on a site inspection with the group during one of our meetings at the project site. We typically look at the site from several different vantage points to gauge the integrity of the remedy.

5. Are you aware of any changes to federal or state laws that might affect the protectiveness of the Site's remedy?
   No.
   Are you aware of any changes in projected land use at the Site?
   No.

6. Please describe the level of cooperation between agencies (USEPA, ADEM, TVA, USFWS, and the DoA).
   I have been involved with this project since 1984. I was the Corps project manager that processed and issued the DoA permits (Section 10 of the Rivers and Harbors Act and Section

404 of the Clean Water Act) that were required for the work. Since construction, I have continued to participate with the group as we have transitioned into long term monitoring and determination of compliance with the Consent Decree. Additionally, I have served as the Chair of the Technical Committee for the past few years. There has consistently been an excellent spirit of cooperation among the agencies, Olin and the Town of Triana as we all worked to ensure that this project achieved the goals and objectives enumerated in the Consent Decree.

7. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?
   Once channel catfish show continued attainment of the performance standard, Olin will be required to maintain the remedy for an additional seven-year period. At the end of this period, if Olin demonstrates to the satisfaction of the Review Panel that the remedy remains in compliance with the performance standard, the Consent Decree will terminate. There are still a few members of the Review Panel/Technical Committee that have been involved with this project from the beginning. It is likely that some, if not all, of those members may retire in the near future and that other current panel members could move to different jobs during this period of reduced activity. For continuity, it is critical that the Review Panel plan for this change in makeup of the panel and outline a process for continued interaction among the continuing members during this seven-year waiting period. Once the seven-year period is over, it will be essential for the Panel to be able to assemble efficiently for consideration and documentation of decisions that will be required at that time.

Triana/Tennessee River Superfund Site **Five-Year Review Interview Form**

Site Name: Triana/Tennessee River **EPA ID No.:** ALD983166299
Interviewer Name: **Affiliation:**
Subject Name: Resident 1 **Affiliation:** BREDL/BEST/MATRR
Subject Contact Information:
Time: 10:30AM CDT **Date:** Sep. 25, 2014
Interview Location: Scottsboro, Alabama
Interview Format (select one): **In Person** **Phone** **Mail** **Other:** Email

Interview Category: Residents

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date?
   Yes

2. What is your overall impression of the project?
   The project has realized some success. However, the last EPA summary did not include the USFWS Biologist findings and ignored the fact that there is continued DDT contamination in the environment which is evidenced in the documented review report by William J. Pearson, Field Supervisor for the USFWS Ecological Services Field Office in Alabama. The report states in part relating to DDT concentrations: "The continued identifications of elevated DDT concentrations in sediment, fish and bird eggs indicate goal "a" has not been fully achieved...findings would suggest goal "d" has not been fully achieved...lack of attainment of all goals and objectives indicate that the remedy is not functioning as intended in the decision document." Pg C-5 to C-12 in the Feb. 2010 5 Year Review.

   The EPA's 2010 Protectiveness summary does not reflect the USFWS Biologists scientific findings. The Protectiveness Statement in part says, "The site's remedy remains protective of human health and the environment..." Pg vii and ix of the Feb. 2010 5 Year Review. The USFWS scientific findings, Pgs C-5 to C-12 directly contradicts the Protectiveness Statement in part.

   Thus, the EPA's 2010 5 Year Review Report intentionally failed to reflect the scientific findings of the USFWS in their Protectiveness Statement or they failed to accurately report the findings in the statement as an inadvertent error. Whichever occurred, the fact that the environmental summary as indicated in the Protectiveness Statement is not accurate.

3. What have been the effects of this Site on the surrounding community, if any?
   There has not been a comprehensive community health survey to determine the current effects of contamination. However, National Cancer Institute data indicates high cancer incident rates within Morgan County and elevated cancer rates in Madison County. With the additional disclosures that Chemical Weapons storage containment on RSA have leached into the environment creates additional environmental impacts on the same area as the DDT contamination concerns. It would make sense, and be a prudent decision, to conduct a comprehensive community health survey to determine the health of the citizens residing in

the Triana community and communities 10 miles downstream from the confluence of the Indian Creek/ Huntsville Spring Branch (IC/HSB) into the Tennessee River. There is a public water intake a short distance downstream from the creek and river confluence.

4. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing?
   Unknown

5. Has EPA kept involved parties and surrounding neighbors informed of activities at the Site? How can EPA best provide site-related information in the future?
   My reports indicate a yes and no answer to this question. It is questionable whether the EPA Review Committee adequately announced the public meeting for the review on all news and broadcast mediums available for the last review period.

6. Do you have any comments, suggestions or recommendations regarding any aspects of the project?
   Yes – 1) It is imperative to build confidence and trust in our government, and that all reports be accurate and inclusive of ALL scientific evidence in the report summaries. 2) A comprehensive community health survey should be performed in the Triana Community and each community 10 miles downstream form the IC/HSB confluence with the Tennessee River. This must include all citizens drinking public water from intakes along the 10 mile down river stream flow.

