UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Explanation of Significant Differences
May 2019

Site Name:	**Ciba-Geigy Corporation Superfund Site**
CERCLA ID #:	**ALD001221902**
Site Location:	**McIntosh, Washington County, Alabama**
Support Agency:	**Alabama Department of Environmental Management**
Lead Agency:	**EPA, Region 4**

I. Introduction

This decision document presents an Explanation of Significant Differences (ESD) for the Ciba-Geigy Corporation (Ciba) Superfund Site (Site) Operable Unit 3 (OU3) Record of Decision (ROD) issued by the U.S. Environmental Protection Agency in July 1995.

This ESD is issued in accordance with § 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), § 300.435(c)(2)(i). The Director of the Superfund Division has been delegated the authority to sign this ESD.

This ESD will become part of the Administrative Record for the Site (NCP § 300.825(a)(2)), which has been developed in accordance with § 113 (k) of CERCLA, 42 U.S.C. § 9613 (k).

The Administrative Record is available for review at McIntosh Town Hall, 206 Commerce Street, McIntosh, AL 36553 Monday - Friday, 8:00 a.m. to 4:30 p.m. and at the U.S. EPA Region 4, 11th Floor Library, 61 Forsyth Street SW, Atlanta, Georgia 30303, Monday - Friday, 7:30 a.m. to 4:30 p.m.

II. Statement of Purpose

The purpose of this ESD is to document a change from the risk-management based soil/sediment cleanup levels established in the 1995 ROD to risk-based cleanup levels and changes to fish tissue performance standards contained in the 2008 ESD for Dichlorodiphenyltrichloroethane (DDT) along with its metabolites (DDD and DDE), collectively referred to as DDTR. This ESD also documents the current chemical-specific "applicable or relevant and appropriate requirements" (ARARs) for DDT and its metabolites in surface water and modifies the Remedial Action Objectives (RAOs) for protection of surface water and reduction of ecological risk to fish, fish-eating birds and mammals, and insectivorous birds exposed to DDTR present in Ciba OU3 media.

The EPA prepares an ESD in accordance with NCP § 300.435(c)(2)(i) when the Agency makes changes to the original selected remedy that are significant, but do not fundamentally alter the remedy selected in the ROD with respect to scope, performance, or cost. This ESD explains changes to the cleanup goals and clarifies RAOs, but does not fundamentally alter the overall cleanup approach.

III. Site History and Contamination

The Ciba Site is located on the Tombigbee River two miles northeast of McIntosh, Alabama and 50 miles north of Mobile, Alabama (Figure 1). The 1996 Ciba OU3 Remedial Design/Remedial Action Consent Decree (Consent Decree), defines OU3 as "that Operable Unit at the Site (as defined below) which addresses contamination within the floodplain area of the Site and effluent ditch and which is identified in the ROD." The Consent Decree defines the Ciba Site as "encompassing approximately 2.4 square miles, located on the east side of United States Highway 43, northeast of McIntosh, Alabama in southern Washington County and depicted generally on the map attached as Appendix C [to the Consent Decree]." (Figure 2 herein). The Ciba OU3 ROD "Site Map" depicts the location of the "floodplain area" of the Site. (Figure 3 herein). The entire Ciba-Geigy (BASF) property is approximately 1500 acres, which includes the developed plant area and approximately 170 acres of undeveloped swamp and bottomland in the Tombigbee River floodplain. Olin Corporation owns approximately 200 acres in the Tombigbee River floodplain adjacent to the Ciba Site.

The Ciba Site is currently owned and operated by BASF, which acquired Ciba-Specialty Chemicals Corporation in 2009. The Geigy Corporation built the facility in the 1950's and began operations in October 1952 with the manufacture of one product, DDT, for which production was discontinued in the 1960s. Through 1970, Geigy Corporation expanded its products by adding the production of fluorescent brighteners, herbicides, insecticides, agricultural chelating agents, and sequestering agents for industry. In 1971, Geigy Chemical Corporation merged with Ciba Corporation to create Ciba-Geigy Corporation. The product line was expanded to include the manufacture of resins and additives used in the plastics industry, anti-oxidants, and small volume specialty chemical products. In 1999, agricultural chelating and sequestering agent production was phased out and closed. In 2003, herbicide and insecticide production was closed.

The EPA began environmental investigations at the Ciba Site in 1982 with identification of soil and groundwater contamination on the Site resulting from past waste management operations. The Site was placed on the National Priorities List (NPL) in 1984. Due to the size and complexity of the Site, the EPA identified four operable units (OUs)(Figure 4):

- OU1 Shallow alluvial ground water aquifer;
- OU2 Soils at ten of eleven former waste management units;
- OU3 Floodplain, including the effluent ditch and areas in the Tombigbee River within close proximity to the Site[1]; and
- OU4 Former waste management area designated as Site 8 (or bluff line site) and the upland portion of the dilute ditch.

Remedial actions under EPA oversight have been performed for all four OUs and each OU is monitored annually to measure remedy effectiveness. Four Five Year Reviews have been conducted to evaluate the effectiveness of the remedies for each OU. The most recent Five Year Review (September 2016) states that the remedies for OU1, OU2, and OU4 continue to mostly function as intended and remain protective of human health and the environment in the short term. A protectiveness determination for the OU3 remedy was deferred pending the completion of the actions described in this ESD and the collection of additional performance monitoring data.

[1] Note, however, the Ciba OU3 ROD limited the scope of OU3 stating that areas in "the Tombigbee River close to the Site will not be discussed in this operable unit because they are currently being addressed in the Mobile River Study." Ciba OU3 ROD at p. 11.

The Record of Decision (ROD) addressing contamination in OU3 was issued in 1995. The OU3 ROD remedy is described as addressing the upper end of the former effluent ditch in the vicinity of sample point B1, the approximate center of the open ditch in the vicinity of sample point C1, and the location referred to as the Cypress Swamp, with treatment in Cypress Swamp to be conducted without consideration of property boundary. (Ciba OU3 ROD at pp. 54-55). The Ciba (BASF) and Olin property boundary bisects Cypress Swamp. The selected remedy was excavation of soils with concentrations above 15 mg/kg DDTR in order to mitigate residual risks to fish-eating birds feeding in the floodplain and what was, at the time, believed to be old growth cypress-tupelo forest. The initial cleanup of OU3 was conducted in 1998 (Figure 5). OU3 was not included in the First Five Year Review (September 2001) as there was insufficient monitoring data on which to base a protectiveness determination.

The Second Five Year Review (September 2006) concluded that the remedy as implemented, was not protective of the environment. Although progress had been made toward the remedial goals, additional remediation of contaminated sediment was recommended to achieve the remedial goals for OU3. Two site inspections conducted in support of the Second Five Year Review found that the OU3 overstory is co-dominated, if not dominated, by sugarberry (*Celtis laevigata*), not cypress-tupelo. Although other native bottomland hardwood and cypress trees were observed in the forested areas, they were not the dominant species. Additionally, the biologically available DDTR in sediment may harm the wildlife and the habitat may act as an attractive nuisance. Thus, the rationale included in the 1995 ROD for utilizing a risk-management based cleanup level of 15 mg/kg (to protect sensitive habitat) rather than a risk-based cleanup level of less than 1 mg/kg was inaccurate.

Based upon the recommendations from the Second Five Year Review, the EPA issued an ESD for Ciba OU3 in 2008 addressing the previously un-remediated area adjacent to Cypress Swamp, referred to in the ESD as the "focus area" to the "south of the former effluent ditch and north of the Olin berm." The 2008 OU3 ESD documented the application of a sand cover over OU3 floodplain areas that had been previously identified in the OU3 ROD as ecologically sensitive. Placement of the sand cover in the focus area was determined to be suitable for the Site as it minimized negative impacts to the habitat. (Figure 5).

The Third Five Year Review (September 2011) stated that although the 1995 OU3 ROD remedy and 2008 OU3 ESD remedy were "protective in the short term because they had been implemented according to site decision documents," an O&M Plan needed to be finalized and institutional controls were required to protect the sand cover before a long-term protectiveness determination could be made.

The Fourth Five Year Review (September 2016) determined that the current soil/sediment cleanup level for DDTR in OU3 must be revised to ensure the remedy is protective of human health and the environment. In order to evaluate the protectiveness of the OU3 remedy, the Fourth Five Year Review suggested that additional site characterization may be required to determine the full extent of contamination.

IV. Selected Remedy and Previous EPA Actions

The 1995 OU3 ROD presented Remedial Goal Options (RGOs) for soil and sediment ranging from 0.04 mg/kg to 3.76 mg/kg for DDTR to be protective of different ecological receptors. The 1995 OU3 ROD stated that in order to achieve a hazard quotient (HQ) of 1 or less, the concentration of DDTR in the floodplain must be no greater than 1 mg/kg [one (1) milligram per

kilogram (mg/kg)]. However, in the 1995 OU3 ROD, the EPA concluded that remediating to 1 mg/kg was not practical because it would require extensive excavation and destruction of the bottomland hardwood forest and the cypress-tupelo swamp. The 1995 OU3 ROD selected 15 mg/kg total DDTR as a risk management-based cleanup goal for OU3 to provide the best balance of overall protection among cleanup goals considered for remediation of the OU3 floodplain soil and sediment. However, as previously stated, two subsequent site inspections conducted in support of the Second Five Year Review found that the OU3 overstory is co-dominated, if not dominated, by sugarberry (*Celtis laevigata*), not cypress-tupelo.

The 1995 OU3 ROD stated that adjustments and modifications to the cleanup goal based on area-specific factors and additional sampling results would be considered by the EPA during the Remedial Design Study, and any adjustments to the cleanup level would be published in an ESD or ROD Amendment.

The 1995 OU3 ROD resulted in the excavation of 23,000 cubic yards of contaminated sediment from portions of OU3 (Figure 5).

Though a performance standard for fish tissue was not established in the 1995 OU3 ROD, a performance goal range of 0.3 to 1.5 mg/kg in whole body mosquitofish (*Gambusia affinis*) tissue was used to assess post-remedy effectiveness. The OU3 remedy resulted in average concentrations of DDTR across OU3 soil/sediment of less than 15 mg/kg; however, large continuous areas greater than 15 mg/kg still existed within OU3, and *Gambusia* tissue concentrations continued to exceed the upper end of the performance goal range. The 2008 OU3 ESD specified placement of a sand cover over areas of the OU3 focus area with soil/sediment DDTR concentrations above 15 mg/kg and continued monitoring of *Gambusia* to assess remedy performance. The EPA estimated the sand cover was placed over approximately 41.7 acres (15.4 acres on BASF property; 26.3 acres on Olin property) in the OU3 focus area. It should be noted that in 1998, when the OU3 remedy was being implemented, the cover application technology was not available (or certainly not widely used by the EPA) to apply soil/sediment as a cover in the ecologically sensitive areas without destroying the habitat.

V. Description of Significant Differences and Basis for the ESD

The 1995 OU3 ROD's use of risk-management based cleanup levels for DDTR in soils/sediments in order to minimize destruction of sensitive habitats is no longer warranted. The Second Five Year Review documented that the majority of the forested wetlands were probably clear-cut at one time; and the sand cap placed as a result of the 2008 OU3 ESD demonstrated that active remediation could be accomplished in the floodplain with minimal destruction of cypress-tupelo forest. Potential impacts to small areas of cypress-tupelo and bottomland forest in Ciba OU3 from remedial activities are insignificant compared to potential risks from DDTR to ecological receptors in OU3 and potential transport of DDTR to downstream areas of the Mobile-Tensaw Delta. Additionally, the habitat in the Ciba OU3 floodplain is not unique in the 260,000-acre delta.

The EPA issued a letter to the PRP dated April 1, 2015 stating that current soil/sediment cleanup levels and performance standards for ecological receptors must be revised to ensure remedial actions are protective of human health and the environment.

The *Gambusia* performance standard range contained in the OU3 Post-Remediation monitoring plan was originally established to protect piscivorous birds from the No Observable Adverse Effects Level (NOAEL) of 0.3 mg/kg to the Lowest Observable Adverse Effects Level

(LOAEL) of 1.5 mg/kg. However, this range does not take into account protection of other ecological receptors and the effects of bioaccumulation and biomagnification in fish.

The 1995 OU3 ROD calculated Remedial Goal Options (RGOs) for multiple ecological receptors and exposure based on the EPA's ecological risk evaluation of the Site, and derived risk-based RGOs for soil/sediment ranging from 0.04 mg/kg to 3.76 mg/kg for DDTR. This range of RGOs is consistent with those developed for DDTR in the floodplain and basin of the adjacent Olin Superfund Site (Olin OU2), where sediment RGOs for DDTR for protection of fish and wildlife ranged from 0.21 to 1.2 mg/kg, floodplain soil RGOs for wildlife ranged from 0.14 to 1.4 mg/kg, and fish tissue RGOs ranged from 0.23 to 0.64 mg/kg.

Remedial Action Objective Summary

Per the EPA's guidance, Remedial Action Objectives (RAOs) are medium-specific goals that define the objectives when conducting remedial actions to protect human health and the environment. RAOs specify the contaminants of concern (COCs), potential exposure routes and receptors, and acceptable concentrations (i.e., cleanup levels) for a site and provide a general description of what the cleanup will accomplish.

The 1995 OU3 ROD contained the following general cleanup objective:

- Remediate the source of the contamination, minimize the migration of the contamination from the soil/sediment to the groundwater/surface water, and prevent current or future exposure to contaminated groundwater or other environmental receptors.

In this ESD, the following RAOs are developed for OU3 to clarify the cleanup objective stated in the 1995 OU3 ROD. The associated cleanup levels for soils and sediments, the surface water protection standards, and performance standards for ecological receptors adopted in this ESD are provided in Table 1. The Ciba OU3 RAOs are specified as follows:

- ***Reduce, or mitigate, risk to piscivorous birds from ingestion of fish exposed to DDTR contaminated sediments.***

- ***Reduce, or mitigate, risk to fish from food-chain exposure to DDTR contaminated sediments.***

- ***Reduce fish tissue concentrations of DDTR to levels protective of predatory fish and piscivorous birds.***

- ***Reduce, or mitigate, risk to ecological receptors exposed to DDTR in contaminated floodplain soils.***

- ***Protect surface water quality from migration of DDTR contaminated media into surface water.***

The EPA anticipates these RAOs can be met without changing the remedial alternatives previously implemented in the 1995 OU3 ROD and 2008 OU3 ESD.

The protective levels to be achieved by the modified RAOs require replacing the non-protective cleanup levels for DDTR selected in the 1995 OU3 ROD and 2008 OU3 ESD with the protective cleanup levels, performance standards, and ARARs presented in Table 1. The specific soil/sediment cleanup levels and fish performance standards in Table 1 are risk-based thresholds based on protection of fish and wildlife and were calculated for ecological receptors representative of the Site using the geometric mean of the NOAEL and the LOAEL toxicity information, and thus are protective of

the environment at OU3. The cleanup levels for DDT and its metabolites (DDD and DDE) in surface water are promulgated standards, i.e., chemical-specific ARARs, in the state ambient water quality criteria.

Determination of attainment of cleanup levels, performance standards, and surface water ARARs will be based on measurements of DDTR in sediment, floodplain soil, whole body forage fish (e.g. *Gambusia*) tissue, whole body predatory fish (e.g. largemouth bass) tissue, and surface water.

Sediment is defined at OU3 as areas that remain inundated for all or part of the year when the Tombigbee River is under base flow (i.e. non-flood) conditions when the only exchange of surface water with the Tombigbee River is through the former effluent ditch, and/or drainage through Olin Basin to the Tombigbee River. Soil is defined as areas of the floodplain that are inundated only during flooding of the Tombigbee River, and are not inundated during non-flood conditions.

The sediment and soil cleanup levels in this ESD are intended to be applied as "average" concentrations across areas representative of ecological exposure. Fish tissue performance standards are also intended to be applied as "average" concentrations across representative exposure areas within Ciba OU3. Surface water ARARs are to be applied as spatial and temporal averages in the surface water bodies of OU3 during non-flood conditions.

Representative sample locations and exposure areas for performance monitoring, specific decision rules for determining remedy success, compliance with ARARs, and attainment of cleanup levels and performance standards within specified limits of uncertainty will be defined in an EPA approved deliverable in accordance with the OU3 Consent Decree.

Sand cover performance monitoring is required and specifc monitoring requirements will be included in an EPA approved deliverable in accordance with the OU3 Consent Decree.

The time frame for attainment of the revised cleanup levels, performance standards, and ARARs may be dependent on 1) further investigation in Ciba OU3 (as recommended in the Fourth Five Year Review); and 2) implementation of the Olin OU2 ROD. The need for any additional remedial action will be documented in an ESD or ROD Amendment, as appropriate.

VI. Support Agency Comments

The EPA consulted with ADEM and provided it the opportunity to comment on this ESD in accordance with NCP § 300.435 (c)(2) and § 300.435 (c)(2)(i) and CERCLA § 121(f).

VII. Statutory Determinations

The EPA has determined that the significant change to the cleanup value for DDT and its metabolites in soil and sediment complies with the statutory requirements of CERCLA § 121, 42 U.S.C. § 9621, is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

VIII. Public Participation

A public notice of availability of the proposed ESD for public comment was published in the Mobile Press-Register in October 2018. The proposed ESD was also distributed to the Site mailing list, was placed in the Administrative Record Files at the EPA Region 4 Record Center in Atlanta Georgia, and copies were made available at the McIntosh Town Hall on Highway

43 in McIntosh, Alabama for review.

The public comment period closed on December 20, 2018.

The EPA has reviewed all comments received during the comment period and has responsed in the Responsiveness Summary included as Appendix A herein, which is made part of the Administrative Record for the Site. No comments were received warranting a signficiant change to the proposed ESD.

IX. Authorizing Signature

I have determined the remedy for Ciba OU3, as modified by this ESD, is protective of human health and the environment, and will remain so provided the actions presented in this report are implemented as described above.

This ESD documents the significant changes related to the remedy at Ciba OU3.

By: _____

Franklin E. Hill, Director
Superfund & Emergency Management Division

Date: 6/5/2019

Table 1. Comparison of Ciba OU3 Cleanup Levels and Performance Standards for DDTR

1995 ROD	2008 ESD	2019 ESD
Cleanup Level Soil/Sediment: 15 mg/kg	Cleanup Level Soil/Sediment: 15 mg/kg Tissue Performance Standard *Gambusia*: 1.5 mg/kg (established 0.3 – 1.5 ppm post 1995 ROD)	Cleanup Levels[2] Sediment: 0.21 mg/kg Floodplain Soil: 0.63 mg/kg Tissue Performance Standards[3] *Gambusia*: 0.23 mg/kg Predatory Fish: 0.64 mg/kg Surface Water ARARs 4,4'-DDD: 0.0002 ug/L[4] 4,4'-DDE: 0.0001 ug/L[4] 4,4'-DDT: 0.0001 ug/L[4] 4,4'-DDT: 0.001 ug/L[5]

[2] The DDTR cleanup levels are consistent with those selected in the 2014 Olin OU2 ROD.
[3] The Olin OU2 ROD uses the term cleanup level for fish tissue.
[4] As calculated by Eq. 19 specified in ADEM Admin. Code r. 335-6-10-.07(1)(d)(2)(ii), for calculation of human health criteria for consumption of fish only for those toxic pollutants classified by EPA as carcinogens, applicable to all waters of the State of Alabama. *See* ADEM Admin. Code r. 335-6-10-.07(1)(e). Table 1- Toxic Pollutant Criteria.
[5] The chronic freshwater criteria for protection of aquatic life, 0.001 ug/L, for 4,4'-DDT, is given in ADEM Admin. Code r. 335-6-10-.07(1), Table 1- Toxic Pollutant Criteria.

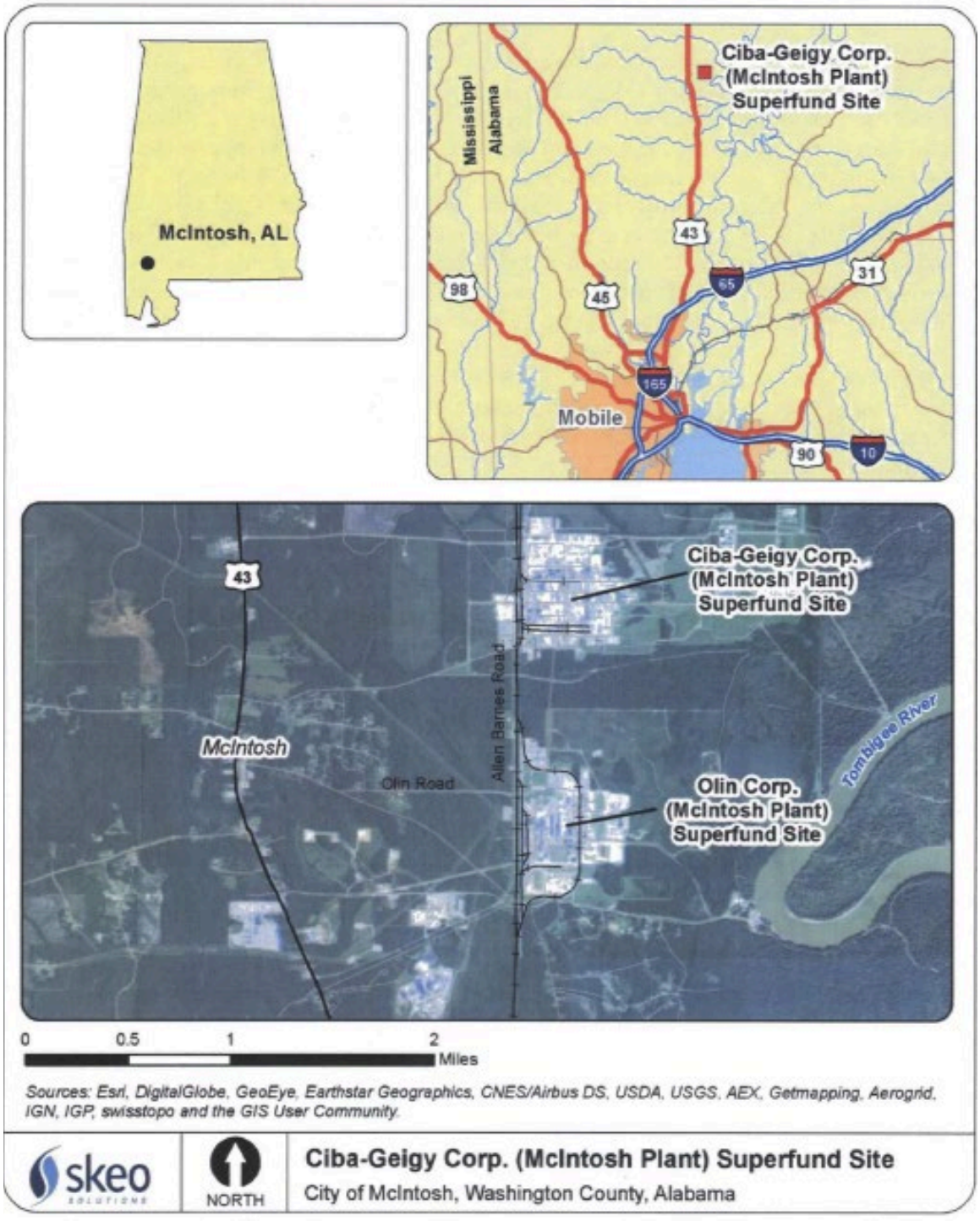


Figure 1. Ciba-Geigy Superfund Site

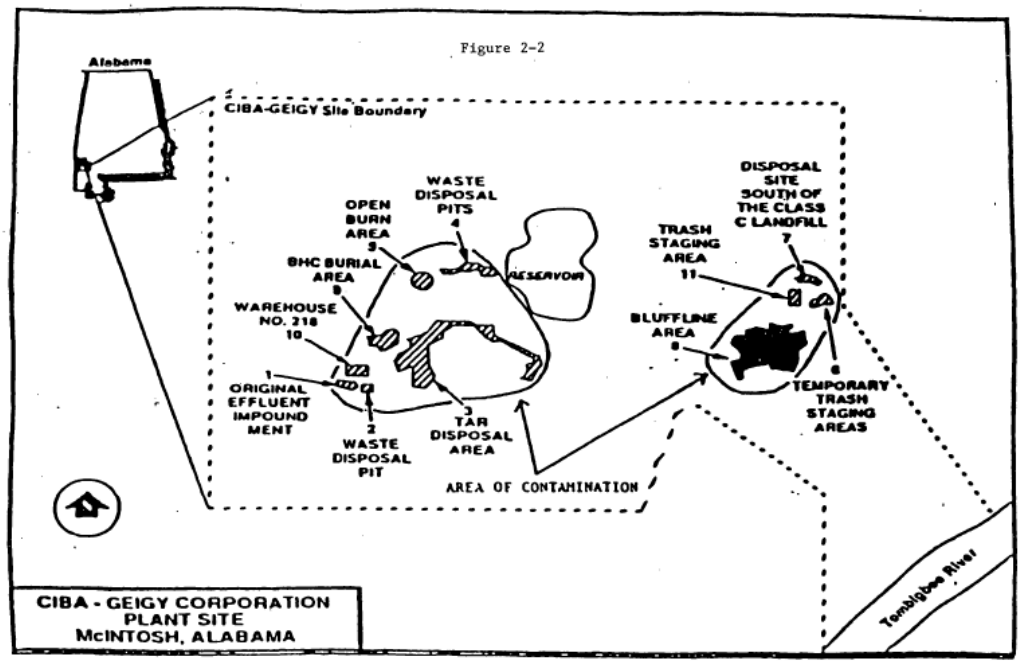


Figure 2. "Ciba-Geigy Corporation Plant Site" as depicted in OU3 ROD Fig. 2-2 and Consent Decree -Appendix C

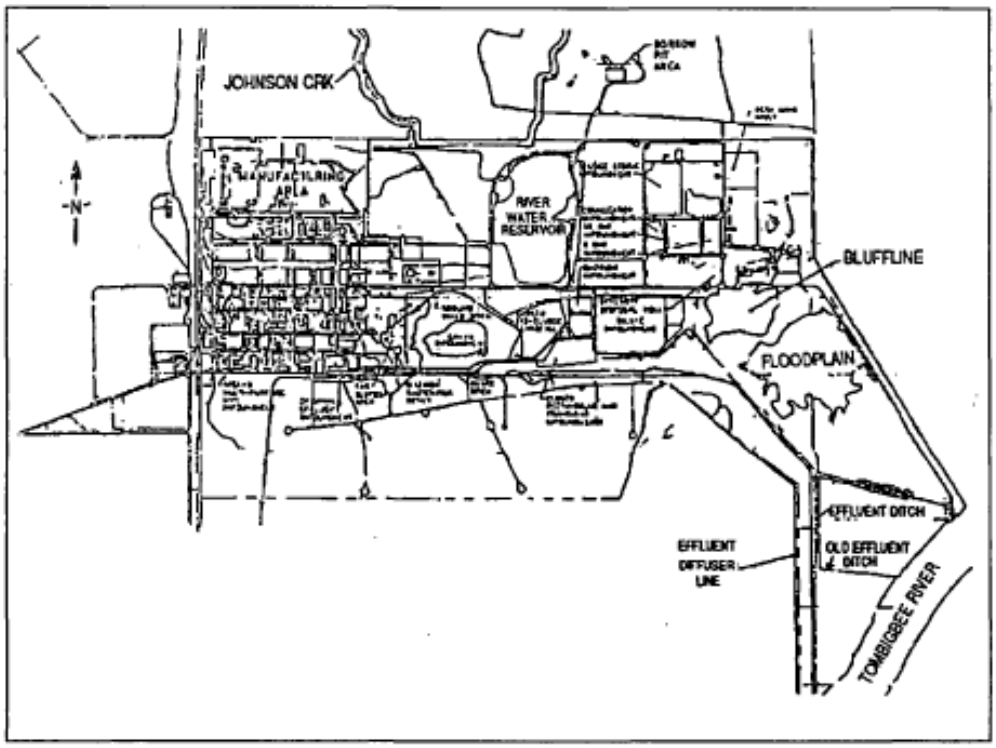


Figure 2-3 Site Map

Figure 3. Ciba-Geigy "Site Map" as depicted in OU3 ROD Fig. 2-3

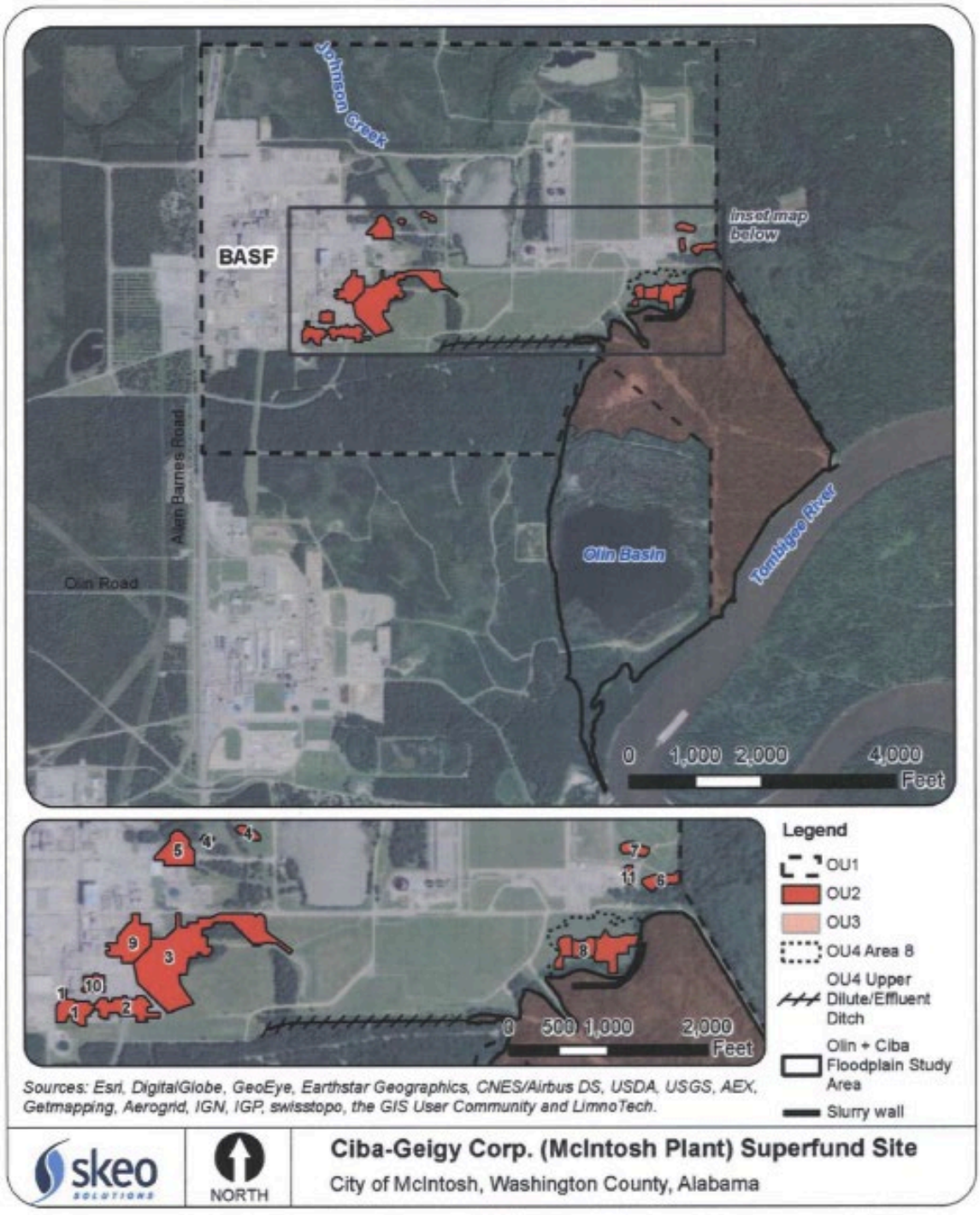


Figure 4. Location of Operable Units (OUs) at Ciba-Geigy Corporation Superfund Site

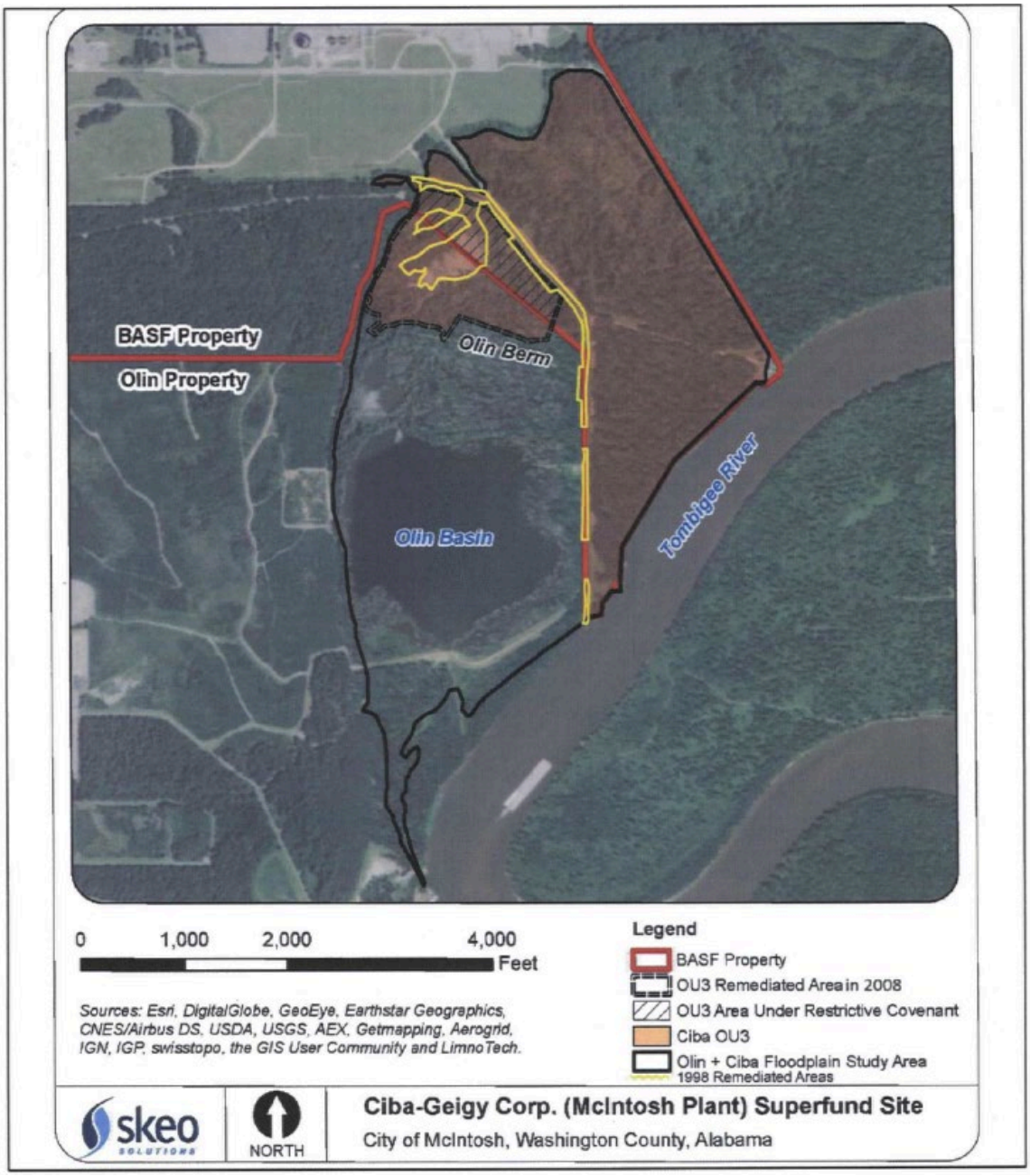


Figure 5. Areas Remediated Under 1995 ROD and 2008 ESD.

INTRODUCTION

This responsiveness summary provides a summary of the significant comments and criticisms submitted by the public on the U.S. Environmental Protection Agency's (EPA's) October 2018 Proposed Explanation of Significant Differences (ESD) for Operable Unit 3 of the Ciba-Geigy Superfund Site in McIntosh, AL (Ciba OU3), and the EPA's responses to those comments and concerns. All comments summarized in this document have been considered in the EPA's final decision in the selection of a remedy to address the contamination at Ciba OU3.

SUMMARY OF COMMUNITY RELATIONS ACTIVITES

The October 2018 Proposed Ciba OU3 ESD, which identified the EPA's preferred cleanup levels and the basis for that preference, including supporting analyses and information, was made available to the public in the administrative record file at the EPA Region 4 Records Center in its Atlanta office, the McIntosh Town Hall, and on the EPA Region 4 webpage.

The notice of availability of the above-referenced documents and the announcements of a public meeting date were published in the Washington County News on October 12, 2018.

The EPA established a 30-day public comment period for the Proposed Ciba OU3 ESD from October 20, 2018 to November 20, 2018. A 30-day extension to December 20, 2018 was granted at the request of BASF Corporation. The EPA's response to the comments received during this period is included in the Responsiveness Summary, which is part of this ESD.

OVERVIEW

The purpose of this ESD is to document a change from the risk-management based soil/sediment cleanup levels established in the 1995 Ciba OU3 Record of Decision (ROD) to risk-based cleanup levels and changes to fish tissue performance standards contained in the 2008 Ciba OU3

ESD for Dichlorodiphenyltrichloroethane (DDT) along with its metabolites (DDD and DDE), collectively referred to as DDTR. This ESD also documents the current chemical-specific "applicable or relevant and appropriate requirements" (ARARs) for DDT and its metabolites DDD and DDE (collectively referred to as DDTR) in surface water and modifies the Remedial Action Objectives (RAOs) for protection of surface water and reduction of ecological risk to fish, fish-eating birds and mammals, and insectivorous birds exposed to DDTR in Site media.

SUMMARY OF COMMENTS AND RESPONSES

Four letters were received via U.S. mail during the comment period from October 20, 2018 to December 20, 2018. Copies of the comments letters and emails are provided as an attachment to this Responsiveness Summary. A summary of the comments contained in the letters and the response to those comments are below.

The U.S. Department of Commerce National Oceanic and Atmospheric Administration and the Department of Interior U.S. Fish and Wildlife Services provided letters concurring with the Proposed Ciba OU3 ESD. Commenters on the Proposed Ciba OU3 ESD included Olin Corporation and BASF Corporation. Due to similarity in comments and the limited number of topics, comments were grouped together according to subject. Rather than respond to each comment individually (which would have resulted in repetitive responses) or respond by referring back to the first comment/response on a particular topic (which would have resulted in undue emphasis on that first comment or response), comments were grouped into comment summaries. Many of these summaries are interrelated and readers are urged to review the Responsiveness Summary in its entirety. In addition, in a very limited number of cases a comment which seemed best suited to more than one category was included in other appropriate categories.

For ease of reading, the comments received are presented in normal text and the EPA's responses are in italics.

Comment Summary 1. Continued migration of soil and sediment from Ciba OU3 may make compliance with DDTR remedial goals in Olin OU2 impractical. The timeframe for attainment of the revised cleanup levels, performance standards, and applicable or relevant and appropriate requirements (ARARs) should not be dependent on the implementation of the April 2014 Olin McIntosh Site OU2 ROD (USEPA, 2014). To ensure Olin's OU2 cap is not recontaminated with DDTR, the proposed cleanup levels at Ciba OU3 should be attained prior to the cap installation in OU2. (Olin General Comment 1, Olin Specific Comment 1).

Response: *Any ongoing source of DDTR to the Olin Basin are diffuse in nature and are occurring at a lower concentration than the concentrations in the sediments at Ciba OU3. Hydrodynamic modeling indicated that the current velocities through the floodplain are insufficient to erode floodplain sediment and soils. The most recent sampling events in the Olin floodplain and Basin have shown that DDTR concentrations are not appreciably accumulating in the Olin Basin under current conditions.*

The remedy for Olin OU2 can proceed after continuing sources of DDTR to Ciba OU3 have been evaluated; and waiting for full achievement of RAOs and performance standards at Ciba OU3 is not necessary before implementation of the Olin OU2 remedy. Evaluation of continuing sources at Ciba OU3 includes addressing residual contamination in the Ciba effluent ditch and evaluation of potential transport through the emplaced sand cover. Once continuing sources of DDTR have been mitigated, the remedy action at Olin OU2 can proceed concurrently with performance monitoring at Ciba OU3.

Comment Summary 2. DDTR fish tissue goals based on the paper by Beckvar et al. (2005) are not site-specific and were improperly selected due to uncertainty around the derivation of those goals by the authors. (Olin General Comment 2, Olin Specific Comment 6, BASF Comment 5). Consequently, the performance standard driving remediation of sediment at the Ciba OU3 should be protection of piscivorous birds, not fish. (BASF Comment 5).

Response: *The EPA acknowledges the limitations associated with the recommendations provided by Beckvar et al. (2005), but the uncertainty around the DDTR tissue-Threshold Effects Level (t-TEL) derived by Beckvar et al. does not bias the threshold toward over-conservatism. To the contrary, Beckvar et al. (2005) suggest that their residue effects values might not be sufficiently protective. The EPA did not use an additional safety factor in directing the use of the DDTR t-TEL derived by Beckvar, which would have resulted in a lower cleanup level. Risk assessors typically develop a tissue-based toxicity value by collecting the studies that reported both a no-effect concentration and a low-effect concentration. The 50th percentile of the distribution of the no-effects concentrations and the 15th percentile of the distribution of the low-effects concentrations form a geometric mean that represents the t-TEL. It is common practice to evaluate the tissue threshold effects level in this manner.*

Research conducted subsequent to the Beckvar et al. paper does not suggest that the Beckvar t-TEL for DDTR is overly conservative or uncertain. More recent research on DDTR has examined non-lethal reproductive effects of DDTR exposure in fish. Lake Apopka, Florida studies involved the same fish species present at the Ciba Site. These studies are discussed to highlight how toxic effects were observed in target (biologically relevant) species. Studies of Lake Apopka, contaminated by DDT from farming, revealed altered reproductive endpoints in Gambusia (Toft et al. 2003) and altered spermatogenesis in male Gambusia resulting in reduced fertility (Edwards et al. 2013). Comparison of brown bullheads (Ameiurus nebulosus) from sites in Lake Apopka reported altered sex steroid hormones in female bullheads and elevated estrogen in the blood of male bullheads compared to the reference lake (Gallagher et al. 2001). These effects occurred at concentrations of DDTR in fillets of 0.0366 mg/kg wet weight. In 2001 Olin collected DDTR concentrations in fish fillets and whole bodies and found that the ratio or proportionality factor between the whole bodies and the fillets was 14, meaning the concentration of DDTR in the whole bodies of fish was 14 times greater than the concentration in the fillets. Assuming the ratio of DDTR in fillets to whole body largemouth bass of 14 observed in the Olin 2001 data, this would translate to a whole-body concentration of about 0.5 mg/kg.