Triana/Tennessee River Superfund Site **Five-Year Review Interview Form**

Site Name: Triana/Tennessee River **EPA ID No.:** ALD983166299
Interviewer Name: _____ **Affiliation:** _____
Subject Name: Resident 2 **Affiliation:** BREDL/BEST/MATRR
Subject Contact Information: _____
Time: 12:30 p.m. **Date:** Sep. 26, 2014
Interview Location: New Hope, AL

Interview Format (select one): **In Person** **Phone** **Mail** **Other:** Email

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Interview Category: Residents

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date?
   Yes.

2. What is your overall impression of the project?
   The 2010 5 Year Environmental Review Report Protectiveness Summary does not reflect the Fish & Wildlife Services Biologists Report concerning DDT contamination in the environment. The Technical Assessment in the Executive Summary is inaccurate based on the US Fish & Wildlife Service officials statements and findings – this is a critical error in the 2010 5 Year Review of the Triana Site.

   Testing of Fish in the contaminated area was not accomplished as advised by the US Fish & Wildlife Service Biologist.

3. What have been the effects of this Site on the surrounding community, if any?
   Currently there is a concern regarding the leakage and disposition of Chemical Weapons on RSA. The U.S. Fish and Wildlife Service Reports DDT contamination in the environment, e.g. fish, sediment and bird eggs.

   A community health impacts study including community health surveys should be accomplished.

   The Huntsville/Madison County Water intake is a short distance downstream from the Indian Creek confluence into the Tennessee River. This water plant supplies water to Triana, Madison, and other areas in Madison County Alabama.

4. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing?
   Chemical Weapons leakage and contamination adjacent to the DDT site.

5. Has EPA kept involved parties and surrounding neighbors informed of activities at the Site? How can EPA best provide site-related information in the future?

Unknown, but it is my knowledge that notification was very limited during the last 5 year review period.

6. Do you have any comments, suggestions or recommendations regarding any aspects of the project?
   Be accurate and truthful in your Protectiveness summary and Executive Summary, this was not the case in the 2010 5 Year Review as evidenced upon review of documents from USFWS presented in the report itself.

Triana/Tennessee River Superfund Site **Five-Year Review Interview Form**

Site Name: Triana/Tennessee River **EPA ID No.:** ALD983166299
Interviewer Name: _____ **Affiliation:** _____
Subject Name: Jason Wilson **Affiliation:** Alabama Department of Environmental Management
Subject Contact Information: JWilson@adem.state.al.us (334) 271-7789
Time: 11:00 a.m. **Date:** 10/23/2014
Interview Location: Email
Interview Format (select one): In Person Phone Mail Other: Email

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Interview Category: State Agency

1. What is your overall impression of the project?
   A good overall impression.

2. How well do you believe the remedy currently in place is performing?
   I believe the remedy in place is performing adequately to address the objectives identified in the Consent Decree.

3. Are you aware of any complaints or inquiries regarding environmental issues or remedial action from residents in the last five years?
   I am aware that EPA has been contacted by a resident inquiring about environmental issues within the last five years.

4. Has your office conducted any site-related activities or communications in the last five years? If so, please describe the purpose and results of these activities.
   I have attended site visits, technical meetings, and review panel meetings within the last five years. The purpose of these visits and meetings were to observe and evaluate the integrity and function of the remedial action.

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy? Are you aware of any changes in projected land use at the Site?
   The Uniform Environmental Covenants Act passed in 2009 requires an environmental covenant to be placed on property not remediated to an unrestricted use scenario. I am not aware of any changes in the projected land use at this time.

6. Please describe the level of cooperation between agencies (USEPA, ADEM, TVA, USFWS, and the DoA).
   The level of cooperation between the agencies has been very good.

7. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?
   No

Triana/Tennessee River Superfund Site **Five-Year Review Interview Form**

Site Name: Triana/Tennessee River **EPA ID No.:** ALD983166299
Interviewer Name: _____ **Affiliation:** _____
Subject Name: Keith Roberts **Affiliation:** Olin Corporation
Subject Contact Information: 3855 North Ocoee St, Suite 200, Cleveland, TN 373121
(423) 336-4388; kdroberts@olin.com
Time: _____ **Date:** 10/13/14
Interview Location: N/A

Interview Format (select one): In Person Phone E-mail Other:

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

1. What is your overall impression of the remedial activities at the Site?
   The remedial activities have successfully met the requirements of the Consent Decree to isolate DDT in the HSB-Indian Creek system from people and the environment.

2. What have been the effects of this Site on the surrounding community, if any?
   The nearby community has benefited from the reduction of DDT in fish to a level below the FDA standard. Remedial efforts have eliminated a concern to the nearby communities.

3. How well do you believe the remedy currently in place is performing?
   The remedy is currently performing as designed and is effectively and permanently isolating DDT from people and the environment.