Johnson et al. (2014) provided a comprehensive review paper in Fish Physiology detailing the current state of the science in endocrine disruption in fish from several classes of chemicals, including DDTR and other chlorinated pesticides. Though the toxicity information presented in this review is not always easily translatable into fish body burdens, several recent studies have been published looking at endocrine disruption and estrogenic effects resulting in intersex conditions in fish associated with DDTR exposure (Sun et al., 2016; Monteiro et al., 2015). In particular, Sun et al. (2016) reported effects on gonad development associated with fish body burdens of 0.057 mg/kg 2,4'-DDT, and 0.272 mg/kg 4,4'-DDE. A study of DDTR body burdens of common carp (Cyprinus carpio) by Jenkins et al. (2018) found significantly lower keto-testosterone levels at an average fish body burden level of 0.107 mg/kg.

A summary of various fish tissue studies and the lowest-observable-adverse-effect level (LOAEL)/lowest-observable adverse effect concentration (LOEC) derived by those studies are presented in Table 1. The value of 0.64 mg/kg selected as the basis for the fish tissue performance standard in the Proposed Ciba OU3 ESD is supported by the range of toxicity values presented in Table 1. Risk assessors typically develop a tissue-based toxicity value by fitting a probability distribution to the available studies on different species and taking a percentile protective of 85% or 90% of species, as was done by Beckvar et al. (2005). Inclusion of Table 1 illustrates that the EPA's choice of the tissue-based toxicity value from the Beckvar et al. (2005) study was not the most conservative among available studies.

Therefore, the use of the Beckvar t-TEL of 0.64 mg/kg in fish tissue is appropriate for use in establishing performance standards and is consistent with tissue performance standards established for DDTR at other sites.

Table 1. Risk-based concentrations for DDT and its degradation products in fish				
	Endpoint	**Tissue Concentration (mg/kg)**	**Notes**	**Reference**
Observed LOECs for fish exposed in early life				
Japanese medaka	gonadal development	0.005	o.p'-DDE in eggs	Papoulias et al. (2003)
Japanese medaka 58 (Pop'DDTs)	intersex and altered gene expression	0.057	Σ o,p'-DDTs	Sun et al. (2016)
Japanese medaka	intersex, increased plasma estradiol, altered gene expression	0.272	p,'p-DDE	Sun et al. (2016)
Japanese medaka	mortality (exposure dose)	0.0018 (regression LOAEL); 0.5 exposure LOAEL	o.p'-DDE in eggs	Villalobos et al. (2003)
9 Studies, 7 species	survival	0.89 - 2.4	p,p'-DDTR	Beckvar et al. (2005)
Published estimated safe tissue concentrations for fish themselves				
Adult fish	provisional due to insufficient sub-lethal data	0.6	DDTR	Beckvar et al. (2005)
Fish early life stages	provisional due to insufficient sub-lethal data	0.7	DDTR	Beckvar et al. (2005)

Comment Summary 3. The RAOs for Ciba-Geigy should include the following:

- Reduce or mitigate risk to adjacent properties by reducing or mitigating the transport of DDTR through sediment, water, or biota that would result in an exceedance of a remediation goal at adjacent properties. (Olin Specific Comment 2)

Response: *The current RAOs identified in Section V of the Proposed Ciba OU3 ESD focus on reducing onsite risk to ecological receptors through achievement of risk-based clean-up levels for sediment, floodplain soil, fish tissue, and achievement of surface water ARARs. When ARARs and risk-based cleanup levels have been achieved at Ciba OU3, it is expected that any offsite transport of DDTR will be at levels less than those expected to drive risk. The RAOs for DDTR identified in Section V of the Proposed Ciba OU3 ESD are consistent with the DDTR RAOs identified in Section 2.8 of the Olin OU2 ROD (EPA, 2014), both in terms of stated objectives,*

and numeric clean-up criteria. If the RAOs for both Ciba OU3 and Olin OU2 are consistent, as proposed, meeting the RAOs for Ciba OU3 obviates the need for an additional RAO specifying mitigation of transport to adjacent properties that are in exceedance of remedial goals for the adjacent properties.

Comment Summary 4. Olin requests review of Ciba Performance Monitoring Plan (PMP) and PMP data when available and requests specific biotic and abiotic media to be monitored along DDTR migration path. (Olin Specific Comments 4 and 5).

***Response**: The best way to monitor Ciba OU3 and Olin OU2 to determine achievement of RAOs is to develop consistent performance monitoring plans for both sites. To that end, the performance monitoring plans for both OUs will be based on a unified set of data quality objectives (DQOs), particularly with regard to monitoring of DDTR in biotic and abiotic media. A unified set of remedy performance monitoring DQOs is best achieved through cooperative efforts between BASF, Olin, and the EPA using all available data for both OUs, and with that data made available to all parties.*

Comment Summary 5. Sediment and soil clean-up levels are too uncertain to be included in a decision document at this time. (BASF Comment 1). BASF believes that the EPA-selected fish tissue performance standards are achievable. However, the back-calculation of the sediment and soil levels has yielded values that are so low that they cannot be achieved without substantial additional remediation which would include significant ecological disruption.

BASF has two overarching concerns with the incorporation of what BASF states are "highly uncertain" sediment and soil cleanup levels into the Proposed Ciba OU3 ESD:

- BASF has a fundamentally different understanding than the EPA of the Conceptual Site Model (CSM) as it relates to the biota exposures to DDTR. In short, multiple exposure pathways acting over varying exposure areas and durations contribute to the biota DDTR levels. Using a regression based only on soil/sediment:biota sample pairs and assuming small exposure areas ignores the influence of the former high-sediment

concentration area, inflates the calculated accumulation factors, and leads to unnecessarily low cleanup levels.

- Even using a traditional approach to determining soil/sediment:biota bioaccumulation factors (BAFs), developing the models that relate soil or sediment to biota is a highly subjective process. Different decisions regarding which data to use, how the data are normalized, and the functional form of the relationship can all have substantial effects on the modeled relationship. These differences can result in calculated sediment and soil cleanup levels that vary by factors of five or more.

Response: *The EPA correctly performed the BAF calculations. BASF's contention that the sediment and soil cleanup levels are too uncertain to be included in a decision document at this time is not supported by site data, the scientific literature, and ecological risk assessment practice. There is sufficient information to derive cleanup levels, regardless of the differences in how BASF and the EPA view the conceptual site model (CSM.) The sediment and soil cleanup levels included in the Proposed Ciba OU3 ESD have already been included in the ROD for Olin OU2 (EPA, 2014) based on comprehensive ecological risk assessments. The EPA reviewed the derivation of the cleanup levels specified in the Olin OU2 ROD and evaluated the effect of including the more recent (2015-2016) Ciba OU3 data collected by BASF in the derivation of cleanup levels (Neptune and Company, 2018). The evaluation found that inclusion of the additional 2015-2016 BASF-collected data did not significantly change the bioaccumulation assumptions that were used in derivation of the cleanup levels.*

The BAF that the EPA calculated was based on concentrations in local sediments in quadrants of Cypress Swamp, Olin Basin, and Round Pond versus the average concentration over these areas. Concentrations decreased in fish in locations of the floodplain where concentrations in sediment decreased. This is an indication that uptake of DDTR into fish tissue is a function of DDTR in surface sediments as modeled by the EPA-calculated BAF. Therefore, the EPA calculated BAF is still appropriate. The 2008 data pair was not included by the EPA in the regression to determine the site-specific BAF for Gambusia because it did not meet the requirement for data pairs to represent homogeneous conditions in the sediments to which the

fish were exposed (Burkhard 2009). The sample pair that BASF pointed out as having been excluded from the calculation to determine the BAF was excluded because it represented heterogeneous conditions in sediments to which the fish were exposed. In 2008 fish were exposed to a combination of the 1998 previously remediated area, with a low concentration of DDTR, and a narrow perimeter of water pooled in Cypress Swamp, with a very high concentration of DDTR between 500 mg/kg and 1,000 mg/kg. Because the degree that fish were exposed to the highly contaminated sediments along the perimeter of Cypress Swamp is unknown and variable as the site underwent wetting and drying, the estimate of the sediment concentration to which the fish were exposed is highly uncertain. Burkhard (2009) recommended not mixing paired observations with different underlying conditions, because the resulting BAF would in all likelihood have poor predictive accuracy.

Specific differences between the EPA and BASF conceptual site models are addressed in the following paragraphs.

BASF's CSM contends that while the 2008 cover remedy lowers exposure to contaminated bed sediment, they hypothesize that the reason why there is still DDTR in the system is due to food-chain cycling of suspended particulate matter. BASF's hypothesis is not supported by the data. Surface water data was collected by Ciba in the early 1990s and again by BASF in 2016. Data is unavailable to support BASF's hypothesis that suspended sediments of high DDTR concentration were present in 2008.

There has been no evidence of a release from Ciba OU3 of highly-contaminated suspended sediments or flocculent in the surface water when water discharges after a flood. Contaminated suspended sediments retained in waterbodies during the non-flood seasons are diluted and washed away by floodwaters during flood seasons and are therefore not retained at high DDTR concentration at the site after a flood.

BASF has stated in their comments on the Proposed Ciba OU3 ESD that the BAF used by the EPA is not applicable because concentrations of DDTR in sediments of Cypress Swamp were

constant between 2010–2015 yet average concentrations measured in fish samples decreased during this period, which BASF interpreted as a decrease in bioavailability. However, factors other than a decreasing BAF, such as changes in lipid contents, fish age, sampling methodology, surface water concentrations, and environmental variables may affect fish tissue concentrations over the short term and in limited sampling sets. The decreasing concentrations of DDTR observed in Gambusia in Cypress Swamp between 2009 and 2011 could be influenced by the depuration process occurring in the fish, which can take approximately 2 years. However, a different collection of individual fish is sampled each year, since the Gambusia disperse throughout the floodplain during flooding conditions, and Gambusia are primarily exposed to the contaminated sediments in Cypress Swamp during annual low-water periods each summer. During this time, body burdens increase as fish are confined to pools in Cypress Swamp for longer periods. The decreasing concentrations in Gambusia observed between 2012 and 2016 are likely representative of decreased lipid contents observed during this period. The low lipids contents in fish collected by BASF in 2015–2016 may explain the decreasing DDTR concentrations observed in fish in Round Pond West (Figures A & B).

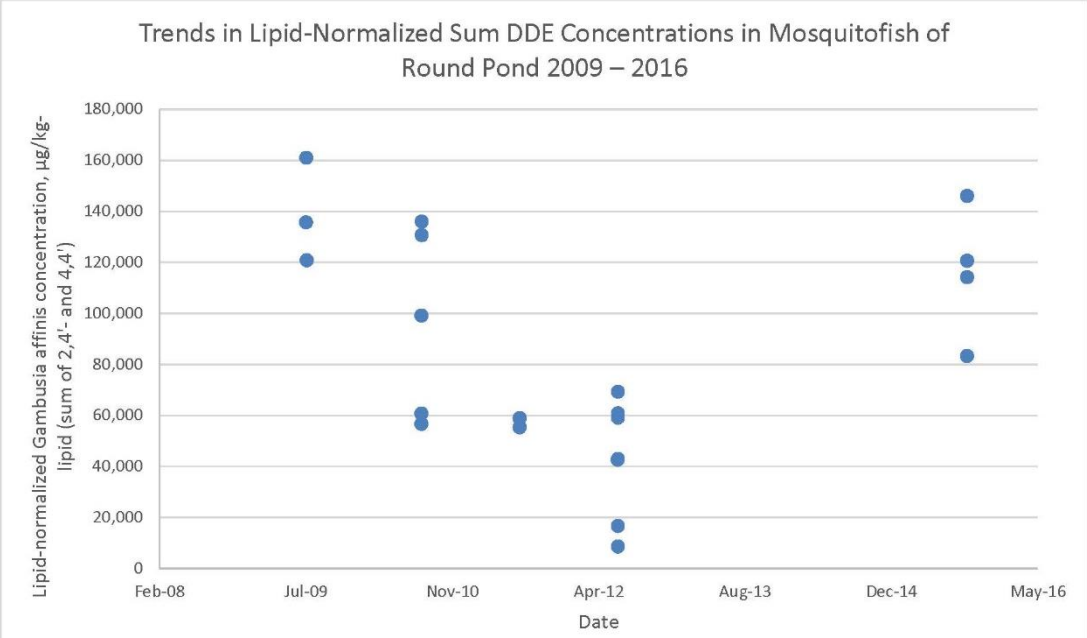


Figure A. Lipid-normalized concentrations of sum of 2,4'-DDE and 4,4'-DDE in Gambusia affinis of Round Pond West 2009-2016.

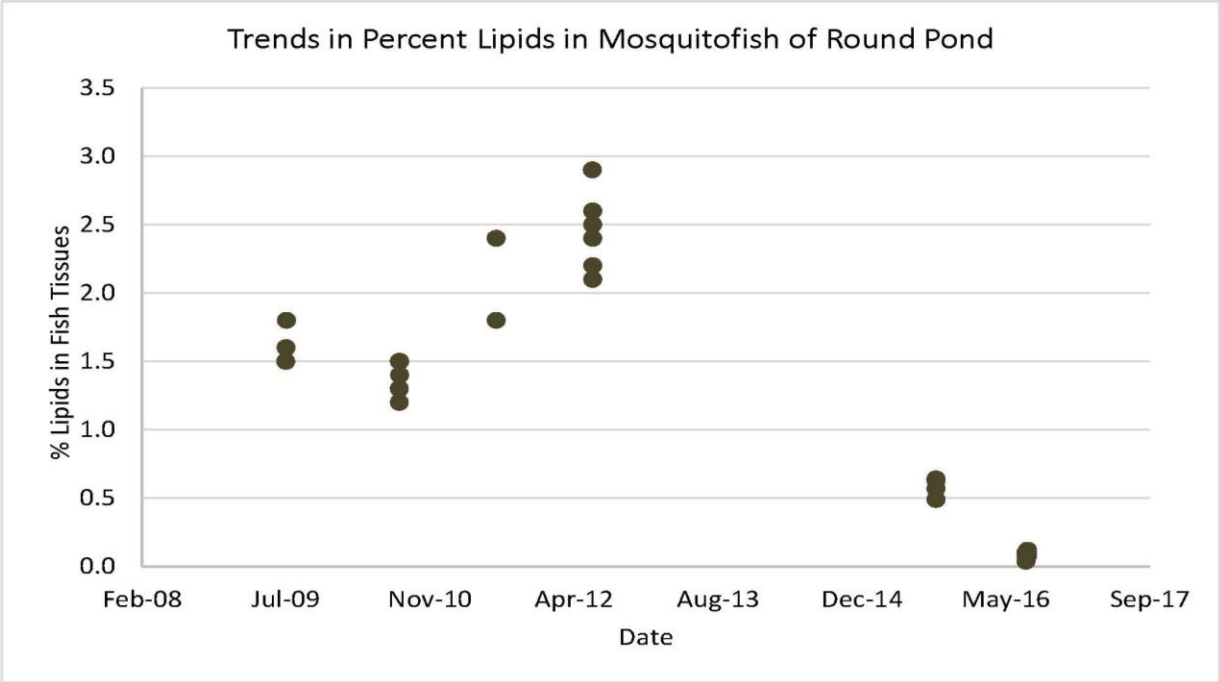


Figure A. Percentage lipids in tissues of Gambusia affinis in Round Pond (2009 - 2016)

Contamination still present in Cypress Swamp fish is due to the DDTR in the surface water and surface sediments, which are related to each other. The future concentrations in the fish are unlikely to decrease below levels observed in 2016 unless the DDTR concentrations in the surface water are reduced.

The EPA agrees that timing of sample collection is important. However, the EPA relates the importance to the number of weeks after fish are isolated in pools before samples were collected as well as the years since remedy construction. BASF's own pilot study of uptake of DDTR in Gambusia (LTI 2008) showed that clean fish purchased from a local vendor and held in cages in the 2008 Ciba OU3 ESD Focus Area for one week, had just as much DDTR in them as fish from Cypress Swamp. This study demonstrated that the uptake of DDTR in fish is rapid. Fish lose their body burdens within 2 years or less (Wang & Wang 2005). For example, the Ciba Gambusia monitoring performed in 2009 found that Gambusia lost 75% of their body burden between week 6 and week 14 when placed in DDTR-free media. Presumably depuration occurred when receding floods kept Gambusia from accessing contaminated sediments surrounding the 1998-remediated area of Cypress Swamp. Concentrations in fish and their eggs

will decrease within weeks as environmental exposures decrease. The EPA can estimate concentrations in fish from the local sediment and surface water concentrations. Additional fish tissue collection or a supplemental risk assessment is not necessary to fill data gaps before issuing the Proposed Ciba OU3 ESD. The current understanding of bioaccumulation in Gambusia is sufficient to develop a cleanup level, and no new samples of Gambusia are needed to understand DDTR bioaccumulation.

BASF contends in its comments that residual sources of DDTR in Ciba OU3, dispersing radially from historically elevated contaminant areas of Cypress Swamp, were suspended in the water column and not covered by sand in 2008 but are mobile and slowly diminishing over time, causing a steady decrease in the fish tissue concentrations throughout Ciba OU3. BASF attributed this source to lasting contamination in suspended sediments and eggs from long-lived fishes. BASF's hypothesis cannot be supported for the following reasons:

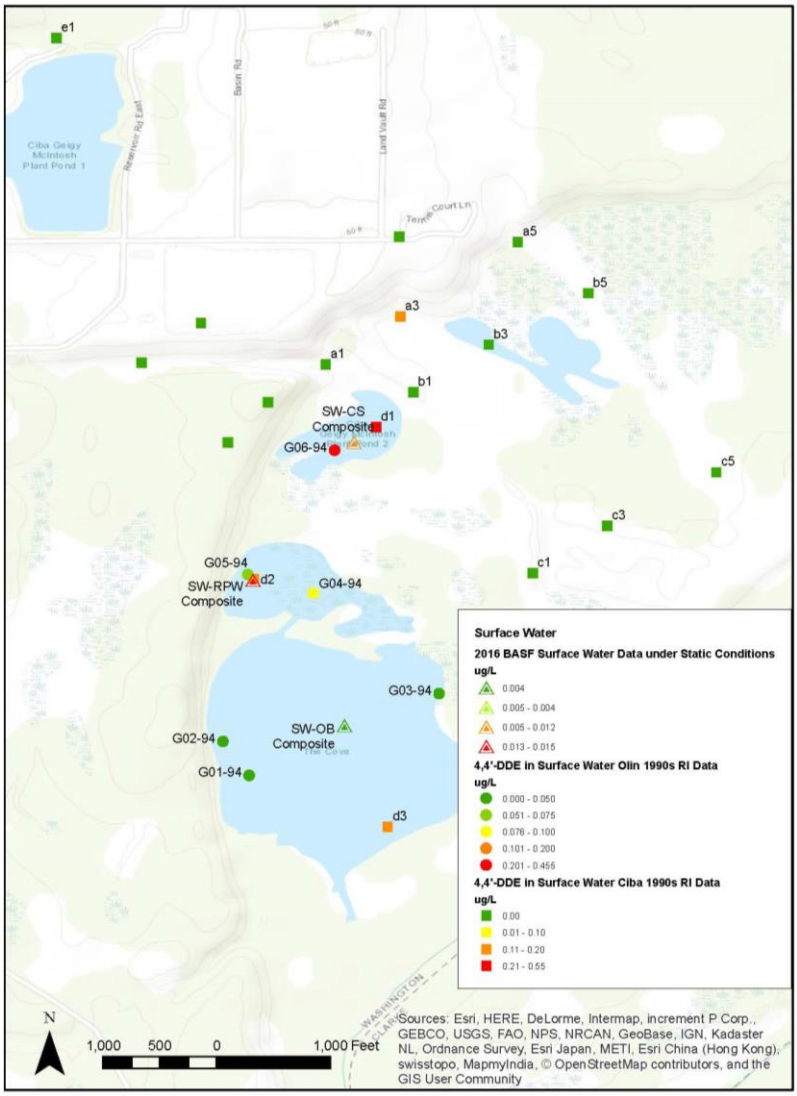
- *The mass of contaminants in suspended sediments and fish eggs is much less than the reservoir of contamination in sediment deposits.*
- *Concentrations on suspended sediments respond rapidly within days or weeks to changes in surface sediments and capping materials that are in dynamic exchange with concentrations in the water column. This fast exchange process cannot explain slowly decreasing concentrations in fish from 2009–2015.*
- *BASF indicated that the EPA should have considered the detritus/fluff layer. However, Gambusia do not ingest the detritus/fluff layer nor do their prey. A mechanistic model that considered the detritus/fluff layer would not explain observed trends in Gambusia.*
- *It is unlikely that fine suspended particles that were in the water column at the time the sand cover was placed are still present in the surface water today, due to the extensive flooding that occurs annually at the site.*
- *Adsorption of DDT to suspended sediments and biofilms is 63% as strong as adsorption of DDT to sediments deposits (Guo et al. 2012). Suspended sediments and biofilms do not harbor a large reservoir of contaminant mass relative to sediment deposits. Therefore, ingestion of sediments, detritus and algae, benthic invertebrates,*

eggs and larvae, and lower-trophic level fish have less effect on concentrations of DDTR in fish relative to uptake through respiration over the gills (Murphy and Murphy (1971).