4. What are the findings from the monitoring data over the past five years for smallmouth buffalo fish fillets and surface water? What are the key trends in contaminant levels that are being documented over time at the Site?
   DDT concentrations in the fillets of smallmouth buffalo have averaged below (met) the performance standard of 5 ppm in 3 of the last five years. DDT concentrations in surface water have been non-detectable. DDT concentrations in fish continue to decline over time.

5. Are you aware of any complaints or inquiries regarding environmental issues or the remedial action from residents in the last five years?
   No

6. Please provide O&M costs incurred for each for each of the following calendar years: 2010, 2011, 2012, 2013, and 2014. [Note: These are costs primarily incurred for the long-term monitoring program and biennial sampling of surface water at the Site]
   2010 - $80,000; 2011 - $88,000; 2012 - $66,000; 2013 - $54,000; 2014 - $67,000 (est.)

7. Have there been unexpected O&M difficulties or costs at the Site in the last five years? If so, please provide details.
   There have been no O&M difficulties or unexpected costs over the last five years.

8. In the last five years, have there been any efforts to evaluate the need for additional fish consumption advisory signage and post additional signs as needed? Has there been any outreach to residents of newly developed neighborhoods in Triana to inform them of the fish consumption advisory?
   The state department of public health has the responsibility for fish advisories. Fish data support the lifting of the consumption fish advisory.

9. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?
   The Review Panel, working with Olin, continues to provide an effective way to manage the remedy through monitoring, meetings, and reporting.

Triana/Tennessee River Superfund Site Five-Year Review Interview Form

Site Name: Triana/Tennessee River **EPA ID No.:** ALD983166299
Interviewer Name: _____ **Affiliation:** _____
Subject Name: Travis Hill Henry **Affiliation:** Tennessee Valley Authority
Subject Contact Information: thhenry@tva.gov
Time: 11:00 a.m. **Date:** 10/24/2014
Interview Location: _____

Interview Format (select one): **In Person** **Phone** **Mail** **Other:** Email

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Interview Category: **Federal Agency**

1. What is your overall impression of the project?
   Although the project has progressed more slowly than originally envisioned, it appears that the ultimate goals of the project eventually will be met.

2. How well do you believe the remedy currently in place is performing?
   The remedy seems to be performing adequately based on many years of monitoring results.

3. Are you aware of any complaints or inquiries regarding environmental issues or remedial action from residents in the last five years?
   The only complaint we are aware of is contained in an email sent from Mr. Garry Morgan on May 5, 2014 to TVA, EPA, and several others.

4. Has your office conducted any site-related activities or communications in the last five years? If so, please describe the purpose and results of these activities.
   TVA staff has participated in regular meetings of the Review Panel and Technical Committee, some of which have included visits to the remediated site during the past 5 years.

   Also, TVA analyzed smallmouth buffalo and channel catfish collected in 2011 from the Tennessee River at a site near the confluence of Indian Creek. TVA also collected specimens of the same two species from that area in 2014, results of analyses will be available 2015 (spring).

5. Are you aware of any changes to federal or state laws that might affect the protectiveness of the Site's remedy? Are you aware of any changes in projected land use at the Site?
   No.

6. Please describe the level of cooperation between agencies (USEPA, ADEM, TVA, USFWS, and the DoA).
   Cooperation among the agencies on this project has been good.

7. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?
   No.

Triana/Tennessee River Superfund Site Five-Year Review Interview Form

Site Name: Triana/Tennessee River **EPA ID No.:** ALD983166299
Interviewer Name: _____ **Affiliation:** _____
Subject Name: Dwight Cooley **Affiliation:** USFWS, Wheeler NWR
Subject Contact Information: 256-353-7243 x 23, dwight_cooley@fws.gov
Time: 11:00 a.m. **Date:** 10/28/2014
Interview Location: _____

Interview Format (select one): **In Person** **Phone** **Mail** **Other:** Email

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Interview Category: **Federal Agency**

1. What is your overall impression of the project?
   My overall impression of the project is positive. Remediation activities have resulted in removal or isolation of significant amounts of DDT and metabolites. We still have a lot to accomplish.

2. How well do you believe the remedy currently in place is performing?
   Based on information provided by action agencies and Olin Corp., it appears the remedy is performing as designed. Measureable levels of DDT and metabolites remain in the system as evidenced by the intermittent, non-attainment of <5 ppm in smallmouth buffalo filets as provided for in the Consent Decree.

3. Are you aware of any complaints or inquiries regarding environmental issues or remedial action from residents in the last five years?
   Yes. Several agencies involved received an email from Garry Morgan complaining about environmental issues and remedial actions. The following (in italics) is the body of that email:

   Dear EPA, TVA, USFWS, DoA Representatives;

   It is my understanding after reading and researching the Triana, Al. site information (EPA ID: ALDD83166299) that this year will be another 5 year review of the Triana, Al. "Superfund Site." This email is a complaint.