- *Suspended sediments were not present in 2008, when the sand cover was installed, because the floodplain soils of the highly-contaminated source area were dry during sand cover installation.*

BASF's theory also cannot explain why fish tissue concentrations did not respond to the 1998 remedy. BASF's theory is remiss in addressing the concentration of DDTR detected in surface water and its role as a continuing source of DDTR contamination observed in fish. Surface water concentrations of DDTR and metabolites were measured in 1991-1994 by Ciba and Olin. The DDTR observed in surface water in the early 1990s was detected in Cypress Swamp, with decreasing concentrations observed downstream in Round Pond and in the Olin Basin. The pattern of higher to lower concentrations detected in surface water reflected the flow of water through the Ciba and Olin floodplains from Cypress Swamp to Round Pond, to Olin Basin, and ultimately to the Tombigbee River (Figure C). Figure C combines surface water data from Ciba and Olin's remedial investigations in the 1990s. BASF's 2016 surface water data representing static flow conditions in the main water bodies of the Ciba and Olin floodplains shows that DDTR was observed in surface water of Cypress Swamp. The early 1990s and 2016 surface water data indicate that DDTR surface water contamination observed in Cypress Swamp originates within the swamp itself versus coming from the BASF upland process area via the Ciba former effluent ditch.

Appendix E of the Final Basis of Design Report (LTI 2007) describes how engineers designed the thickness of the sand cover, and its organic amendment with wood chips, to prevent the elevated concentrations of DDTR in sediment porewater in the capped sediment from slowly spreading into the porewater at the surface of the sand cover over time. The cover was designed to prevent the upward movement of DDTR through the combined processes of molecular diffusion and mixing by local resuspension and burrowing activities of sediment-dwelling insects and worms inhabiting the top 6 centimeters of the sand cover. The 9-inch sand cover, for example, was designed such that the concentration in the



sediment porewater 100 years after placement of the sand cover was predicted by the fate and transport model described in the report to be only 0.0000549 µg/L. The sand cover, in theory, should prevent the DDTR concentrations in surface water from exceeding the ARAR for 4,4'-DDT of 0.0001 µg/L for 100 years. The detection of DDTR in surface water of Cypress Swamp in 2016 indicates that the sand cover is not performing as well as intended.

Figure B. Surface water concentrations of DDT and metabolites (DDTR) measured in 1991-1994 and reported in the Ciba and Olin respective remedial investigations compared to BASF 2016 surface water data.

It should be noted that fish tissue concentrations are also influenced by the concentrations of DDTR in the surface water. The observed concentrations in largemouth bass tissues were related to the observed concentrations in surface water in the 1990s and in 2016 to estimate the site-specific bioconcentration factor (Figure D). The bioconcentration factors of between approximately 100,000 L/kg-tissue and 50,000 L/kg-tissue observed in the 1990s and in 2016, respectively, are consistent with reported bioconcentration factors for DDT and its metabolites in the literature by Jarvinen et al. 1976, who reported a bioconcentration factor of 100,000 L/kg tissue. Due to the strong tendency for fish to take up DDTR into their tissues from DDTR in the surface water, it is important for the Ciba and Olin floodplains to reduce the concentrations in surface water in addition to meeting the cleanup levels in sediments in order to achieve the fish tissue performance goals provided in the Proposed Ciba OU3 ESD.

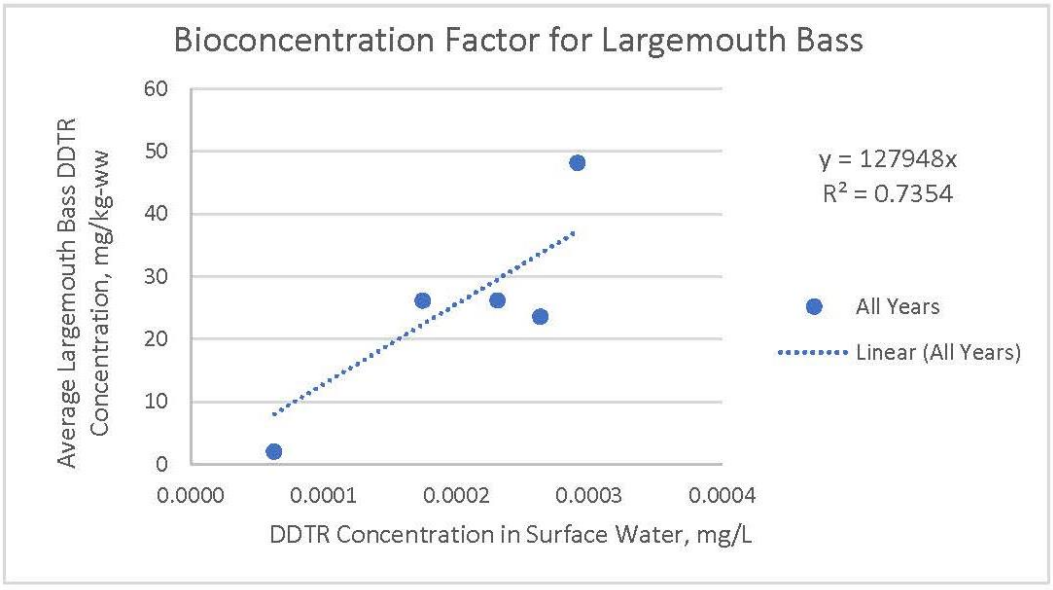


Figure D. Observed tissue concentrations in whole-body largemouth bass compared to concentrations of DDTR in surface water of the same water body where the fish were collected. The line through the data shows a bioconcentration factor of 127,948 L/kg-tissue, which was approximated as 100,000 L/kg-tissue for discussion purposes.

Comment Summary 6. BASF commented that Adaptive Management is the appropriate path forward to ensure remedy success without finalizing the sediment and soil cleanup levels in the ESD. (BASF Comment 2).

Response: *Adaptive management is not an appropriate framework for determining cleanup goals, as cleanup goals must be based on an evaluation of risk to receptors through complete exposure pathways. As detailed in the response to Comment #5, additional data collection will not significantly change the exposure and bioaccumulation assumptions used to derive the protective, risk-based cleanup levels, and thus it is appropriate to document those cleanup levels in the ESD.*

In April 2018, the EPA recommended that BASF participate in the EPA National Optimization Program's Remedy Optimization Review for the Ciba-Geigy Site. The Remedy Optimization Review is an independent study funded by the EPA that evaluates existing site data, discusses the conceptual site model (CSM), analyzes remedy performance, and provides suggestions for improving short and long-term monitoring at the site. BASF declined the EPA's proposed July 2018 site visit by the EPA HQs remedy optimization review team and independent technical experts. In August 2018, BASF instead submitted an Adaptive Management (AM) proposal for additional investigation and monitoring. In November 2019, the EPA met with BASF to discuss the Remedy Optimization Review and to date, BASF has not committed to participating in the optimization evaluation. The EPA believes the National Optimization Program is more appropriate for Ciba OU3.

"Adaptive Management is a formal and systematic site or project management strategy approach centered on rigorous site planning and a firm understanding of site conditions and uncertainties. This technique, rooted in the sound use of science and technology, encourages continuous re-evaluation and management prioritization of site activities to account for new information and changing site conditions." (OLEM 9200.3-120). AM approaches must comply with all regulatory requirements (e.g., CERCLA, the NCP, ARARs, the EPA policy and guidance).

BASF's proposed AM Plan does not demonstrate sound science and lacks understanding of AM principals described in OLEM 9200.3-120.

The 1995 Ciba OU3 ROD was written with an AM approach. As an example, the ROD states that if studies indicated that 15 ppm DDTR in soil/sediments is not protective then the final cleanup number would be adjusted. If the cleanup level was adjusted the public would be notified by a fact sheet, ESD or a ROD amendment.

As new information became available, the EPA and responsible party re-evaluated the cleanup strategy being implemented at Ciba OU3. The 1995 Ciba OU3 ROD remedy was modified in 2008 by an ESD to address the fact that the remedial goals were not being achieved in an acceptable period of time.

In Table 4-2 of the 2007 Final Basis of Design Report, prepared by Ciba Specialty Chemical for the 2008 Ciba OU3 ESD, information was presented that the sand cover (with an amendment) placed on top of Ciba OU3 floodplain areas with DDTR concentrations in soils and sediments above 15 ppm would result in a site-wide average concentration of 2.3 ppm or less. The average concentration of 2.3 ppm in soils/sediments was expected to achieve a fish-tissue performance goal of 1.5 ppm in Gambusia. However, the 2010 discovery of elevated DDTR concentrations in largemouth bass in the Olin Basin brought to the forefront the concern that DDTR biomagnifies in predatory fish, such that a lower fish-tissue performance goal (< 1 ppm) in Gambusia was necessary to protect predatory fish. The ecological risk assessment (ERA) conducted for Olin OU2 resulted in the adoption of a more conservative fish-tissue performance goal (0.64 ppm in bass) in the 2014 Olin ROD in order to protect predatory fish. To achieve the fish-tissue performance goal, the sediment cleanup goal necessarily became lower than what was documented in the 1995 Ciba OU3 ROD.

BASF's AM Plan proposes an arbitrary "trigger criteria" of 4 ppm DDTR in soil/sediment that is unprotective of ecological receptors. The ERAs for both Ciba OU3 and Olin OU2 determined soil/sediment cleanup levels must be below 1 ppm DDTR to be protective.

BASF's AM Plan proposes biota monitoring as the "bench mark" to measure remedy effectiveness but rejects use of protective, risk-based soil/sediment cleanup levels. The NCP requires cleanup levels be established for each exposure medium (soil, sediment, ground or surface water). Fish-tissue levels may be used to measure remedy performance but not used in lieu of media-specific cleanup levels.

BASF's AM Plan proposes grid-based soil/sediment sampling (1,600 samples) across the entire floodplain (including in Olin OU2), which is an unnecessary re-opening of remedial investigation/risk assessment activities. BASF's proposed sampling does not meet the EPA's overall site management objectives. An adequate sampling design must focus on remedy performance monitoring and include sampling to: (1) Identify/mitigate continuing sources of contamination to OU3 from OU2 and OU4; (2) Monitor/address potential DDTR transport through and/or erosion of the cover material; and (3) monitor to determine achievement of risk-based cleanup levels in all media.

The EPA disagrees with BASF's unsubstantiated assertion that the EPA's risk-based cleanup levels will require "ecologically disruptive remediation over a very large area" with costs to "exceed the thresholds" triggering National Remedy Review Board and the EPA Administrator review. Analysis of 2015-2016 BASF-collected data shows sediment/soil DDTR levels are at or close to risk-based cleanup target levels except in the former effluent ditch.

BASF's AM proposal does not adequately address the impact of surface water contamination on biota. Contamination still present in Cypress Swamp fish is likely due to the DDTR in the surface water and surface sediments, which are related to each other. The ARAR for surface water was identified in the 1995 Ciba OU3 ROD, but to date, there has been limited sampling of surface water at the Site. Surface water is a critical medium for exposure of biota to contamination and an important medium to evaluate long-term remedy efficacy and protectiveness. The future concentrations in the fish are unlikely to decrease below levels observed in 2016 unless the DDTR concentrations in the surface water are reduced. It is important to reduce the

concentrations in surface water in addition to meeting the cleanup levels in sediments to meet the fish tissue performance goals provided in the Proposed Ciba OU3 ESD.

Section V of the Ciba OU3 ESD will be clarified to explain how the cleanup levels, performance standards and ARARS are to be met. Determination of attainment of cleanup levels, performance standards, and surface water ARARs will be based on measurements of DDTR in sediment, floodplain soil, whole body forage fish (e.g. Gambusia) tissue, whole body predatory fish (e.g. largemouth bass) tissue, and surface water.

Sediment is defined at Ciba OU3 as areas that remain inundated for all or part of the year when the Tombigbee River is under base flow (i.e. non-flood) conditions when the only exchange of surface water with the Tombigbee River is through the former effluent ditch, and/or drainage through Olin Basin to the Tombigbee River. Soil is defined as areas of the floodplain that are inundated only during flooding of the Tombigbee River, and are not inundated during non-flood conditions.

The sediment and soil cleanup levels in this ESD are intended to be applied as "average" concentrations across areas representative of ecological exposure. Fish tissue performance standards are also intended to be applied as "average" concentrations across representative exposure areas within Ciba OU3. Surface water ARARs are to be applied as spatial and temporal averages in the surface water bodies of OU3 during non-flood conditions.

Representative sample locations and exposure areas for performance monitoring; specific decision rules for determining remedy success, compliance with ARARs, and attainment of cleanup levels and performance standards within specified limits of uncertainty will be specified in EPA-approved deliverables in accordance with the 1996 Ciba-Geigy OU3 RD/RA Consent Decree.

Sand cover performance monitoring will be required and the monitoring requirements for documentation of sand cover performance will be included in an EPA-approved deliverable in accordance with the Consent Decree.

The time frame for attainment of the revised cleanup levels, performance standards, and ARARs may be dependent on 1) further investigation in Ciba OU3 (as recommended in the Fourth Five Year Review); and 2) implementation of the Olin OU2 ROD. The need for any additional remedial action will be documented in an ESD or ROD Amendment, as appropriate.

Comment Summary 7. Descriptions and depictions of Ciba OU3 in the Proposed ESD are inaccurate and BASF's responsibility under the 1996 Consent Decree should include DDTR in all of Olin OU2 as within the definition of Ciba OU3. (BASF Comment 3). In particular, the comment states that the Ciba OU3 ROD "provides that the Site includes 370 acres of 'undeveloped swamp and bottomlands that comprise a portion of the Tombigbee River floodplain.'"

Response: *The comment does not accurately reflect the decision by the EPA on the remedial actions to be implemented under the 1996 Ciba-Geigy OU3 RD/RA Consent Decree (Consent Decree) embodied in the 1995 Ciba OU3 ROD, incorporated as Appendix A to the Consent Decree, and as modified by the 2008 Ciba OU3 ESD (2008 ESD). Nor does the comment accurately reflect the Ciba-Geigy "Site" definition, OU3 definition, and "Site" figures in the Consent Decree and 1995 Ciba OU3 ROD.*

The Consent Decree defines "Operable Unit Three" as "that Operable Unit at the Site (as defined below) which addresses contamination within the floodplain area of the Site and effluent ditch and which is identified in the ROD." CD Sect. IV (Definitions)(emphasis added). The Consent Decree defines the "Site" as "the Ciba-Geigy Superfund Site, encompassing approximately 2.4 square miles, located on the east side of United States Highway 43, northeast of McIntosh, Alabama in southern Washington County and depicted generally on the map attached as Appendix C." CD at Id. (emphasis added). The "Ciba-Geigy Corporation Plant

Site" map in Consent Decree Appendix C and Ciba OU3 ROD Figure 2-2 depict the "Site" boundary as the Ciba-Geigy property boundary. (Figure E below). In addition, the Ciba OU3 ROD "Site Map" depicts the "Floodplain" area and "Effluent Ditch" on the Ciba-Geigy Site as within the confines of the Ciba-Geigy property boundary. (Figure F below). As discussed in detail below, the only area the Ciba OU3 ROD specified as being within the scope of the selected remedy regardless of property boundary was the area designated as "Cypress Swamp." The Ciba (BASF) and Olin property boundary bisects Cypress Swamp.

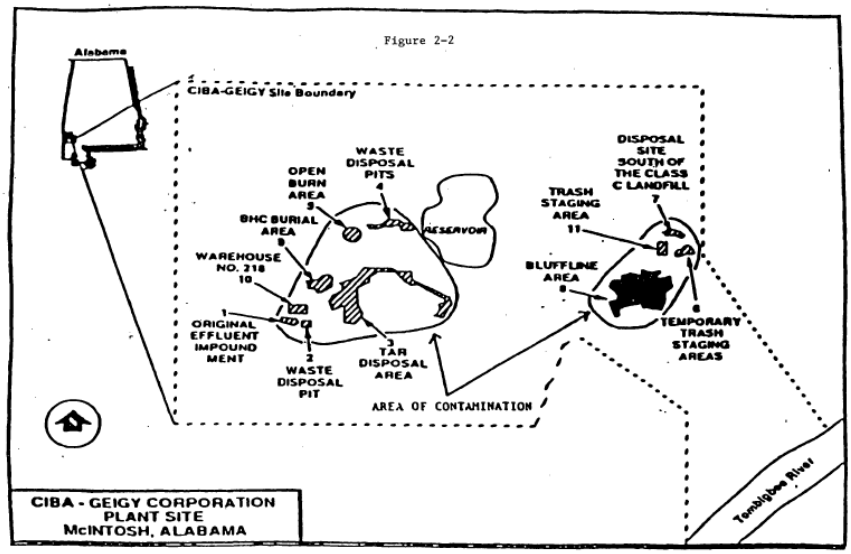


Figure E. Ciba-Geigy Plant Site -1995 Ciba OU3 ROD (Fig. 2-2) and Consent Decree Appendix C

BASF's comment refers specifically to text on page 1 of the Ciba OU3 ROD which describes the "Ciba-Geigy property," not the "Site." The Ciba OU3 ROD states: "The entire Ciba-Geigy property encompasses approximately 1,500 acres, of which 1,130 acres (2.4 sq miles) consists of developed plant site. The remaining 370 acres consists of undeveloped swamp and bottomlands that comprise a portion of the Tombigbee River floodplain. The floodplain is separated from the developed portions of the plant property by a steep escarpment known as the 'bluffline.'" ROD at 1 (emphasis added).

The acreage description of the "Ciba-Geigy property" in the Ciba OU3 ROD is not accurate. The error in acreage is also found in the Remedial Investigation/Feasibility Study Report Addendum for OU3 (Revised Nov. 1994), which describes OU3 as "that portion of the floodplain owned by Ciba-Geigy Corporation (370 acres), consists of undeveloped swamp and bottomland that comprise a portion of the Tombigbee River floodplain." FS Addendum, p. 2 (emphasis added). The OU3 FS Addendum notes that its "primary purpose . . . was to document the assessment of technology, development and detailed evaluation of potential alternatives for remediation of the floodplain area of the Mclntosh Superfund Site designated as Operable Unit No. 3." It is clear the intent of the FS and the Ciba OU3 ROD, when referring to the "floodplain" was in reference to that portion of the floodplain owned by Ciba-Geigy (BASF), and the "Cypress swamp" area. The EPA and the commenter agree that only approximately 170 acres of the "undeveloped swamp and bottomlands that comprise a portion of the Tombigbee River floodplain" are on the "Ciba-Geigy property" (now the BASF property). Neither Figure 2-2 or 2-3 in the Ciba OU3 ROD, nor Appendix C in the Consent Decree, depicting the Ciba-Geigy "Site" include any portion of the Olin property. Specifically, the "Site Map" depicted in Ciba OU3 ROD Figure 2-3 (Figure F below) marks the subject "floodplain" area as within the Ciba-Geigy (BASF) property boundary.

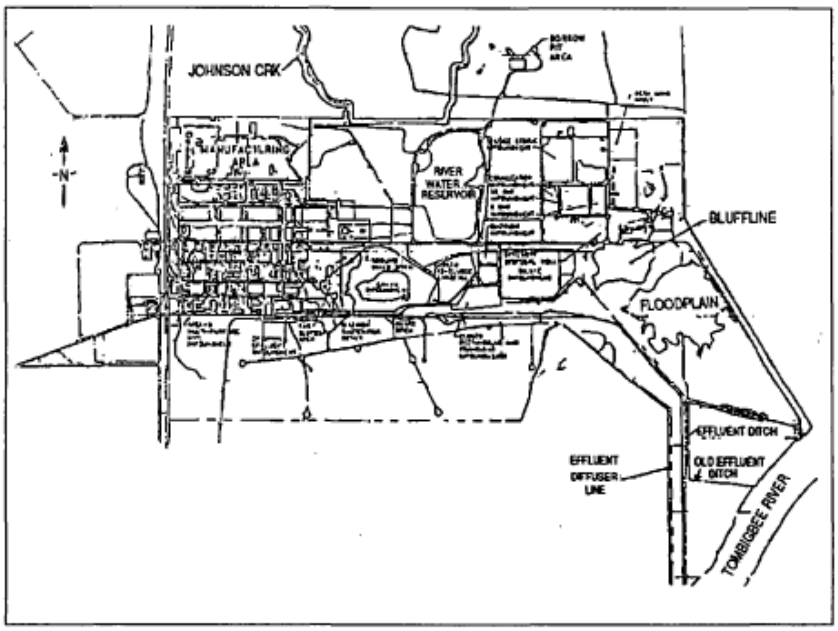


Figure F. 1995 Ciba OU3 ROD (Fig. 2-3 Site Map):

The Ciba OU3 ROD describes OU3 generally as "contamination with the floodplain, the effluent ditch (previously called the lower portion of the dilute ditch) and areas in the Tombigbee River within close proximity to the Site." However, the Ciba OU3 ROD then limits the scope of OU3 stating areas of "the Tombigbee River close to the Site will not be discussed in this operable unit because they are currently being addressed in the Mobile River Study." ROD at p. 11. The selected Ciba OU3 ROD remedy required to be implemented under the Consent Decree is described as addressing the upper end of the former effluent ditch in the vicinity of sample point B1, the approximate center of the open ditch in the vicinity of sample point C1, and "Cypress Swamp . . . with no consideration of property boundary." (ROD at pp. 54-55). Notably, other areas within the Olin property boundary, including Round Pond and Olin Basin, were not addressed by the Ciba OU3 ROD remedy. The Ciba OU3 ROD clearly distinguishes what it refers to as the "floodplain" area from "Olin Basin." In Section I (Site Location and Description) of the Ciba OU3 ROD, the "Ciba-Geigy floodplain" area is distinguished from "off-site" areas, including Olin Basin. Specifically, it states "the principal off-site aquatic habitats are the Olin drainage which includes a small cypress swamp, a connecting drainage way and associated depression, and Olin Basin, which is a lake occupying approximately 65

acres." (ROD at p. 4)(emphasis added). As previously stated, only Cypress Swamp was included in the selected Ciba OU3 remedy "regardless of property boundary." Section 6 of the Ciba OU3 ROD discussion regarding contaminants of concern further contrasts the "soil and sediment in the Ciba-Geigy floodplain" from sediments in the "Olin Basin" and treats these areas as separate geographic features.

The 2008 Ciba OU3 ESD addressed the previously un-remediated area it refers to as the "focus area" to the "south of the former effluent ditch and north of the Olin berm." The focus area does not include Olin Basin or Round Pond. BASF's depiction of Ciba OU3 in Figure 1 (Site Location Map) of BASF's 2014 Remedial Action Report identifies Ciba OU3 as that portion of the floodplain lying north of the Olin Berm and excluding Olin Basin and Round Pond, which is consistent with the EPA's descriptions and depictions of Ciba OU3 (Figure G).

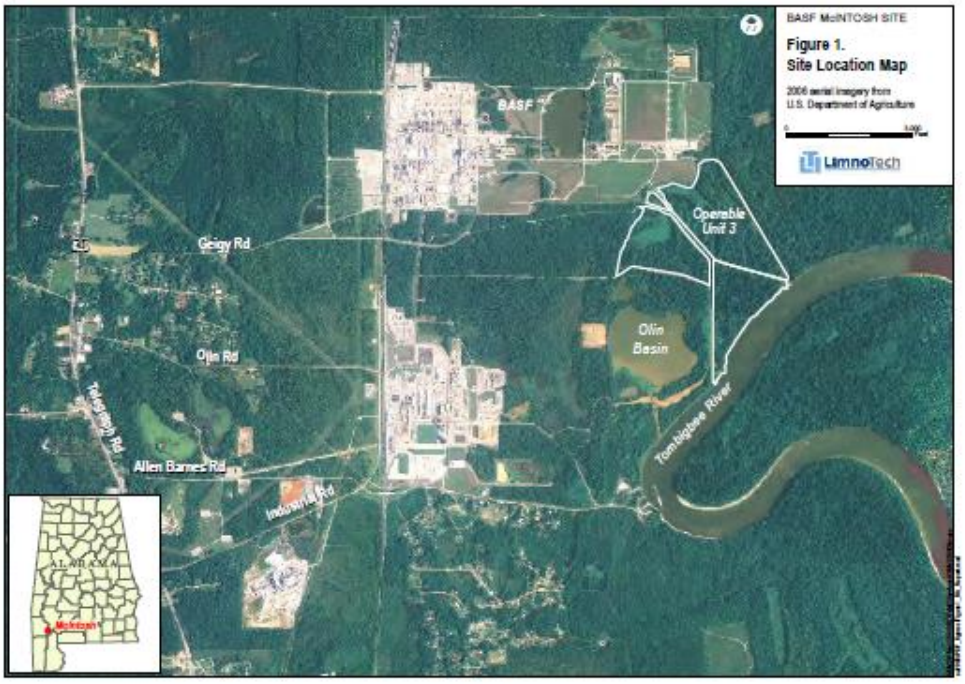


Figure G. 2014 Remedial Action Report, prepared for BASF Corp. (by LimnoTech)

Table 4.4 in the 2007 Final Basis of Design Report, prepared by Ciba Specialty Chemical for the 2008 Ciba OU3 ESD, states that the focus area is approximately 55 acres, with Ciba OU3

including a total of approximately 270 acres. The EPA has estimated that the sand cover in Ciba OU3 includes approximately 41.7 acres total (15.4 acres on Ciba (BASF) property and 26.3 acres on Olin property), with Ciba OU3 including a total of approximately 196 acres. Although the acreage descriptions provided in the site record are inaccurate and inconsistent among documents, the 1995 Ciba OU3 ROD, 1996 Consent Decree, 2008 Ciba OU3 ESD, and the Site figures included therein are clear in consistently excluding Olin Basin and Round Pond from Ciba OU3. The EPA has selected the remedy for the remaining areas within the Olin property boundary and Olin floodplain, including Olin Basin, to be carried out under the 2014 Olin OU2 ROD.

The NCP provides broad authority for the EPA to carry out response actions in operable units, defined in 40 CFR 300.5, to mean: "[A] discrete action that comprises an incremental step toward comprehensively addressing site problems. . . . The cleanup of a site can be divided into a number of operable units depending on the complexity of the problems associated with the site. Operable units may address geographical portions of a site, specific site problems or phases of an action, or may consist of any set of actions performed over time or any actions that are concurrent but located in different parts of a site." The operable unit divisions the EPA has selected to carry out the remedies in Ciba OU3 and Olin OU2 are reasonable based on site-specific considerations, including contaminants of concern locations and the different capping technology required for the co-mingled contaminants in Olin Basin as compared to the excavation and sand cover applications previously carried out in Ciba OU3.

Section III of the Proposed Ciba OU3 ESD will be clarified to accurately reflect the Consent Decree definitions and Ciba OU3 ROD descriptions of the Ciba "Site" and "OU3" as discussed in this response; and notes the correct acreage of the portion of the undeveloped Ciba OU3 floodplain owned by BASF as totaling approximately 170 acres.

Comment Summary 8. The ARAR for surface water should be the aquatic life AWQC, not the human health-based criterion. (BASF Comment 4). If the human health-based criteria are used,

they should be applicable to individual DDTR components (DDD, DDE, DDT), not the sum of the component isomers.

Response: *The human health-based criteria (for consumption of fish) for the individual isomers (4,4'-DDD; 4,4'-DDE; and 4,4'-DDT) will be applied as the more stringent ARARs. Table 1 in the Proposed Ciba OU3 ESD has been revised to reflect the standards for these individual isomers.*

Section 121(d) of CERCLA, as amended, specifies in part, that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate (i.e., ARARs) to the hazardous substances or particular circumstances at a site unless such ARAR(s) are waived under CERCLA Section 121(d) (4). See also 40 C.F.R. § 300.430(f)(1)(ii)(B).

Alabama Administrative Code (AAC) 335-6-10-.06 identifies the minimum conditions applicable to all Alabama state waters: "State waters shall be free from substances attributable to sewage, industrial wastes or other wastes in concentrations or combinations which are toxic or harmful to human, animal or aquatic life to the extent commensurate with the designated usage of such waters."

Human health criteria are applicable to all state waters, defined in AAC 335-6-10-.02(11) as "all waters of any river, stream, watercourse, pond, lake, coastal, or surface water, wholly or partially within the State, natural or artificial. This does not include waters which are entirely confined and retained completely upon the property of a single individual, partnership or corporation unless such waters are used in interstate commerce." Waters in Ciba OU3 are not entirely confined and retained upon the BASF property, and during flood stage become a contiguous part of the Tombigbee River, thus must conform to the criteria appropriate for the designated usage of the Tombigbee River. The designated use of the Tombigbee River from the Mobile River upstream to one-half mile downstream of the Norfolk Southern Railway Crossing is

"Fish and Wildlife" (AAC 335-6-11-.02(15)), where the best usage of the water is defined as "fishing, propagation of fish, aquatic life, and wildlife" (AAC 335-6-10-.09(5)). Because fishing is designated as a best usage, human health criteria based on consumption of fish are applicable to Ciba OU3 waters.

AAC 335-6-10-.07 (Toxic Pollutant Criteria Applicable to State Waters) specifies, in part, that: (1) The U.S. Environmental Protection Agency has listed the chemical constituents given in Table 1 [of this chapter] as toxic pollutants pursuant to Section 307(a)(1) of the Federal Water Pollution Control Act (FWPCA). Concentrations of these toxic pollutants in State waters shall not exceed the criteria indicated in Table 1 to the extent commensurate with the designated usage of such waters. (d) Except as noted in Table 1, two human health criteria are provided for each pollutant--a criterion for consumption of water and fish, and a criterion for consumption of fish only. 2. For pollutants classified by the U.S. Environmental Protection Agency as carcinogens, the criteria shall be given by the following equations, except where numeric values are given in Table 1. (e) The criteria given in Table 1 for consumption of fish only or computed from equation 17 or equation 19 for consumption of fish only, shall apply to all waters of the State.

Per Table 1 in AAC 335-6-10, the standards for 4.4'-DDD; 4,4'-DDE, and 4,4'-DDT (for consumption of fish) are computed from Eq. 19. Table 1 in the Proposed Ciba OU3 ESD will be revised to include the computed values, which are consistent with those provided in the Olin OU2 ROD.

Comment Summary 9. The proposed changes to the remedy are fundamental and require a ROD Amendment (BASF Comment 6). The proposed ESD states that the "EPA anticipates these RAOs can be met without changing the remedial alternatives implemented in the 1995 ROD and 2008 ESD." It is not clear how the lower remedial goal options (RGOs) can be met without changes. Further explanation is needed. (Olin Specific Comment 3).

Response: *The proposed changes are not "fundamental" and do not require a ROD Amendment. The Proposed Ciba OU3 ESD memorializes the risk-based cleanup levels [i.e. the "RGOs" referenced in the comment] and ARARs, and clarifies RAOs; however, it does not require a fundamental change to the selected remedies in the 1995 OU3 ROD or 2008 ESD (i.e., excavation and sand cover application), or a significant expansion of the remedial footprint.*

Moreover, the 1995 Ciba OU3 ROD gave flexibility to modify cleanup levels based on further studies. Based on data collected subsequent to the implementation of the sand cover in 2008, sediment and forage fish tissue in certain areas of Ciba OU3 are close to meeting the RAOs and numeric cleanup levels specified in the Proposed Ciba OU3 ESD. Further focused source control efforts in upland soil areas if necessary and in the effluent ditch, together with evaluation of transport through the emplaced sand cover should allow achievement of RAOs without additional widespread floodplain remediation. If additional remediation is needed in these areas it can be accomplished with the issuance of an ESD because the additional remediation is consistent with the previously selected remedies and would differ "significantly," but not "fundamentally," from the selected remedies with respect to scope, performance or cost. 40 C.F.R. 300.435(c)(2)(i).

Significant Changes generally involve a change to a component of a remedy that does not fundamentally alter the overall cleanup approach. Examples of significant changes, such as included in the Proposed Ciba OU3 ESD, may include changes in cleanup levels or ARARs because the existing cleanup level is no longer protective. Although this new requirement may significantly change the remedy (i.e., cleanup level, timing, volume, or cost), it will not fundamentally alter the remedy specified in the Ciba OU3 ROD or 2008 Ciba OU3 ESD (i.e., the selected technology will not change) and it will not impact the level of protection (i.e., risk reduction) that the remedy will provide.

Fundamental Changes involve an appreciable change in the scope, performance, and/or cost, and result in a reconsideration of the overall waste management approach selected in the original ROD. (See "A Guide to Preparing Superfund Proposed Plans, Records of Decision, and

Other Remedy Selection Decision Documents," EPA OSWER 9200.1-23P, July 1999). The Proposed Ciba OU3 ESD does not result in a reconsideration of the overall waste management approach selected in the Ciba OU3 ROD or 2008 Ciba OU3 ESD.

Comment Summary 10. BASF provided a red-line markup of the proposed ESD with suggested wording changes.

Response: *The EPA gave full consideration to the suggested wording changes. Suggested wording changes that were not incorporated into the ESD were omitted for reasons discussed in the responses to Comment Summaries 1 through 9.*

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Appendix A
Ciba-Geigy OU3 Explanation of Significant Differences
Responsiveness Summary

Department of Interior
U.S. Fish and Wildlife Service
Deepwater Horizon NRDAR Field Office
341 Greeno Road North, Suite A
Fairhope, Alabama 36532
Phone: 251-929-0168 Fax: 251-929-3440

December 18, 2018

Ms. Beth Walden
Ciba NPL Site Remedial Project Manager
U.S. Environmental Protection Agency, Region IV
61 Forsyth Street, S.W.
Atlanta, GA 30303

Dear Ms. Walden,

We appreciate the opportunity to review the proposed Explanation of Significant Difference (ESD) for the Ciba-Geigy Corporation Superfund Site (Ciba Site) Operable Unit 3 (OU3) Record of Decision (ROD). Among other things, the ESD proposes to change the risk-management based soil/sediment cleanup level established in the 1995 ROD to a risk-based cleanup level. The ESD also proposes to modify the fish tissue performance standard.

As you are aware, the U.S. Fish and Wildlife Service (Service) has long been concerned about the potential for contamination on the Ciba Site to adversely affect fish and wildlife. Resources at risk not only include natural resources on the Ciba Site, but also aquatic organisms, wildlife, and habitat quality in the ecologically and economically important Mobile-Tensaw River Delta downstream of the Site. The Service has expressed concern on several occasions that the risk management-based soil/sediment cleanup level, 15 parts per million (ppm), in the 1995 ROD is not protective of fish and wildlife on or downstream of the Ciba Site. In 1999, the Service's Environmental Response Team conducted a risk-based assessment for the Ciba Site which determined that the threshold for adverse effects for total DDT (DDT plus and its metabolites DDD and DDE) in sediment ranged between 0.03 and 0.2 ppm (USFWS 1999). The Service has since advocated for a sediment cleanup goal in this concentration range. Accordingly, we strongly support the proposed change to risk-based soil/sediment cleanup levels proposed in the ESD. The levels proposed should promote the protection of fish, wildlife, and habitat quality.

The Service has also expressed concern that the performance standard for fish tissue was not protective of fish or fish-eating wildlife. Beckvar et al. (2005) identified an adverse effects threshold for DDT ranging between 0.6 to 0.7 ppm in whole body fish. DDT concentrations exceeding this threshold were detrimental to fish health and survival. To protect piscivorous wildlife the New York State Department of Environmental Conservation adopted 0.2 ppm as a criterion for DDT in fish (Nowell et al. 1999). These levels are again similar to the risk-based

levels proposed for the Ciba Site. Again, we support the proposed changes to the performance standard for fish tissue.

We appreciate the opportunity to review the ESD for the Ciba Site. Please contact me at (251) 928-2037 if you have questions regarding these comments.

Sincerely,

Peter Tuttle
Lead Administrative Trustee
South Alabama NRDA

cc:
Commissioner, Department of Conservation and Natural Resources, Montgomery, AL
State Geologist, Geological Survey of Alabama, Tuscaloosa, AL
Regional Resources Coordinator, National Oceanic and Atmospheric Administration,

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.

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Office of Response and Restoration
Assessment and Restoration Division
263 13th Avenue South
St. Petersburg, FL 33701

MEMORANDUM

TO: Beth Walden, EPA RPM

FROM: Michel Gielazyn, Ph.D., NOAA RRC

SUBJECT: NOAA Comments on EPA Explanation of Significant Differences, October 2018

DATE: December 20, 2018

CC: Peter Tuttle, FWS

The U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA) appreciates the opportunity to comment on Explanation of Significant Differences for the Ciba-Geigy Corporation Superfund Site, McIntosh, Alabama, prepared by US EPA, October 2018. If you have any questions, please contact Michel Gielazyn, Ph.D., NOAA RRC, at 727-551-5771, michel.gielazyn@noaa.gov.

NOAA concurs with the conclusions of the subject document, the clean-up levels for the Ciba Operable Unit 3 (OU3) floodplain need to be risk-based and ecologically protective.

NOAA concurs with the "Description of significant differences and basis for the ESD" outlined in the subject document. NOAA has previously expressed concerns that the management decision clean up sediments in the Ciba floodplain to 15ppm DDTr (DDTr = DDTr (DDTr = p,p'DDT + o,p'DDT + p,p'DDD + o,p'DDD + p,p'DDE + o,p'DDE) was not protective of ecological receptors (e.g., NOAA 2007). The range of sediment Remedial Goal Options presented in the Record of Decision (ROD) (EPA 1995) was 0.04 to 3.76 ppm DDTr. And, as stated in the ROD, "For the majority of the scenarios considered, in order to achieve a HQ of 1 or less, the concentration of DDTR in the floodplain must be no greater than 1 ppm". This goal was based on the Ecological Risk Assessment prepared for and accepted by EPA (Roy F. Weston, Inc. 1994). At the time the ROD was written, there were concerns about destruction of habitat if floodplain

sediments were cleaned-up to 1ppm DDTr, as the subject document states, this is no longer a concern. In conclusion, NOAA supports risk-based ecologically protective DDTr clean-up levels and performance standards as outlined in Table 1 of the subject document.

References

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December 14, 2018

Via E-Mail: walden.beth@epa.gov

Ms. Elizabeth Walden
Remedial Project Manager
Superfund Remedial Branch
U.S. Environmental Protection Agency Region 4
61 Forsyth Street, S.W.
Atlanta, GA 30303-3104

Subject: Comments on the Proposed ESD
Ciba-Geigy Superfund Site, McIntosh, AL
Operable Unit No. 3, EPA I.D. No. ALD001221902

Dear Ms. Walden:

BASF is writing to provide comments on the Proposed ESD for the Ciba-Geigy Superfund Site Operable Unit (OU) No. 3. As you are aware, BASF has previously expressed concern about several items included in the ESD – particularly, the soil and sediment cleanup levels, procedural issues in the adoption of those levels in Olin OU2 ROD, and the overlap of BASF OU3 and Olin OU2. For ease of reference, BASF is attaching the correspondence in which those concerns were previously expressed. Additionally, on December 12, 2018, we provided proposed revisions to the ESD that would allow a collaborative path forward – that document is also attached. The full list of attachments is provided at the end of this cover letter and those are incorporated by reference into BASF's comments on the Proposed ESD for OU3.

The main body of this communication provides a technical justification for the proposed ESD revisions we provided last week. Based on our recent meetings and correspondence regarding Remedy Optimization and Adaptive Management, we believe that BASF and EPA can reach an agreement on the right approach to ensure a protective remedy in the floodplain. However, we believe it is critical that the language in the ESD reflects the agreement that the biota performance standards should be the determinant of remedy success, and that it preserves the flexibility to move forward using Remedy Optimization and Adaptive Management concepts without locking in unnecessarily low and arbitrary sediment and soil cleanup levels.

BASF remains committed to ensuring the protection of the floodplain ecosystem. We believe that the minor changes we have suggested to the proposed ESD will allow us to develop a collaborative path forward that builds on the recent recommendations of the Superfund Task Force (USEPA, 2018b).

Absent these recommended changes, BASF feels we will be locked in to a remedy approach that could cost upwards of $50 million although the biota, which the Agency has agreed is the determinant of remedy success, are very close to meeting the performance goals and continue to trend in that direction. Further, the changes proposed in the ESD as drafted are of a magnitude in cost and scope that they constitute a "fundamental change" requiring a ROD amendment. Finally, BASF cannot agree to the redefinition and narrowing of the geographic extent of BASF's obligations under OU3, which is fundamental to BASF's obligations under the Consent Decree, and our contribution protection and covenant not to sue from the Agency. Unless these issues are satisfactorily addressed we will have no option but to invoke dispute resolution. We are optimistic based on recent communications that this will not be necessary.

We look forward to moving forward and achieving our shared goals. Please do not hesitate to contact me if there is anything you need.

Sincerely,

Stephen K. Havlik
Senior Remediation Specialist

cc: Austin Pierce, ADEM

Attachments:

BASF Comments on Olin OU2 Proposed Plan. June 20, 2013.
Letter to Lisa Ellis from Laurel Lockett clarifying overlap between BASF OU3 and Olin OU2. April 29, 2015.
Letter from Steve Havlik to Beth Walden to express concern regarding application of Olin OU2 goals to BASF OU3. December 21, 2017.
Letter from Steve Havlik to Beth Walden presenting Adaptive Management Plan for OU3 Floodplain. August 9, 2018.
Letter from Steve Havlik to Beth Walden Response to Technical Comments. August 10, 2018.
Letter from Doug Reid-Green to Randall Chaffins with Proposed ESD Revisions. December 13, 2018.
Statutory Warranty Deed, #464, page 237, Entry 64527, public records of Washington County, Alabama

Comments on Proposed ESD for the Ciba-Geigy Superfund Site

Introduction

On October 16, 2018, EPA Region 4 (R4) notified BASF they had issued a proposed Explanation of Significant Differences for Operable Unit 3 (OU3) of the Ciba-Geigy Superfund site in McIntosh, Alabama. The original Record of Decision (ROD) for OU3 was issued in 1995. The sediment and soil cleanup level for DDTR in the ROD was 15 mg/kg, and a performance goal for *Gambusia* tissue of 1.5 mg/kg to protect wading birds was established during the initial remedy design phase (documented in Ciba, 1998). BASF has performed two remedial actions to address DDTR in the floodplain: an excavation remedy in 1998 and a cover remedy in 2008. Following the two remedy events, the sediment and soils in the floodplain are far below the original 15 mg/kg goal, and due to a 99% reduction in tissue concentrations, the *Gambusia* are meeting the DDTR performance goal throughout the entire floodplain (OU3).