   After review of documents related to the Triana site, coupled with the recent disclosure concerning Chemical Weapons leaks on RSA, Al. I am requesting that I be notified of any future public meetings and all governmental interagency meetings related to the RSA, Wheeler National Wildlife Refuge Indian Creek-Huntsville Spring Branch(IC-HSB) Triana, Al. EPA contaminated site. This request extends to any public or interagency meetings related to the recent Chemical Weapons cleanup and /or contamination which may affect the environs surrounding RSA including IC-HSB, Tennessee River, Wheeler Wildlife Refuge and the environs surrounding Triana, Al. I am requesting to be admitted for attendance or be provided an informational link, via phone or internet, for all future meetings if attendance in person is not possible.

Review of the documents reveals what appears to be an intentional omission from the EPA Triana Report Summary as it relates to the United States Fish and Wildlife Service Biologist's findings. This is an environmental justice issue and I find it disturbing that EPA's Report summary omitted the biologist's findings.

I am a fisherman and environmental group representative of the Bellefonte Efficiency and Sustainability Team/Mothers Against Tennessee River Radiation (BEST/MATRR), a local chapter of the Blue Ridge Environmental Defense League (BREDL), a 501c3 environmental stewardship organization; member(s) of our group live in the Triana , Al. area.

As a retired U.S. Army Medical Department soldier and retired Department of Defense Race Relations Equal Opportunity Specialist and current non-profit organization environmentalist I am very concerned with a lack of current efforts and report omissions as they relate to the Triana environs, e.g. community health (Documented high area cancer rates, National Cancer Institute.), lack of a comprehensive community health assessment, discontinuing of well monitoring, lack of fisheries testing into the IC-HSB environment as described in the "Consent Decree," ignoring the USFWS Biologist findings in the last Triana, Al. EPA Report Summary. The environmental justice and area contamination issue is compounded by the recent disclosures involving Chemical Weapons contamination on RSA and surrounding environs.

The Tennessee River provides the areas residents drinking water; it is literally our "lifeblood" and must be protected. The degree of protection of the area's residents is questionable due to what appears to be intentional omissions from the Triana EPA summary.

My concerns and complaint are referenced as follows by recent media reports and EPA documentation at the links provided:

Subject: Triana, Al. Racial Discrimination-Environmental Justice Issue - Environmental Contamination

Triana, Al. - Environmental Justice Issue, population 75% African American.

LA Times article: "RSA, in the swampy lowlands of northern Alabama, is the largest of the 249 sites in 40 U.S. states and territories."
http://www.latimes.com/nation/la-na-chemical-weapons-cleanup-video-20140321,0,1936291.premiumvideo

The latest 5 year report on the Triana EPA Superfund Cleanup Site, dated February 2010.
http://www.epa.gov/superfund/sites/fiveyear/f2010040003356.pdf

USFWS Biologists' statement in Page C-9 - 11 of the report linked above, also note the supervisory report on this issue. This is disturbing and indicates a continuing problem of DDT leakage into the Biosphere as described by the US. Fish and Wildlife Service Biologist Peter Tuttle.

Statement from the U.S. Fish and Wildlife official at the last review: "..recent monitoring indicates that residual DDT contamination in the HSB-Indian Creek (Huntsville Spring Branch-Indian Creek) System continues to represent a significant threat to fish, and habitat quality. Continued risk to human health is also a concern...USFWS is concerned that that current levels of DDT in this system are not protective of fish, wildlife or habitat quality on the WNWR (Wheeler National Wildlife Refuge)."

EPA's page on the Triana Super Fund site link:
http://www.epa.gov/region4/superfund/sites/npl/alabama/triatenval.html

The "Consent Decree" mandates that DDT must be below 5 PPM in fish, the 5 PPM is not met, according to the Fish and Wildlife Service (FWS) Biologist Peter Tuttle. The EPA report summary misleads the public regarding the "Cleanup Progress Report" as it omits the FWS Biologist report in the report's summary.

Testing has not been accomplished on regular, annual intervals; test well monitoring was discontinued many years ago. Health assessments, nor testing of the area's citizens, have not been accomplished. Testing of the areas fish populations have not been accomplished per the recommendations of the FWS Biologist.

It now appears there is more than a concern about DDT, reference the LA Times article linked above about chemical weapons contamination leaching into the biosphere.

4. Has your office conducted any site-related activities or communications in the last five years? If so, please describe the purpose and results of these activities.
   All U.S. Fish and Wildlife Service (FWS) activities and/or communications over the last five years have been presented and discussed during scheduled Review Panel and Technical Meetings.

5. Are you aware of any changes to federal or state laws that might affect the protectiveness of the Site's remedy? Are you aware of any changes in projected land use at the Site?
   No.

6. Please describe the level of cooperation between agencies (USEPA, ADEM, TVA, USFWS, and the DoA).
   During my involvement in the project, cooperation between agencies has been exemplary. There have been instances where we have disagreed on specific actions or issues but agency representatives have always respectfully listened to all sides of those disagreements in a professional manner.

7. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?
   The FWS continues to be concerned that current levels of DDT in this system are not protective of fish, wildlife, or habitat quality on Wheeler National Wildlife Refuge. The rationale for that concern was presented on pages 20-21 of Chapter 6 Agency Submittals contained in Fourth Report on the Remedial Action to Isolate DDT from People and the

Environment in the Huntsville Spring Branch-Indian Creek System in Wheeler Reservoir, Alabama: Volume I Activity Report published by U.S. Environmental Protection Agency in 2008. The following (in italics) is the body of that rationale:

Monitoring by the Olin Corporation demonstrated significant declines in the concentrations of DDT and its degradation produces DDD and DDE (collectively termed DDT) in fish fillets immediately following the initiation of remedial actions in 1986. Sampling by the U.S. Fish and Wildlife Service (FWS) demonstrated corresponding declines in red-wing blackbird nestlings and wood duck eggs. However, FWS has become increasingly concerned over the rate of DDT decline. Changes in DDT concentrations at this site appear consistent with an exponential rate of decline. This pattern, marked by a steep initial decline followed by a gradual slowing and leveling off of the rate of change, is characteristic of the decline for DDT and other persistent contaminants in aquatic ecosystems. FWS is concerned that rate of DDT decline in the Huntsville Spring Branch (HSB) and Indian Creek (IC) System has slowed substantially and that current levels of DDT in this system are not protective of fish, wildlife, or habitat quality on Wheeler National Wildlife Refuge (NWR).

To assess the residual threat of DDT in the HSB-Indian Creek System, FWS evaluated DDT in sediment, fish, and bird eggs in 2004. Among the findings were that DDT concentrations in 10 composite sediment samples from the off- channel wetlands in the HSB floodplain, HSB, and IC ranged from 1 to 7 ppm, with the exception of two samples from HSB (25 ppm and 1,300 ppm). DDT in all sediment samples exceeded the consensus-based probable effect concentration (PEC) for total DDT (0.57 ppm) identified by MacDonald et al. (2000). The PEC is defined as a level of contamination in sediment above which adverse effects to sediment dwelling organisms are expected to frequently occur. DDT in 17 whole largemouth bass from HSB and IC ranged from 1.3 to 37 ppm. Mean concentrations were higher in HSB (17 ppm) than in IC (8.0 ppm). DDT in three whole smallmouth buffalo ranged from 6.8 to 16.7 ppm, with a mean of 12.2 ppm. All fish exceeded a protective level of 0.6 to 0.7 ppm DDT in whole fish recommended by Beckvar et al. (2005). About half of the largemouth bass (9 of 17) and all smallmouth buffalo had one or more external anomalies, including parasite, lesions, fin erosion, developmental aberrations, and tumors. DDT in hooded merganser eggs collected from wood duck boxes along HSB and IC ranged from 0.4 to 287 ppm (adjusted to expected moisture content). Critical eggshell thinning and/or substantial decline in productivity of sensitive bird species has been documented at DDE (a metabolite of DDT) concentrations in eggs as low as 4 ppm. Several fish eating birds exhibit such effects when concentrations in eggs exceed 10 ppm. Adjusted DDE concentrations in hooded merganser eggs from HSB and IC ranged from 0.4 to 220 ppm, with mean concentrations of 93 and 59 ppm, respectively. Nine of 12 (75%) of the eggs exceeded 10 ppm.

These findings of this investigation heightened FWS concerns that DDT in HSB-Indian Creek System continues to represent a significant threat to fish, wildlife, and habitat quality on Wheeler NWR. The apparent exponential rate of DDT decline in this system suggests that threat of DDT will persist for an extended period. FWS has recommended a more comprehensive characterization of DDT contamination in HSB and IC to more thoroughly evaluate ecological risks and assess implications to the management of Wheeler NWR. FWS also advocated the evaluation of additional measures, such as the spot removal of areas of

highly contaminated soil and sediment, to reduce the threat of DDT in the HSB-Indian Creek System.

FWS is concerned with the conclusion put forth in the Fourth Report of Remedial Action that the 5.0 ppm performance standard for fish fillets in all reaches has been attained. Attainment of the smallmouth buffalo in Reach A is based on an average DDT concentration of 3.7 ppm from three fish collected in 1994. The average concentrations in smallmouth buffalo in Reach A were 19 ppm in 1993 and 84 ppm in 1995. Attainment of the 5.0 ppm goal in Reach A has not again been achieved since 1994. The average concentration in 2008 exceeded 10 ppm. Attainment of the performance standard in 1994 appears to be a statistical anomaly resulting from the small sample size.

FWS also remains concerned that the remedial action is not adequately providing for attainment of all of the Goals and Objectives established in paragraph 13 of the Consent Decree. Specifically, the continued identification of elevated DDT concentrations in sediment, fish, and bird eggs indicate that Goal a. ("Isolate DDT from people and the environment in order to prevent further exposure") has not been fully achieved. Also, DDT concentrations in sediment, fish, and birds collected from Wheeler National Wildlife Refuge continue to exceed literature-based effect levels. These findings would suggest that Goal d. ("Mitigate effects of DDT on wildlife habitat in the Wheeler National Wildlife Refuge") has also not been fully achieved.