The proposed ESD issued by EPA R4 includes new biota performance standards and sediment and soil cleanup levels to protect predatory fish and insect-eating birds, as well as surface water ARARs. BASF has five general comments on the proposed ESD:

Comment #1: The sediment and soil cleanup levels are too uncertain to be included in a decision document at this time.

While BASF understands that EPA R4 believes an ESD is needed to document that the original 15 mg/kg goal for sediment and soil is not protective, we do not agree an ESD that includes the sediment and soil cleanup levels from the Olin OU2 ROD is needed to be protective. However, the proposed sediment and soil cleanup levels are far too uncertain to be included in a decision document at this point and should only be included as interim cleanup levels, if at all.

Comment #2: Adaptive Management is the appropriate path forward to ensure remedy success without finalizing the sediment and soil cleanup levels in the ESD.

A structured Adaptive Management program, an approach currently promoted by EPA for achieving remedy success at Superfund Sites, will prevent unacceptable risk to human health and the environment without immediately assuming that remediating to highly uncertain sediment and soil cleanup levels will be required. We understand that EPA agrees that biota tissue levels are the primary determinant of remedy success, and that soil and sediment cleanup levels can be adjusted to reflect actual conditions once biota have reached the biota performance goals. The Agency has indicated that the provisions at the end of Section V were intended to provide the flexibility to address this concern. However, the ESD as drafted, does not clearly articulate that approach.

Comment #3: The description of OU3 in the proposed ESD is ambiguous and depictions of OU3 in the figures are inaccurate. The ESD should clearly state that BASF has responsibility for DDTR throughout the entire floodplain, consistent with the OU3 Consent Decree and the Agency's interpretation of BASF's obligations under the OU3 Consent Decree since execution in 1996.

The scope of BASF's obligations under the OU3 Consent Decree define BASF's rights to contribution protection under the Decree, as well as BASF's covenant not to sue from EPA. Millions of dollars of work, both investigative and remedial, have been performed by BASF in the floodplain, including on property owned by Olin, since the Consent Decree was executed, and it is improper to issue an ESD that now attempts to redefine, and limit the area of BASF's obligations. In fact, both the original ROD as well as the 2008 ESD specifically contemplated remedial work that has been performed on the Olin Property.

While the narrative description of OU3 (370 acres) in the ESD is consistent with the BASF understanding of its responsibilities related to DDTR as well as historical agency action under the Consent Decree (that is, that BASF is obligated to address all DDTR in the Tombigbee floodplain on and adjacent to the BASF property), the figures show a boundary of OU3 north of the Olin Berm. The ESD should be clear that the "370 acres" comprises approximately 170 acres in the floodplain owned by BASF and approximately 200 acres in the floodplain owned by Olin. BASF wants to ensure that its statutory protections under the Consent Decree are not undermined by the description and figures contained in the ESD.

Further, the figures attached to the proposed ESD depicting EPA's proposed extent of OU3 do not even correctly reflect the boundaries of the BASF property at the time that the Consent Decree was issued. Specifically, at that time, BASF owned approximately 8 acres immediately west of the north-south section of effluent ditch that was conveyed to Olin in September 2006 by BASF's predecessor, Ciba Specialty Chemicals Corporation. (See Statutory Warranty Deed, #464, page 237, Entry 64527, public records of Washington County, Alabama, a copy of which is attached hereto). BASF's proposed edits to the ESD clarify that the OU3 Consent Decree applies to the entire floodplain.

Comment #4: The freshwater chronic aquatic life criteria is the appropriate ARAR for surface water.

The surface water ARAR included in the proposed ESD is based on human health risks resulting from frequent (once per week) fish consumption from the site. BASF and Olin both have 24 hour security to prevent trespassing on their properties and fishing is not allowed. BASF's RCRA permit also has specific requirements restricting access to the site. Signage is posted above high-water mark stating No Trespassing at the River. Surveillance cameras are installed at the river and monitored around the clock. Security tours are conducted daily to the water's edge, and BASF and Olin share all information regarding floodplain security.

Comment #5: The performance standard that drives sediment remedial decision-making should be based on DDTR effects in piscivorous birds.

The science regarding DDTR effects on birds is much better established than the science related to DDTR effects in fish. There are relatively few studies of DDTR effects in fish and several of the studies are of notably poor quality. Conversely, hundreds of studies have been performed to evaluate DDTR effects in birds (USEPA, 2007).

EPA R4 and BASF share the common goal of implementing a remedy for entire OU3 floodplain that is protective of public health and the environment. With minor modifications to the ESD, there is a clear path forward to achieving the goal. BASF has provided proposed revisions to the ESD in an earlier submittal and as an attachment to this document.

Comment #1: The Sediment and Soil Cleanup Levels are Too Uncertain to be Included in the ESD

The development of sediment and soil cleanup levels to protect ecological end-receptors based on bioaccumulation factors (BAFs) is an inherently uncertain process. Food-web models designed to predict such accumulation factors include large numbers of variables including physical parameters of the contaminant, organic carbon concentration, organic carbon type, temperature, available food species, gill ventilation rates, incidental soil ingestion rates, etc. Many of these factors can vary widely, even over a relatively small site. Attempts to measure accumulation rates in the field have varied over large ranges. Borga et al. (2010) have noted variations of 1 to 3 orders of magnitude in accumulation rates for the same contaminants in the same species. Despite this uncertainty, it is not uncommon to use BAFs to calculate cleanup levels.

EPA used a traditional approach to develop sediment and soil cleanup levels for the Olin OU2 ROD and is proposing the adoption of those cleanup levels. First, EPA determined the threshold DDTR concentrations for biota that are likely to cause ecological effects, and determined that predatory fish and insect-eating birds were the most sensitive ecological receptors. Second, EPA back-calculated the sediment and soil values needed to achieve the protective levels of DDTR in predatory fish and insect-eating birds by developing BAFs using site-specific data.

While BASF disagrees with the biota performance standards that are proposed for the reasons outlined in comment #5, BASF believes that the selected biota performance standards for predatory fish and insect-eating are achievable. However, the back-calculation of the sediment and soil levels has yielded values that are so low that they cannot be achieved without substantial additional remediation that would be ecologically disruptive and cost upwards of $50 million dollars.

BASF has two overarching concerns with the incorporation of the highly uncertain sediment and soil cleanup levels into the ESD:

- BASF has a fundamentally different understanding than EPA of the Conceptual Site Model (CSM) as it relates to the biota exposures to DDTR. In short, multiple exposure pathways acting over varying exposure areas and durations contribute to the biota DDTR levels. Using a regression based only on soil/sediment:biota

sample pairs and assuming small exposure areas ignores the influence of the former high-sediment concentration area, inflates the calculated accumulation factors, and leads to unnecessarily low cleanup levels.

- Even using a traditional approach to determining soil/sediment:biota BAFs, developing the models that relate soil or sediment to biota is a highly subjective process. Different decisions regarding which data to use, how the data are normalized, and the functional form of the relationship can all have substantial effects on the modeled relationship. These differences can result in calculated sediment and soil cleanup levels that vary by factors of five or more.

Differences in Conceptual Site Models

The EPA approach to developing sediment and soil cleanup levels implicitly assumes that the DDTR in biota is all related to the local sediment concentrations. It assumes that all exposure sources are in equilibrium with the very local sediments where the target species is collected. Under the BASF CSM, DDTR exposures are from multiple sources acting over varying exposure areas and timeframes, which are not necessarily in equilibrium with the sediments where the sample is collected. For example, exposures to aquatic organisms would include **(Figure 1):**

- Direct absorption from the water column,
- Incidental sediment ingestion,
- Ingestion of detritus and algae,
- Ingestion of benthic invertebrates,
- Ingestion of eggs and larvae, and
- Ingestion of lower trophic-level fish.

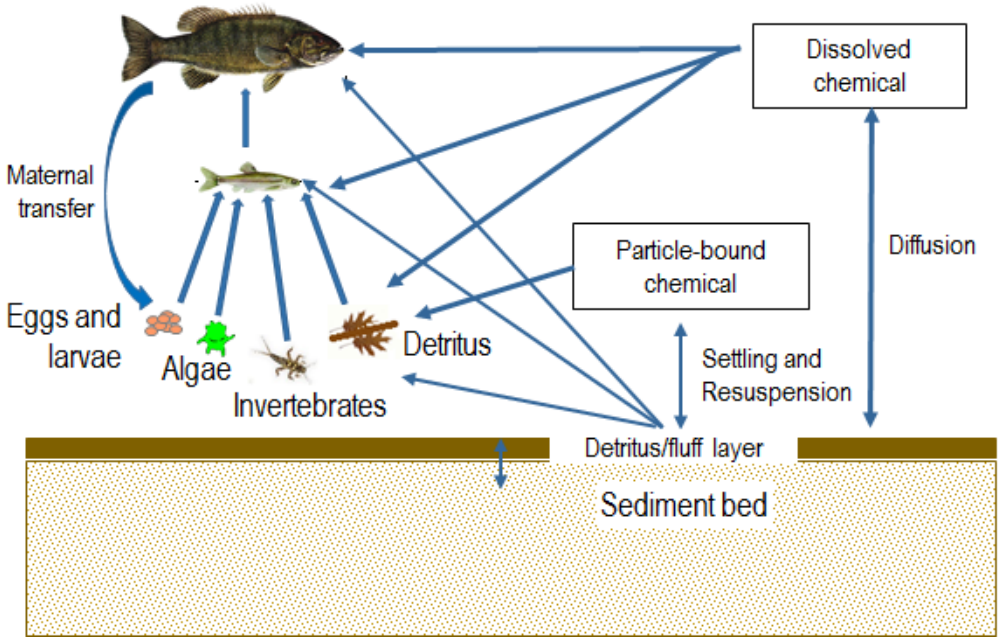

Figure 1. DDTR exposures for fish in McIntosh floodplain.

These exposure pathways have widely varying areas of influence (**Figure 2**):

- Direct sediment exposures are largely limited to home range of the fish.
- Dissolved chemical exposures extend to the water column mixing zone, which is dependent on water level and hydraulic connectivity. Following hydraulic disconnection, the mixing extent is largely limited to the extent of the individual water body.
- Detritus and algae are light and easily transportable – the exposures are estimated to extend throughout the floodplain, with the highest exposures closest to the highest concentration sediment.
- Food chain exposures extend to the limit of home range of species that contribute to the food supply of forage fish (directly or through eggs and larvae).

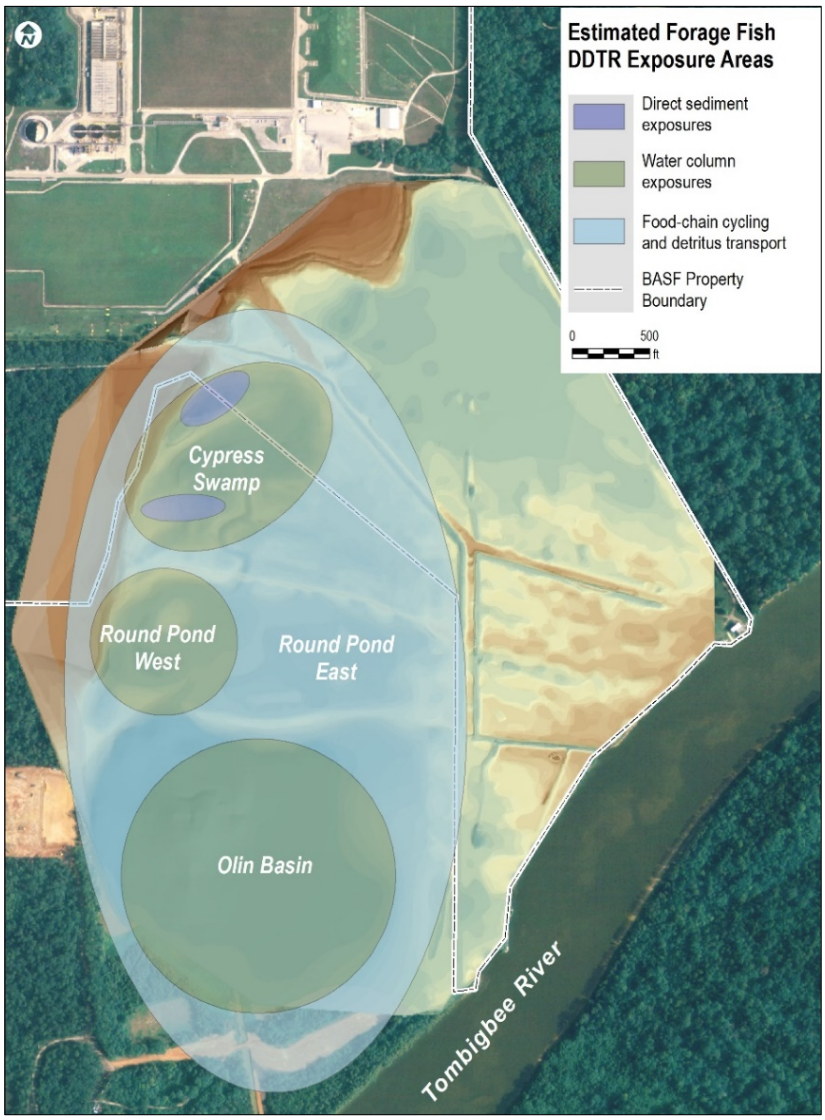

Figure 2. Estimated spatial extents of DDTR exposures for forage fish in McIntosh floodplain.

- These exposure pathways also have different timeframes over which they would reach equilibrium with the sediments following a remedial action:
    - Direct sediment exposures would drop off rapidly following cover installation
    - Dissolved chemical exposures would be expected to drop off rapidly following cover installation.
    - Detritus exposures in the covered area would decrease immediately following cover installation. However, detritus from the high-sediment-concentration area that was transported outside of the high-sediment-concentration area prior to the remedy could continue to influence biota exposures over several years.
    - Food chain exposures would be expected to continue for many years as the DDT is cycled from fish to larvae and back up the food chain.

The site-specific data support the larger exposure areas implied by the BASF CSM. The DDTR in biota collected outside of the covered area has declined in response to the cover action, including in forage fish, indicating larger exposure areas than the home range of the target species.

Gambusia samples were collected in Round Pond West and Round Pond East each year from 2009 to 2012, until the DDTR levels were below the 1.5 mg/kg performance standard for three straight years. They were collected again in 2015 in both water bodies and in 2016 only in Round Pond West. Both of the Round Ponds are outside of the covered area**. Figure 3** shows the mean DDTR concentrations in *Gambusia* since 2009. The *Gambusia* in Round Pond East started at 0.82 mg/kg and are now at levels below detection limits, suggesting that essentially all of the DDTR exposure in *Gambusia* in Round Pond East came from the area now covered. The *Gambusia* in Round Pond West started at a higher level (2.7 mg/kg) and have declined at a slower rate. Additionally, the DDTR levels varied widely between the samples collected in in 2015 and 2016. These results suggest that the cover remedy helped lower DDTR exposures in Round Pond West, but that local DDTR may also be influencing *Gambusia* body burdens.

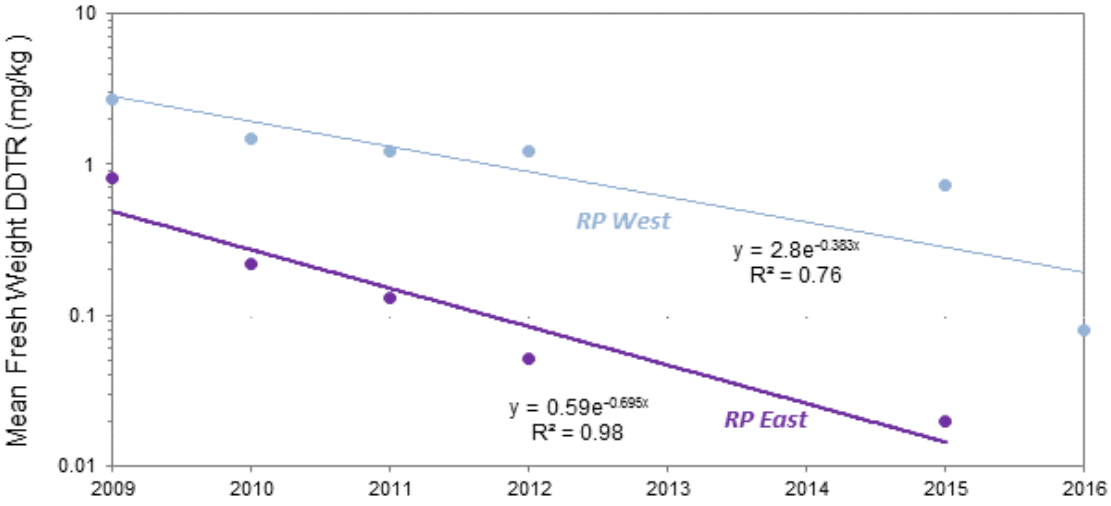

Figure 3. Decline in Round Pond *Gambusia* DDTR following cover remedy.

The site-specific data also support the longer exposure durations implied by the BASF CSM. The *Gambusia* in Cypress Swamp have declined at a steady first order rate of approximately 50% per year from 2008 to 2015, which is consistent with the hypothesis that DDTR is cycled through the food chain. *Gambusia* only have a life span of about 1 year (Haynes and Cashner, 1995). If the local sediment were the only driver of *Gambusia* DDTR, the tissue levels would have dropped dramatically after the cover installation and then leveled off. As of 2015, there was no indication of a plateau in the decline of DDTR. **Figure 4** shows the gradual decline in Cypress Swamp *Gambusia* since the cover was installed.

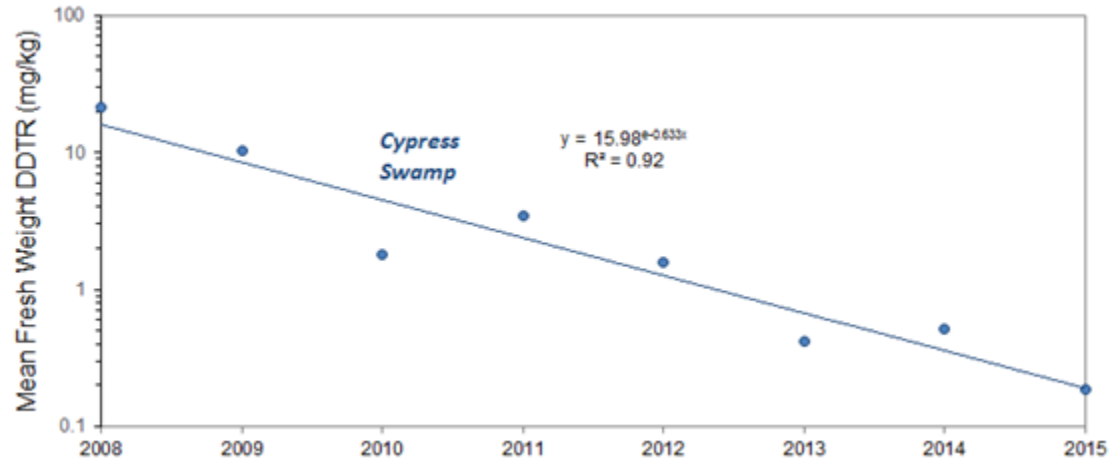

Figure 4. Decline in Cypress Swamp *Gambusia* DDTR following cover remedy.

Food-chain cycling of DDTR is also consistent with scientific literature. Maternal transfer of persistent contaminants from fish to their eggs is well-established (Arnot and Gobas, 2004; Russell et al, 1999; Chiuchiolo, 2004). Eggs, larvae, and tadpoles are an important part of the *Gambusia* diet (Johnson, 2008; Meffe and Snelson, 1989; Goodsell and Kats, 1999).

A simple model of distance from the peak sediment concentration and time since the cover installation does an excellent job of explaining the DDTR concentrations in *Gambusia*, suggesting that the now covered high-concentration sediments were the dominant source of DDTR for forage fish throughout the floodplain. Details of the assumptions in this model were provided in an earlier correspondence (BASF 2018b). Not accounting for exposures due to the previous high-sediment-concentration area inflates the BAF and decreases the sediment cleanup level needed to achieve the biota goals.

Uncertainty due to Decision-making in Developing BAFs

Developing a BAF is inherently a subjective and decision-intensive process. For a site such as BASF McIntosh, with multiple datasets collected over many years, different risk assessors may use different assumptions, include different datasets, and derive very different BAFs leading to very different cleanup levels.

For determining the sediment cleanup level, EPA back-calculated from the sediment cleanup level needed to protect predatory fish in two steps: calculating a sediment:forage fish BAF and then calculating a forage fish:predatory fish BAF. For their analysis, EPA chose to use only data in which the sediment and forage fish were collected concurrently. Ideally, the sediment:biota pairs would be collected from a distribution of sediments that are reasonably representative of the range of the sediment concentrations potentially influencing the biota. This would help address some of the concerns presented by the different CSMs. That was not the case in the development of the proposed sediment cleanup level – the majority of the data was from the Olin property, which had much lower sediment concentrations than the BASF property. Additionally, the single biota:sediment pair from the high concentration area was excluded from the analysis.