References

Beckvar, N., T.M. Dillon, and L.R. Read. 2005. Approaches for linking whole-body fish tissue residues of mercury or DDT to biological effects thresholds. Environ. Toxicol. Chem. 24:2094-2105.

MacDonald, D.D., C.G. Ingersoll, T Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Archives of Environmental Contamination and Toxicology 39:20-31.

Triana/Tennessee River Superfund Site **Five-Year Review Interview Form**

Site Name: Triana/Tennessee River **EPA ID No.:** ALD983166299
Interviewer Name: _____ **Affiliation:** _____
Subject Name: Bruce Brye **Affiliation:** Consulting
Subject Contact Information: email
Time: email **Date:** 10/28/2014
Interview Location: email

Interview Format (select one): **In Person** **Phone** **Mail** **Other: Email**

Interview Category: **Federal Agency**

1. What is your overall impression of the project?
   This is a good project which should be used as the model for all other superfund projects.

2. How well do you believe the remedy currently in place is performing?
   Extremely well

3. Are you aware of any complaints or inquiries regarding environmental issues or remedial action from residents in the last five years?
   No, I am not.

4. Has your office conducted any site-related activities or communications in the last five years? If so, please describe the purpose and results of these activities.
   No.

5. Are you aware of any changes to federal or state laws that might affect the protectiveness of the Site's remedy?
   Because this was the first superfund project, there was no basis for determining the end results. The FDA guidelines for limits for human consumption of fish were used as the goal. The courts agreed that this was the acceptable basis for determining that total DDT had been complied with. Since then there have been other methods of establishing endpoints, but the courts continue to use these FDC guidelines for this project.
   Are you aware of any changes in projected land use at the Site?
   No.

6. Please describe the level of cooperation between agencies (USEPA, ADEM, TVA, USFWS, and the DoA).
   For the most part, cooperation has been good. However, some of the USFWS designated representatives have attempted to disregard the court approval of the fish guidelines by setting more stringent guidelines which would put the USFWS in charge of the project.

7. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?
   No.

Appendix H: Detailed Analysis to Support Answer Question B

CERCLA human health and ecological risk assessment guidance had not yet been established prior to the Consent Decree being issued. Thus, toxicity values and exposure factors were not used to establish risk-based performance standards. Instead, the Consent Decree selected the performance standard of 5 ppm of DDT in skinless fish fillets of channel catfish, largemouth bass and smallmouth buffalo to monitor the effectiveness of the remedy. The performance standard was based on fish consumption guidelines issued by the FDA to protect the national food supply as a whole.

According to EPA guidance on developing fish consumption limits,[4] FDA's jurisdiction in setting action levels is limited to contaminants in food shipped and marketed in interstate commerce. Thus, the methodology used by FDA in establishing action levels is to determine the health risks of chemical contaminants in fish that are bought and sold in interstate commerce rather than in locally harvested fish. FDA action levels are indicators of chemical residue levels in fish that should not be exceeded for the general population who consume fish and shellfish typically purchased in supermarkets or fish markets that sell products that are harvested from a wide geographic area, including imported fish and shellfish products. However, the underlying assumptions used in the FDA methodology were never intended to be protective of recreational, tribal, ethnic, and subsistence fishers who typically consume larger quantities of fish than the general population and often harvest the fish they consume from the same local water bodies repeatedly over many years.

According to EPA fish consumption guidance[5] EPA and FDA have agreed that the use of FDA Action Levels for the purpose of making local fish advisory determinations is inappropriate. In letters to all states, guidance documents, and annual conferences, this practice has been discouraged by EPA and FDA in favor of EPA's risk-based approach to derive local fish consumption advisories.

Using risk assessment methodology, EPA has developed recommended screening values (SVs) in fish for recreational and subsistence fishers for contaminants that have established FDA action levels. The EPA SV is defined as the concentration of the chemical in edible portions of fish that is of potential public health concern and that is used as a threshold value against which tissue residue levels of the contaminant in fish and shellfish can be compared. The SV is calculated based on both the noncarcinogenic and carcinogenic effects of the chemical contaminant, which are discussed in detail in EPA guidance. The carcinogenic and noncarcinogenic-based SVs are listed in Table H-1 for the recreational fisher since this is believed to be the most reasonable scenario.

As shown in Table H-1, the recreational fisher SV based on a 10^{-4} cancer risk level is 4 times more protective than the FDA action level and the noncancer based SV is 2.5 times more protective than the FDA action level. The recreational cancer risk associated with the FDA

[4] Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories Volume 2 Risk Assessment and Fish Consumption Limits. Third Edition. EPA Office of Water. EPA 823-B-00-008. November 2000.
[5] Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories Volume 1 Fish Sampling and Analysis. Third Edition. EPA Office of Water. EPA 823-B-00-007. November 2000.

action level is 4×10^{-4} which exceeds the upper bound of EPA's risk management range and it also exceeds the noncancer threshold of 1.0. Based on EPA risk assessment guidance, EPA and FDA have agreed that the use of FDA action levels for the purposes of making local advisory determinations is inappropriate.