The problem associated with calculating accumulation factors from data pairs that are from only the lower end of the distribution of sediment concentrations is established in the literature. McLeod et al (2014) showed that when organisms are collected in clean locations in systems with substantial contaminant gradients, the calculated accumulation factors are biased high.

EPA calculated a predatory fish:sediment accumulation factor as a two-step process: forage fish:sediment and predatory fish:forage fish. The two factors were combined to back calculate a sediment cleanup level that would achieve the biota performance standard. In the process, multiple decisions were made regarding which data to include, whether to normalize the data, and how to structure the relationship. As an example of how the

decision-making in developing accumulation factors affects the eventual cleanup levels, BASF looked at alternate approaches to developing sediment BAFs. Two alternate approaches include:

- Inclusion of a single sample pair from the high sediment concentration area prior to the cover installation. This sample pair was included in the Olin ROD dataset, but was excluded from the calculation to determine the BAF.
- Using only the most recent largemouth bass and sediment data. The most recent data is the least likely to have been affected by the previous high-concentration sediment area, though for long-lived species such as bass, there would likely be residuals for many years after remedy implementation. Olin Basin is the only waterbody with a sufficient dataset of both bass and sediment to make a reasonable comparison. The bass were collected in 2015 and the sediments were collected in 2009.

Table 1 shows a comparison of how these alternate approaches would affect the BAFs and cleanup levels.

Table 1. Comparison of BAFs and sediment cleanup levels using various approaches.

Approach	Calculated BAF	Resulting Sediment Cleanup Level
EPA R4 approach	3.0 (3.0 predatory fish to forage fish x 1.0 forage fish to sediment)	0.21 mg/kg
Including single sample pair from pre-remedy Cypress Swamp (high sediment concentration Area)	1.5 (3.0 predatory fish to forage fish x 0.5 forage fish to sediment)	0.42 mg/kg
Recent Olin Basin data	0.5 (direct predatory fish to sediment)	1.28 mg/kg

Olin Basin serves as an excellent example of the disconnect between the predatory fish performance standard and the proposed sediment cleanup level. The sediment DDTR data collected in Olin Basin as part of the Olin Remedial Investigation and presented in the Olin ROD is limited (7 samples), but it implies a substantial cleanup is needed to address DDTR. The mean DDTR concentration was 1.5 mg/kg and 6 of 7 samples exceeded the proposed 0.21 mg/kg sediment cleanup level. Even if the cleanup level is applied as a surface-area weighted average concentration, it implies that nearly the entire 76 acre basin would need to be remediated. Based on the mean sediment concentration and the BAFs used to develop the cleanup levels, the predicted largemouth bass would be ~4.5 mg/kg. However, the most recent largemouth bass samples collected in 2015, only have a DDTR concentration of 0.81 mg/kg – exceeding the performance standard of 0.64 mg/kg by only about 25%. The largemouth bass concentration declined by about 80% between 2010 and 2015, so it is quite possible that predatory fish in Olin Basin are already meeting the predatory fish performance standard under existing DDTR sediment concentrations. However, even if the DDTR decline stopped in 2015, it would not be necessary to remediate the entire basin. Addressing any remaining high sediment concentration areas is almost certain to achieve the predatory fish performance standard.

For determining soil cleanup level, EPA back calculated a soil:insect relationship using six spider/crawling insect and soil pairs. As was the case for the sediment accumulation factors, BASF evaluated alternate approaches to evaluate the effects on the cleanup levels. The alternate approaches include:

- Using the exact same six-pair soil and invertebrate dataset, but choosing not to normalize for lipids or organic carbon and using the power function that fit the data better than a ratio.
- Using the only soil to invertebrate dataset where a clear relationship exists between the soil and invertebrate DDTR concentrations – the soil and earthworm

(*Lumbriculus*) data collected as part of the post-monitoring data following the 1998 remedy.

Table 2 provides a comparison of how these approaches would affect the BAFs and the cleanup levels.

Table 2. Comparison of BAFs and soil cleanup levels using various approaches.

Approach	BAF equation	Resulting Soil Cleanup Level
EPA R4 approach	$C_{i\text{-}LN} = 3.21 \times C_{s\text{-}OCN}$	0.63 mg/kg
Different functional form fit to same dataset	$C_i = 0.5281 \times C_s^{0.6426}$	3.3 mg/kg
Using *Lumbriculus* dataset	$C_i = 0.38 \times C_s$	3 mg/kg

C_i = invertebrate DDTR concentration, $C_{i\text{-}LN}$= lipid normalized invertebrate DDTR concentration
C_s= soil DDTR concentration, $C_{s\text{-}OCN}$= organic carbon normalized soil DDTR concentration

As with the sediment accumulation factors, reasonable alternate approaches to developing soil cleanup levels yield results that vary by more than a factor of five from the proposed values.

Currently, the EPA has only proposed a soil cleanup level for the protection of insect-eating birds – there is no associated biota performance standard. The protectiveness for insect-eating birds is determined by a Hazard Quotient equation with multiple inputs. However, the invertebrate concentration is the primary variable that determines the calculated dose. Using the default values from the Olin ROD, including the Exposure Point Concentration soil value of 1.4 mg/kg, a protective value for insect tissue would be 1.3 mg/kg. BASF recommends incorporating this value as a performance standard in place of the highly uncertain soil cleanup level.

There is substantial uncertainty in the proposed sediment and soil cleanup levels. It may not be necessary to remediate to these levels to achieve the biota performance standards. In fact, the recent data from Olin Basin demonstrates that it will almost certainly not be necessary to remediate to the proposed soil and sediment cleanup levels to achieve remedy success. Removing the soil and sediment levels or referring to them as “Interim cleanup levels” will preserve flexibility for developing mutually acceptable remedial approaches and utilizing best practices (e.g., Remedy Optimization and Adaptive Management) as recommended by the Superfund Task Force (USEPA, 2018b).

Comment #2: Adaptive Management is the Appropriate Path Forward

In a letter to EPA dated August 9, 2018, BASF submitted a detailed plan to use Adaptive Management to achieve a protective remedy at OU3. EPA has made a clear push to increase the use of Adaptive Management at Superfund Sites. Between 1999 and 2017, EPA made mention of Adaptive Management as a potential strategy for Superfund Sites in

two guidance documents, but did not actively promote it as a major part of Superfund decision-making:

- *Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* issued in 1999 (OSWER 9200.l -23P);
- *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* issued in 2005 (OSWER Directive 9355 .0-85);

However, in the last several years, Adaptive Management has been a major focus for EPA as part of the strategy to make progress on Superfund remediation and NPL site removal. Since 2017, several new documents have been published to promote the use of Adaptive Management:

- *Remediating Contaminated Sediment Sites - Clarification of Several Key Remedial Investigation/Feasibility Study and Risk Management Recommendations, and Updated Contaminated Sediment Technical Advisory Group Operating Procedures* issued in 2017 (OLEM Directive 9200.1-130 – subsequently referred to as the 2017 Guidance Clarification).
- *Superfund Task Force Recommendation #3: Broaden the Use of Adaptive Management*, July 2018 (OLEM 9200.3-120)
- *2018 Update to the Superfund Task Force Report* (July 23, 2018)

EPA is aggressively promoting Adaptive Management because it understands that it is important to make progress at contaminated sites even when there is disagreement among the parties. Adaptive Management is a tool to get to the "right answer" at complex sites in the face of substantial uncertainty.

The 2017 Guidance Clarification document states:

> *The Sediment Remediation Guidance encourages site managers to use an Adaptive Management approach, "especially at complex sites to provide additional certainty of information to support decisions." An adaptive approach could include early removal or remedial actions…, an interim ROD, a contingency ROD, or could be done as part of the remedy implementation.*

Given the intermittent inundation of the floodplain, the degree to which hydraulic connectivity among waterbodies changes with changing water levels, and the dynamic nature of the floodplain ecosystem, BASF McIntosh represents a complex site that would merit an Adaptive Management approach. Additionally, EPA guidance provides great flexibility for how and when an Adaptive Management approach is incorporated into remedial planning. The performance monitoring plan document noted in the proposed ESD would be an appropriate document to finalize a structured Adaptive Management program. Explicit mention of Adaptive Management as a valid approach in the ESD will help facilitate moving forward towards a successful remedy.

The final Adaptive Management plan would be based on collaboration with EPA R4. The plan would incorporate actions to address EPA concerns such as evaluating the potential for an ongoing upland source, determining whether the existing cap is protective (including whether there may be DDT transport via groundwater upwelling), and addressing the sediment in the effluent ditch in the floodplain.

Under an Adaptive Management approach, BASF is committed to performing the needed remediation to reach the biota performance standards. Once the performance standards are met, a final decision document can be issued to memorialize the final sediment and soil cleanup values needed to meet the biota standards.

Based on discussions with R4 regarding potential use of an Adaptive Management at the Site, BASF learned that EPA agrees that biota tissue levels are the primary determinant of remedy success, and that soil and sediment cleanup levels can be adjusted to reflect actual conditions once biota have reached the biota performance goals. The Agency indicated that the provisions at the end of Section V were intended to provide the flexibility to address this concern. The ESD should be revised to clearly articulate this approach. To the extent that soil and sediment cleanup goals are included, they should be identified as "interim" and subject to readjustment once biota performance goals have been met. BASF has provided draft revisions to the ESD to reflect these changes.

Comment #3: OU3 Extends Throughout the Floodplain

In 1996, BASF entered into a Consent Decree for OU3 that, among other things, provided BASF with contribution protection for any "matters addressed" in the Consent Decree. The terms of the Consent Decree, and the 1995 OU3 ROD that is incorporated as an appendix to the Consent Decree, make clear that BASF is responsible for implementing a remedy to address the unacceptable risk of DDTR throughout the Tombigbee floodplain on and adjacent to the BASF property.

Among other things, the OU3 ROD provides that the Site includes 370 acres of "undeveloped swamp and bottomlands that comprise a portion of the Tombigbee River floodplain. The floodplain is separated from the developed portions of the plant property by a steep escarpment known as the 'bluffline.'" ROD at 1. At the time of the Consent Decree, BASF owned approximately 170 acres in the described floodplain area and Olin owned the remaining 200 acres (approximately) lying south and west of the BASF property. In 2006, BASF conveyed 8 acres immediately west of the north-south section of the effluent ditch to Olin. At the present time, BASF owns approximately 172 acres within the floodplain, and Olin approximately 208 acres.

Further, the Consent Decree and incorporated documents make clear that BASF is responsible for addressing the unacceptable risk of DDTR throughout the floodplain, not just on property owned by BASF. The ROD describes OU3 as, among other things, "Contamination <u>within the floodplain</u>, the effluent ditch (previously called the lower portion of the dilute ditch) and areas in the Tombigbee River <u>within close proximity</u> to the Site." (Emphasis added) ROD at 11. And, the Olin basin has been consistently included in the Study Area for the site, and addressed in the Contaminants of Concern section of the OU3 ROD. Likewise, the Statement of Work for OU3, which is also incorporated as an appendix to the Consent Decree, requires BASF to prevent or mitigate the continued release of contaminants *from* OU3 while also reducing contaminants within OU3.

Pursuant to the Consent Decree, and at the direction of EPA, BASF has conducted significant work to remedy the unacceptable risk of DDTR in the floodplain -- and the majority that work has been performed on Olin property. The proposed ESD acknowledges this, noting in Section IV that "The 1995 ROD resulted in the excavation of 23,000 cubic

yards of contaminated sediment from the OU3 wetland and floodplain areas." The majority of those 23,000 cubic yards were excavated from Olin property, as shown on the map below:

Figure 5. Map showing 1998 Cypress Swamp excavation was largely conducted on Olin property.

Hundreds of samples have been collected on the Olin property at the direction of EPA pursuant to the OU3 Consent Decree, as shown in Figure 6.

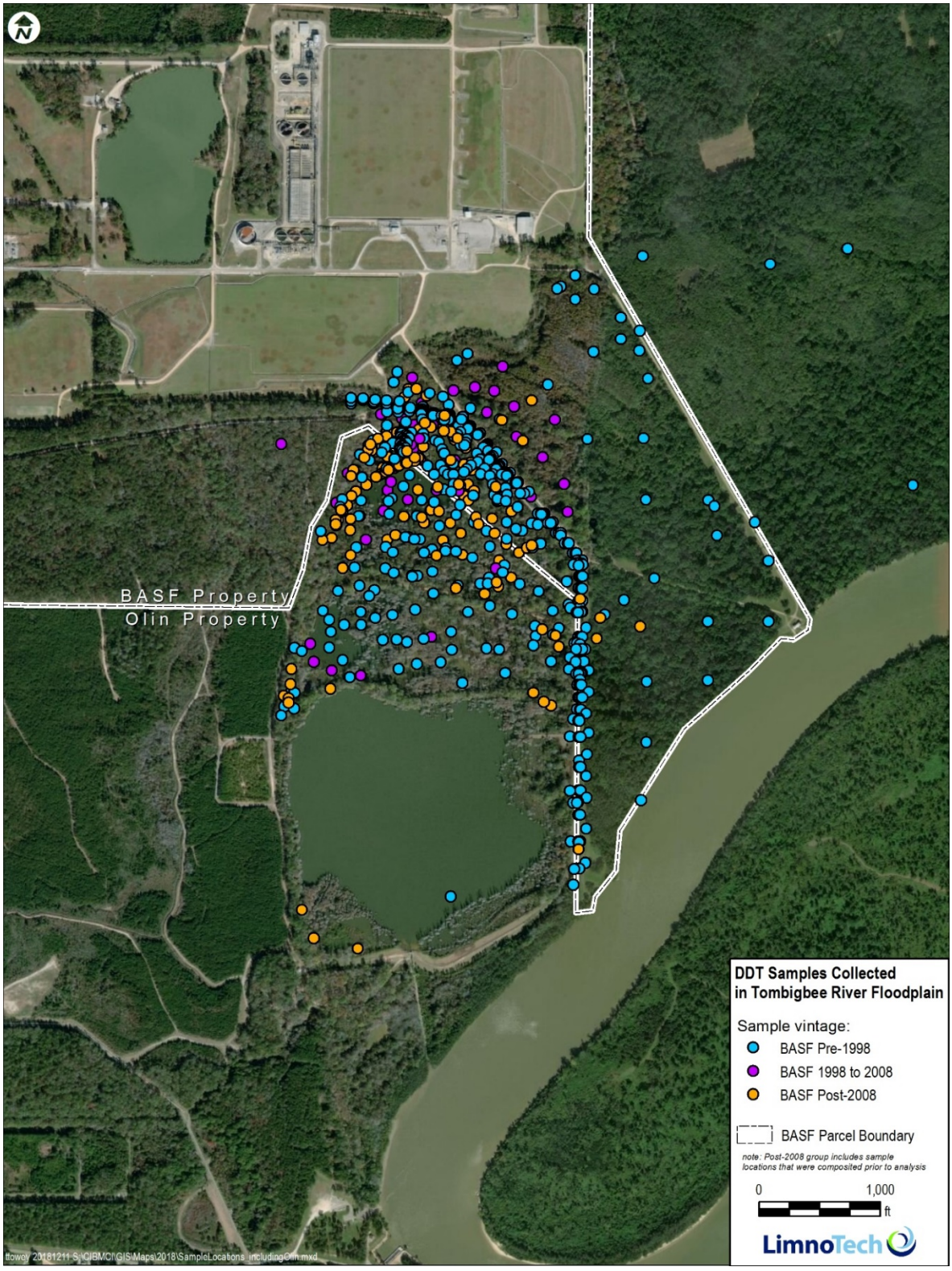

Figure 6. BASF sample locations, including many sample locations on Olin property.

Moving forward, BASF may be required to further address any residual unacceptable risk of DDTR located on Olin property. BASF is concerned, however, that there are conflicting

delineations of OU3 within the proposed ESD. On page 2, OU3 is again described as including "370 acres consist of undeveloped swamp and bottomland located in the Tombigbee floodplain" (which as noted above necessarily includes area south of Olin Berm). Figures 2 and 3, however, show the OU3 boundary at the southern extent of the current cover and not extending south of Olin Berm.

BASF has already conducted significant work south of the berm, and its Consent Decree requires it to address any further unacceptable risk of DDTR there, if necessary. BASF is concerned that drawing the OU3 boundary as presented in Figures 2 and 3 in the ESD could be interpreted as altering BASF's responsibility for DDTR under the OU3 Consent Decree, and limiting the contribution protection guaranteed to BASF in the Consent Decree. The ESD narrative and figures should be consistent and reiterate that BASF has responsibility for DDTR throughout the floodplain under the OU3 Consent Decree.

Comment #4: The chronic aquatic life criteria is the appropriate ARAR for surface water

As noted in the proposed ESD, the State of Alabama has water quality standards for the protection of human health and for the protection of aquatic life. The human health standards for DDTR isomers are based on excess cancers associated with fish consumption assuming the ingestion of 30g of fish per day (one fish meal per week) from a contaminated area. The OU3 waterbodies, however, all are located on BASF and Olin properties with 24-hour security detail, and fishing is prohibited on both properties. BASF's RCRA permit also has specific requirements restricting access to the site. Signage is posted above high-water mark stating No Trespassing at the River. Surveillance cameras are installed at the river and monitored around the clock. Security tours are conducted daily to the water's edge, and BASF and Olin share all information regarding floodplain security.

The one-fish meal per week assumption is not appropriate for any waterbody within OU3. Notably, carcinogenic risks were evaluated as part of the human health risk assessment for Olin OU2, and risks were found to be within acceptable ranges for all scenarios (see page 53 of USEPA, 2014). Accordingly, the Alabama freshwater chronic aquatic life criterion is the appropriate surface water ARAR for OU3 waterbodies (0.001 mg/kg).

If the Agency does not agree that the aquatic life criterion is the appropriate surface water ARAR for OU3 waterbodies, then the ESD should clarify that the Alabama human health criteria apply to individual DDTR isomers, rather than to the DDTR sum. This is consistent with the values in Table 31 in the Olin OU2 ROD (USEPA, 2014).

Comment #5: The performance standard that drives sediment remediation decision-making should be based on DDTR effects in piscivorous birds

BASF objects to the use of the t-TEL from Beckvar et al. 2005 ("Beckvar 2005") as a reliable threshold for adverse effects to predatory fish. The studies summarized by Beckvar 2005 all were published before 1982 and included several studies that were not peer reviewed. At least two of the non-peer-reviewed studies used by Beckvar 2005 had

significant quality control issues and should have been excluded from the evaluation (e.g., one study had up to a 40% difference between the fish counts in the tanks at the end of the study and what they had expected based on their mortality counts). Beckvar 2005 notes that "for this review, we were unable to meet the minimum 20 data point requirement specified in the sediment TEL guidelines." Beckvar 2005 further states, "therefore, these DDT tissue residue-effect numbers should be considered provisional and used carefully." In a follow up paper in 2011, Beckvar and Lofuto reiterate that "data used in this [Beckvar 2005] analysis were mostly older studies reporting lethal effects so the calculated thresholds were considered provisional."

In the Olin OU2 ROD, EPA cited three additional studies in addition to those summarized by Beckvar 2005. However, those additional studies were all based on acute rather than chronic toxicity, followed by the application of an acute to chronic ratio (ACR). The summary study that was used to develop the ACR notes that across all of the included studies, ACRs ranged from 1.1 to 18,550 – indicating no consistent relationship between acute and chronic toxicity. Thus, EPA's use of these studies only served to further increase the uncertainty around the appropriate threshold effects value. EPA's use of Beckvar 2005 and the other cited studies resulted in a highly uncertain threshold effect for fish for setting performance standards for the floodplain.

BASF raised concerns regarding the use of the Beckvar t-TEL as an appropriate threshold in a letter to EPA R4 dated December 12, 2017 (included as an attachment to this document). In response to that letter, EPA noted additional studies that include DDTR effects on fish. Although those studies include more recent research than the studies used by Beckvar, the understanding of DDTR effects on fish continues to be poor. The additional studies primarily make the case that the 2,4'-substituted isomers are more likely than the 4,4'-substituted isomers to induce hormonal change in a specific species of minnow. They are not sufficient for setting DDTR performance standards in predatory fish in OU3, particularly because the 2,4'-isomers represent less than 10% of the total DDTR in OU3 *Gambusia* since 2009.

Given both the paucity of data for the assessing DDTR effects in fish and the low quality of the studies available to assess DDTR effects on fish, predatory fish should not be used as the end-receptor for remedial decision-making. EPA should instead continue with the approach set forth in the Proposed Plan and use wading birds as the ecological end receptor to guide remedy decision-making related to sediments. A great deal more reliable research is available to assess DDTR effects to birds than to fish (USEPA, 2007).

BASF has indicated to EPA that it believes the performance standards for fish are achievable in OU3 and that it will accept the fish performance standard under an Adaptive Management approach. However, the science is not strong enough to use for setting an already uncertain sediment cleanup level.

Comment #6: The Proposed Changes To The Remedy Are Fundamental, And Must Be Made Through A ROD Amendment

The Proposed ESD includes fundamental changes to the remedy in the OU3 Consent Decree and ROD. Consequently, those changes cannot be made through an ESD, but can only be made through a ROD Amendment.

As described in the 2008 ESD, the BASF OU3 ROD required: "[e]xcavat[ion] of soil and sediment to 15 ppm DDTr (sum of DDT and its metabolites) in the majority of the floodplain." In addition, the original ROD required "[p]ost remediation monitoring of Gambusia and Lumbriculus worms to evaluate effectiveness of the remedy. The goal for the Gambusia is to reduce the DDTR body burden below 1.5 ppm."