Table H-1. Comparison of FDA Action Levels with the EPA Screening Value

Chemical Contaminant	FDA Action Level (ppm)	EPA SV for Recreational Fishers (ppm)[a]		Relative Risk Associated with FDA Action Level	
		10^{-4} Risk Level	Noncancer HI =1.0	Cancer Risk	Noncancer HI
Total DDT	5.0	1.2	2.0	4×10^{-4}	2.5
a. Carcinogenic risk based on fish consumption rate of 17.5 grams/day, 70 kg body weight, 70-year lifetime and most current toxicity values in EPA's Integrated Risk Information System database.					

Also evaluated was the 3.5 ppm DDT concentration in smallmouth buffalo that achieved continued attainment in Reach C in 2006. The 1998 and 2000 continued attainment concentrations in largemouth bass and channel catfish were not evaluated since Alabama's more recent fish samples showed DDT levels at or below the detection limit of 0.46 ppm, which is lower than EPA's screening values. Reach C is the reach that is accessible to the general public. The year 2006 concentration for SMB is equivalent to a cancer risk of 3.0×10^{-4}. This cancer risk exceeds EPA's upper-bound risk of 1×10^{-4} that is generally used to set performance standards under the Superfund program. Since the recreational fisher exposure scenario used to develop EPA's screening values assumes a fish consumption of 17.5 grams per day (or 1.2 pounds per month), it can be stated alternatively that for smallmouth buffalo in Reach C, an acceptable carcinogenic risk would be achieved with a daily consumption of 5.8 grams per day (or 0.4 pounds per month). This daily consumption is considered reasonable for the smallmouth buffalo which is not considered a game fish commonly pursued for sport or consumption.

Fish monitoring conducted pursuant to the 1983 Consent Decree continues to demonstrate the remedy effectiveness in reducing DDT levels in fish, and it is anticipated that this will continue. Following continued attainment of smallmouth buffalo in Reach A, which could occur as early as the year 2015 sampling event, the Consent Decree then requires a final fish sampling event after seven years, in which all three fish species will be sampled in Reaches A, B, and C. When this data is available, the remedy effectiveness will be re-evaluated.

Human health-based cleanup goals were not established in the Consent Decree for identifying contaminated sediment requiring excavation. According to the remedial action plan and decision documents, the selected remedy offered the most reduction in limiting re-suspension of contaminated sediments (the main release source of total DDT to humans and the environment) by isolating the most contaminated sediments with the least amount of destruction of wetland and aquatic habitat. Sediments were capped to include portions of the overbanks where DDT was documented to be at significantly lower concentrations. Human exposure to sediment within

Reaches A, B and C are considered incomplete based on EPA Region 4 risk assessment guidance[6] because the sediments are covered year-round by water.

Ecological-based performance standards or cleanup goals were also not established in the Consent Decree for identifying contaminated sediment requiring excavation. CERCLA ecological risk assessment guidance was not developed when the Consent Decree was prepared; however, qualitative performance goals were identified to ensure protection of ecological receptors. In addition, a number of studies were conducted prior to the Consent Decree to identify representative ecological receptors that, if protected, would also be protective of other species that were not as sensitive. The qualitative goals of the remedy pertaining to protecting ecological receptors included:

- Isolate DDT from the environment in order to prevent further exposure.
- Minimize further transport of DDT out of the HSB-Indian Creek system.
- Minimize adverse environmental impact of remedial actions.
- Mitigate effect of DDT on wildlife habitats in the Wheeler National Wildlife Refuge.

Prior to designing the final remedial approach, Olin was required to complete a number of ecological studies to ensure that the remedial approach addressed potential environmental impacts from exposure to DDT contamination. Further, an analysis of the environmental impacts of the selected remedy was also evaluated to ensure the actual remedy did not increase environmental risks. The USACE contractor conducted field investigations between 1982 and 1985 to support the development of interim remedial goals to monitor remedy progress.

Extensive studies were conducted to evaluate DDT concentrations in whole fish, fish fillets, caged fish, benthic organisms, sediment and surface water, as well as erosion and depositional studies. Details of the studies' conclusions are presented in Appendix I and summarized herein to demonstrate that a comprehensive understanding of the ecological habitat was evaluated prior to selecting the final cleanup plan. The key conclusions of these studies indicated that most of the DDT contamination is located in channel sediments and a vast majority of the impacted sediments are located in Reach A. In addition, the studies indicated that a majority of DDT is transported in the water column as suspended sediment, which represents the major source of DDT update by fish, while uptake of DDT by fish from food obtained in sediment and the water column was determined to be much less significant. The studies also evaluated exposure of threatened and endangered species to DDT and concluded that these species did not inhabit the Site area or only utilized the project area occasionally.

Finally, in December 2003, the Review Panel determined that sediment studies would be valuable in monitoring the effectiveness of the remedial action. A review of sediment levels was completed in 2004 and sediment sampling for DDT was completed in 2005. The sediment sampling results indicated that no additional sediment remediation was required since DDT concentrations were considerably lower than the baseline data and that natural recovery was occurring by covering of the sediments with lower concentrations of DDT, mixing and dilution, and degradation. Based on the review of the sediment data, the Review Panel determined that no

[6] Region 4 Human Health Risk Assessment Supplemental Guidance. Technical Services Section, Superfund Division. January 2014 Draft Final.

additional remediation or further investigation of sediments was necessary. The Review Panel agreed that any additional dredging of historical localized areas of residual contamination would result in destruction of the major portion of the existing natural habitat of the HSB-Indian Creek system and would provide significant opportunity for suspension and redistribution of DDT further into the HSB-Indian Creek system and into the Tennessee River. The Review Panel concluded that removal and isolation of the majority of the DDT from the aquatic ecosystem presents a significant environmental improvement over leaving DDT in place, which would allow for ongoing exposure to wildlife.

Based on these studies, the Review Panel selected DDT concentrations in fish fillet as the performance standard for monitoring the effectiveness of the remedy in reducing DDT in the surface water column.

Appendix I: Summary of Historical Studies Supporting the Selected Remedy

The 1983 Consent Decree did not require the completion of a baseline ecological risk assessment as guidance for completing such assessments was not available. However, the Consent Decree did require the completion of a number of ecological studies that evaluated impacts of site contamination on various components of the ecosystem. The USACE and their contractors conducted a number of studies in support of selecting a preferred remedial alternative to address DDT contamination in the HSB-Indian Creek system and in the development of a performance standard that measures the protectiveness of the selected remedy. The studies include analyses of DDT concentrations in whole fish, fish fillets, benthic organisms, surface water and sediment; in addition, uptake studies were conducted using fish cages. Other studies evaluated benthic species abundance and diversity and erosion and depositional studies. Key conclusions from the various studies include:

- Ninety-two percent of the DDT contamination is in the channel sediments, and of the total DDT in the system, 94 percent is in Reach A.
- DDT is transported with the sediment by the water in HSB-Indian Creek.
- The major source of the DDT in the water column (greater than 95 percent) is the channel sediments upstream of HSBM 4.0.
- Storm events at low pool (winter) transport more DDT than other types of flow events.
- Channel catfish, smallmouth buffalo and largemouth bass are found in each Reach of the HSB-Indian Creek system and are identified as the surrogate species to monitor remedy effectiveness.
- The major source of DDT uptake by fish is through the water column and uptake through their food is much less significant.
- Remedial alternatives such as installing dams to prevent DDT transport downstream from Reach A would continue to expose benthic organisms, fish and terrestrial receptors higher in the food chain (e.g., bald eagle) within Reach A.
- Dredging would result in destruction of a major portion of the existing natural habitat of HSB-Indian Creek and provide significant opportunity for suspension and redistribution of DDT further into the HSB- Indian Creek system and into the Tennessee River.
- Remedial alternatives that would isolate DDT would destroy the benthic and fish habitat in the short-term in the old ditch but would be compensated by recolonization within the new ditch.
- Monitoring DDT fish fillet is selected as the performance standard to address the effectiveness of the remedy in reducing DDT transport in the water column because the uptake by fish is most significant from suspended sediments in water.
- Threatened and endangered species (Alabama Cave Shrimp, Gray Bat, Indiana Bat, American alligator, and Bald Eagle) were evaluated in 1985[7] and it was determined that
    - Alabama Cave Shrimp does not occur in or downstream of the project area.

[7] Biological Assessment of Impacts Upon Endangered Species by Olin Chemical Corporation Remedial Action Plan to Isolate DDT from People and the Environment. Prepared by WAR, Oct 1985

  - Indiana Bats are uncommon to rare in the region and probably do not use the project area to any significant degree.
  - The Bald Eagle and the Gray bat are known to utilize the project area at least occasionally, but monitoring activities and special permit actions should eliminate potential adverse impacts.
  - American alligator occurs in the project area; these alligators were removed to more suitable habitat prior to remedial construction activities.
- Removal and isolation of the majority of the DDT from the aquatic ecosystem represents a significant environmental improvement over leaving DDT in place, which allows for ongoing exposure to wildlife.
- Sediment studies conducted in 2004 and 2005 demonstrated that natural recovery processes have occurred (sedimentation, biodegradation, photodegradation, and dilution), as evidenced by the data (fish DDT decreasing).

Based on the results of these ecological studies, the Review Panel agreed that any benefits of additional remediation in Reaches A, B, C could be offset by habitat destruction or contaminant releases through re-sedimentation. The Review Panel concluded that the natural recovery processes can be expected to continue in the future.