The 2008 ESD required the application of a sand cover over portions of the floodplain owned by Olin and BASF "as an exposure barrier to DDTr left in place where excavation would unnecessarily destroy habitat" and "[p]ost remediation monitoring of Gambusia and a combination of Lumbriculus [sp] and/or DDTr in sediment transported within the site to evaluate the effectiveness of the remedy" with "[n]o change in the performance goal for the Gambusia." Shortly after implementation of the ESD, EPA suspended further evaluation of *Lumbriculus* and the focus of remedial performance was based upon evaluation of concentrations of DDTR in *Gambusia*.

In general, BASF has met the existing OU3 DDTR soil/sediment number in the floodplain, and has been monitoring the progress of body burden in *Gambusia* and other biota to determine the effectiveness of the OU3 remedy. Body burden rates in *Gambusia* and other biota continue to generally decline, as would be expected given bioaccumulation, life expectancies of target biota and other factors.

The proposed ESD however, drastically and fundamentally alters these goals. Under the ESD, the soil and sediment cleanup levels drop from 15 mg/kg to .21 mg/kg for the sediment, and .63 mg/kg for the soil. The former represents a decrease of 98.6%, while the latter represents a decrease of 95.8%. Further, the cleanup levels derived in the Olin OU2 ROD were developed after the feasibility study portion of the CERCLA process and have not been evaluated for either their implementability of feasibility if they can be achieved. The final levels were also changed from those in the proposed plan, which constitutes a fundamental change.

As noted above, these proposed values are so low that they cannot be achieved without substantial additional remediation that would be ecologically disruptive and cost upwards of $50 million dollars.

Because the scope and performance of BASF's remedy would be fundamentally altered by proposed cleanup target levels, they may not be made through an ESD and must be made, if at all, through a ROD amendment.

Conclusions

The sediment and soil cleanup levels in the proposed ESD are too uncertain to be used as final cleanup levels. A structured Adaptive Management program will lead to remedy success, likely without the need to spend upwards of $50 million, which is what BASF estimates could be the result if the proposed soil and sediment cleanup goals are implemented. A few relatively minor modifications to the proposed ESD will:

- Document that achieving the biota goals will be the ultimate measure of remedy success;
- Reflect the inherent uncertainty in the calculations of interim sediment and soil cleanup levels;

- Specify an approach that will allow for a structured Adaptive Management program;
- Confirm BASF's obligations under OU3 Consent Decree extend to the entire OU3 floodplain; and
- Allow for a mutually agreeable path forward to addressing ecological risk associated with DDTR.

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USEPA, 2018b. Superfund Task Force Recommendations: 2018 Update. Andrew Wheeler, Acting Administrator. July 2018.

ATTACHMENTS

1. BASF Comments on Olin OU2 Proposed Plan. June 20, 2013.
2. Letter to Lisa Ellis from Laurel Lockett clarifying overlap between BASF OU3 and Olin OU2. April 29, 2015.
3. Letter from Steve Havlik to Beth Walden to express concern regarding application of Olin OU2 goals to BASF OU3. December 21, 2017.
4. Letter from Steve Havlik to Beth Walden presenting Adaptive Management Plan for OU3 Floodplain. August 9, 2018.
5. Letter from Steve Havlik to Beth Walden Response to Technical Comments. August 10, 2018.
6. Letter from Doug Reid-Green to Randall Chaffins with Proposed ESD Revisions. December 13, 2018.
7. Statutory Warranty Deed, #464, page 237, Entry 64527, public records of Washington County, Alabama

ATTACHMENT 1

BASF Comments on Olin OU2 Proposed Plan. June 20, 2013.

BASF

The Chemical Company

June 20, 2013

Via Certified and Electronic Mail
Ms. Beth Walden
Superfund Remedial Branch
U.S. Environmental Protection Agency
61 Forsyth Street
Atlanta, Georgia 30303

RE: Comments to Proposed Plan for Olin McIntosh Operable Unit 2

Dear Ms. Walden:

BASF Corporation submits the following comments to the U.S. Environmental Protection Agency's (EPA) Proposed Plan for Olin McIntosh's Operable Unit 2 (OU-2). Specifically, BASF opposes the proposed remedial goals for DDTr in OU-2.

BASF operates at the property adjacent and to the north of the Olin McIntosh site. Under the oversight of EPA and the Alabama Department of Environmental Management (ADEM), BASF has been performing DDTr remediation work in the floodplain (BASF OU-3) since 1995. The OU-3 remediation includes activities on both BASF and Olin floodplain property. Beginning with the original Record of Decision through three consecutive 5-year reviews, EPA management has consistently upheld the remedy chosen for the floodplain remediation and the performance goal set for DDTr.

Over forty percent (approximately 89 acres) of Olin's OU-2 overlaps with BASF's OU-3. Consistency in addressing DDTr is therefore necessary and critical to achieving a sound remedy. However, in the Proposed Plan for the Olin site, EPA has recommended a set of DDTr remedial goals for OU-2 that differ from BASF's OU-3 even within this overlapping area. This inconsistency is troubling given that the existing remedy not only was developed with input and approval from EPA**,** ADEM, and the NRD trustees, but has proven to be successful and protective.

In addition, the Olin goals appear not to consider DDTr data collected during the process of BASF's remediation. Instead, EPA has chosen to propose DDTr remedial goals for Olin's OU-2 that are so low they may be technically impracticable to achieve.

In closing, the protection of health, safety and the environment is BASF's most important responsibility. We care about our employees and we care about the communities in which we operate. For this reason, BASF strongly believes that the Proposed Plan for the Olin McIntosh Operable Unit 2, and specifically the proposed DDTr remedial goals, must be

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based on sound scientific and technical principles, and consistent with prior agency management decisions. The proposed DDTr remedial goals for Olin fall short of this mark.

BASF appreciates the opportunity to provide these comments. In addition, BASF requests a meeting with EPA to discuss this letter. We will be in contact with the agency shortly to schedule such meeting.

Sincerely,

Stephen K. Havlik
Senior Remediation Specialist

CC: Franklin Hill (USEPA)
Richard Campbell (USEPA)
Carol Monell (USEPA)
Charles King (USEPA)
Sonja Favors (ADEM)

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ATTACHMENT 2

Letter to Lisa Ellis from Laurel Lockett clarifying overlap between BASF OU3 and Olin OU2. April 29, 2015.

CARLTON FIELDS
JORDEN BURT

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April 29, 2015

Lisa Ellis, Esq.
USEPA Region IV
61 Forsyth Street, S.W.
Atlanta, GA 30303-8960

VIA Email

Re: Ciba-Geigy Superfund Site, McIntosh, AL (Ciba Site)

Dear Lisa:

I am writing to follow up on our call on April 15, 2015, and to respond to recent requests that have been made by EPA staff to BASF's technical staff regarding the Ciba Site.

As we discussed at length during the call, BASF's has always understood that the OU3 ROD covered all the DDTR in the floodplain adjoining the Ciba property (whether on the BASF property, Olin property or otherwise) and that BASF's Consent Decree with EPA for OU3 governed BASF's obligations with respect to the remediation of DDTR both on and off the Ciba property. This seemed to be somewhat of a surprise, and you requested that we provide further information regarding the extent of BASF's historical DDTR sampling efforts in the area of the Ciba Site, including specifically sampling that took place on the Olin property. The attached figure summarizes all of the DDTR sediment samples collected and analyzed by BASF over the life of the project, broken down by relevant time periods: (1) pre-1998 sample locations (blue dots), (2) post-ROD samples collected prior to 2008 (ESD) (purple dots); and (3) post-2008 sample locations (orange dots). As can easily be seen, BASF's historical sampling efforts have always included sampling on the Olin property, and more specifically, the bulk of samples collected since the OU3 ROD have been collected on the Olin property.

In the course of preparing this figure, our consultants noted that there was a change in the boundary of Olin's OU2 remedy between the EPA's Proposed Plan and the Olin OU2 ROD. As shown on Attachment 2, the top figure, which is from the Olin OU2 Proposed Plan correctly depicts the location of the Olin-BASF property boundary running through the northernmost pond. In the ROD, the northern boundary of the "Approximate Location of OU2" is shown at the ditch north of the pond. While we are not sure what significance EPA attaches to such a figure, given the obligation to address contamination where ever it has come to be located, BASF wants to be sure that EPA understands that the BASF property boundary is, in fact, to the south, through the pond as correctly shown in the Proposed Plan and a substantial portion of BASF's sampling effort has been on the Olin property commensurate with what is understood to be our obligations under the Consent Decree. Attachment 3 provides an overlay of the "Approximate Boundary of OU-2" from the Olin OU-2 ROD against the actually boundary as confirmed most recently by a survey prepared by Environmental Precision Associates, Inc. dated December

2013. The property line location has been correctly shown in all BASF submittals relating to the Ciba Site.

Second, since our call, EPA staff has made a number of calls to both BASF's technical project manager, Steve Havlik, as well as BASF's outside consultant, LimnoTech, to request compilations of all historical data collected by BASF. (See copy of an email from Charles King to Steve Havlik dated April 22, 2015 on Attachment 4, on which you were copied). While our respective clients have what I understand to be a very productive, positive and collegial long-term relationship, we request that until BASF and the Agency develop an agreement regarding the appropriate path forward, which we expect will be the subject of the requested meeting with Franklin Hill and senior Agency staff, that EPA refrain from further direct communication with either BASF's in-house technical staff or outside consultants. Steve Havlik has let Charles King know that this request likely would be coming, and we hope that everyone at the Agency will understand that this request is made to facilitate accurate and focused communication, in order to insure that the parties are all on the same page going forward. Until that time, we request that all communication regarding the Ciba Site be made through either through BASF's in-house counsel, Linda Brenneman, or me.

While BASF has completed a file review in order to prepare the attached figure, BASF has not prepared an electronic compilation of that data in the format requested. The figure provided does provide spatial and temporal information regarding the sampling performed by BASF historically. Of course, this does not include additional sampling performed by Olin, that would further flesh out the cumulative DDTR sampling effort in the vicinity and downstream of the Ciba Site. However, BASF is very concerned regarding the Agency's request for the reformating of the historical data, and think that there should be some discussion regarding the appropriate use of that before additional analyses of the data is performed. Specifically, because of the depositional environment in which these samples collected [sediment accumulation has been demonstrated to be approximately 0.2-0.3 inches per year; (BASF McIntosh Ciba-Geigy Superfund Site OU3 Remedial Action Report, 2014; Olin OU2 ROD, 2014)], the depths at which samples were collected historically would not be representative of the current surface layer. Therefore, use of the historical analytical data would not be appropriate for use to predict bioavailability to potential receptors today. As suggested by Mr. Hill's letter, the best measure of the efficacy of the BASF OU3 remedy, as modified by the 2008 ESD, may well be additional sampling of actual receptors, rather than modeling based on old data, various default assumptions and projections. This is one of the areas that we would expect to discuss further during our upcoming meeting.

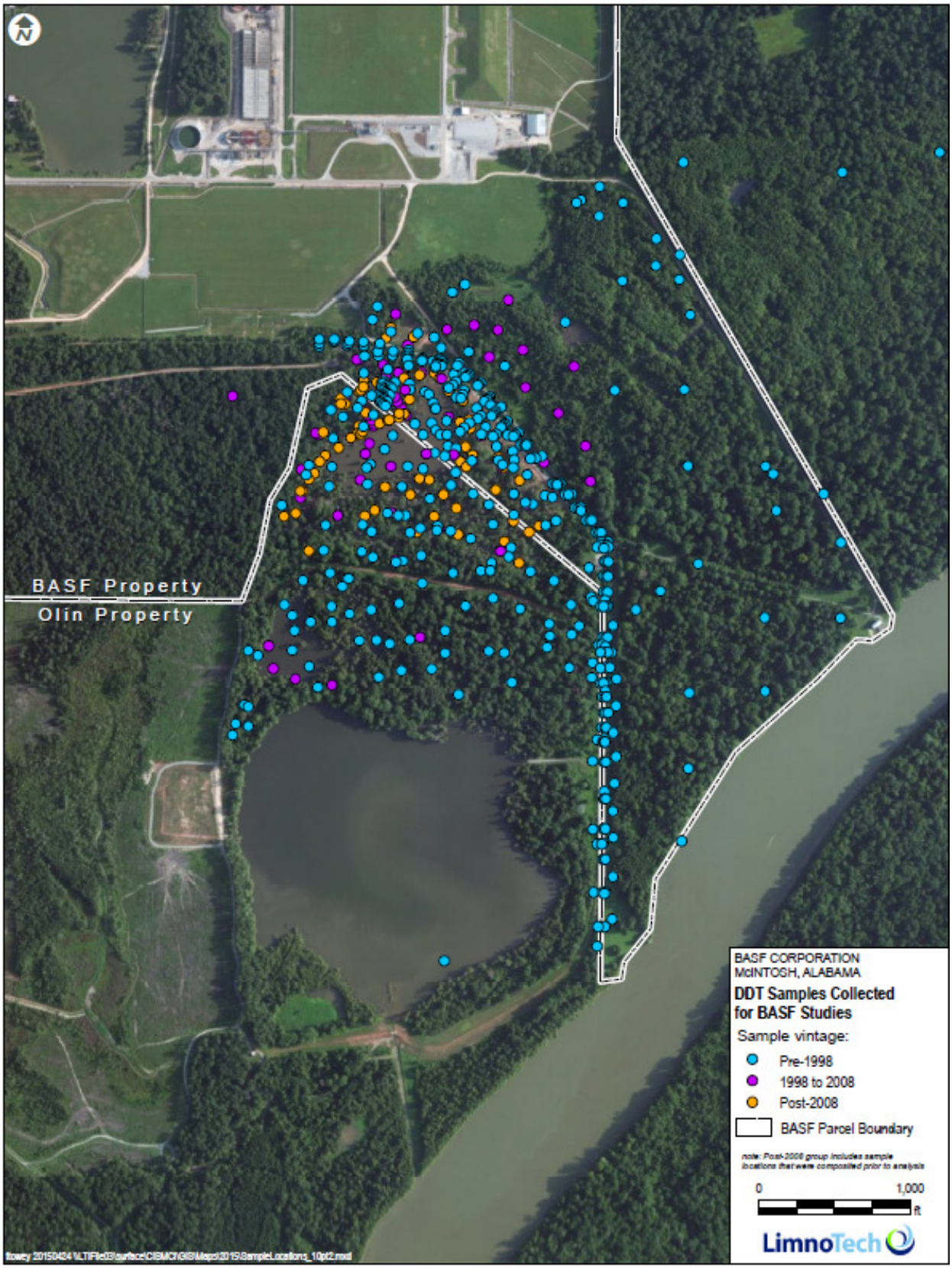
We look forward to meeting with you and the EPA team soon to discuss these issues further.

Yours sincerely,

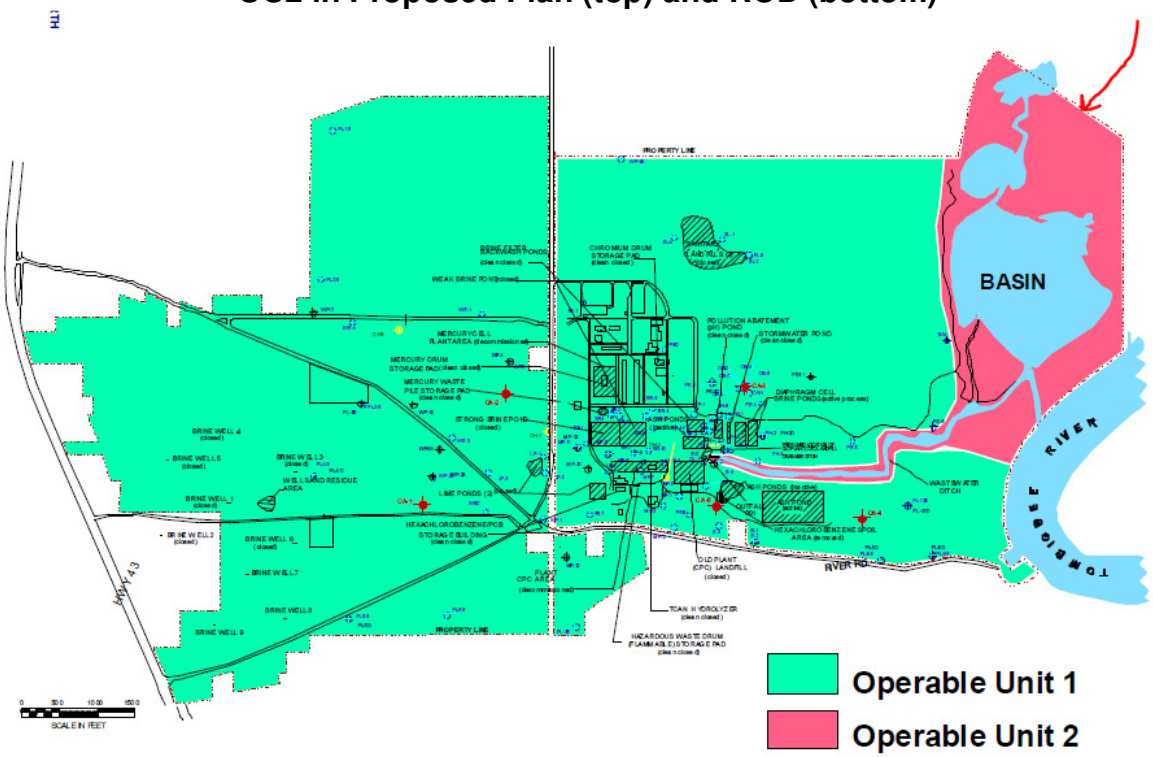
Laurel Lockett

cc: Linda Brenneman, Esq. (BASF)
Steve Havlik (BASF)
Cheryl Luke, Esq. (DOJ)

ATTACHMENT 1 – BASF Historical DDTR Sample Locations 1992-Present



ATTACHMENT 2 – Comparison of BASF-Olin Property Boundary and Locations of OU2 in Proposed Plan (top) and ROD (bottom)



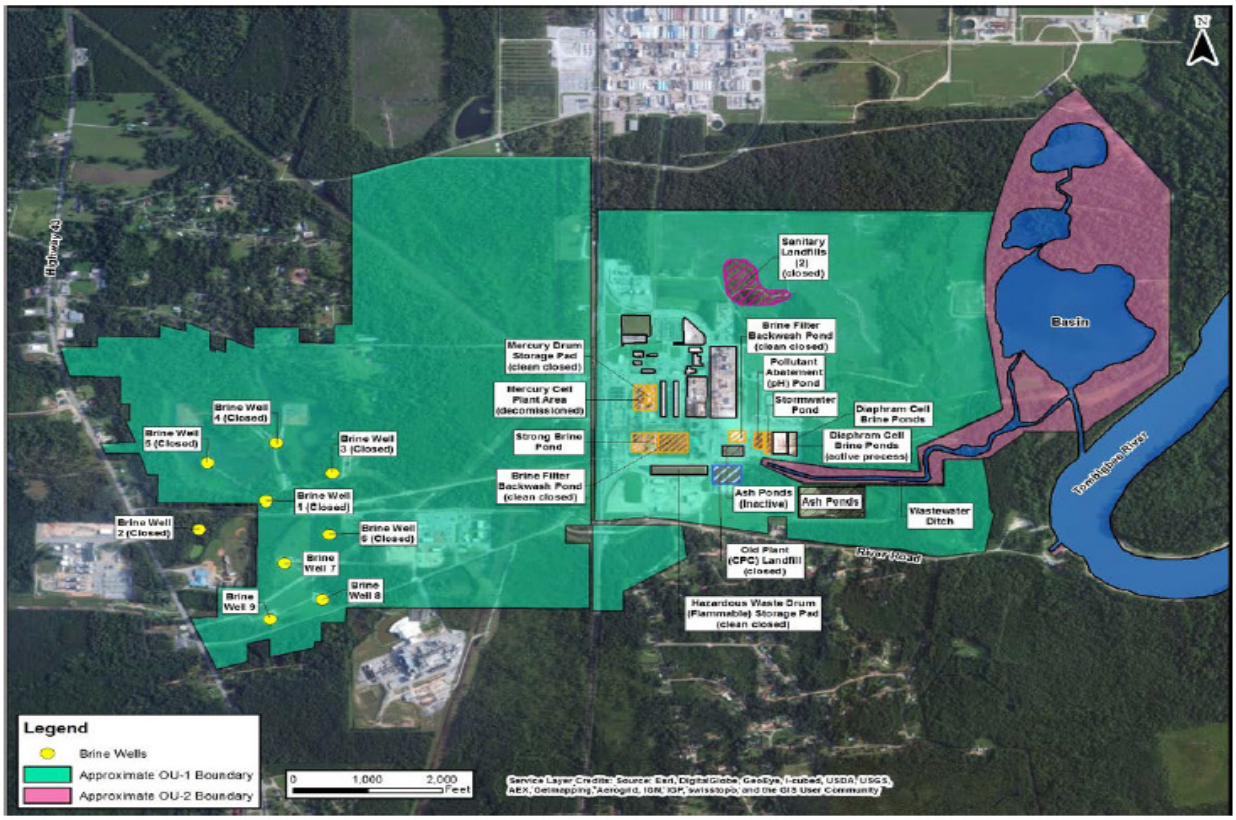
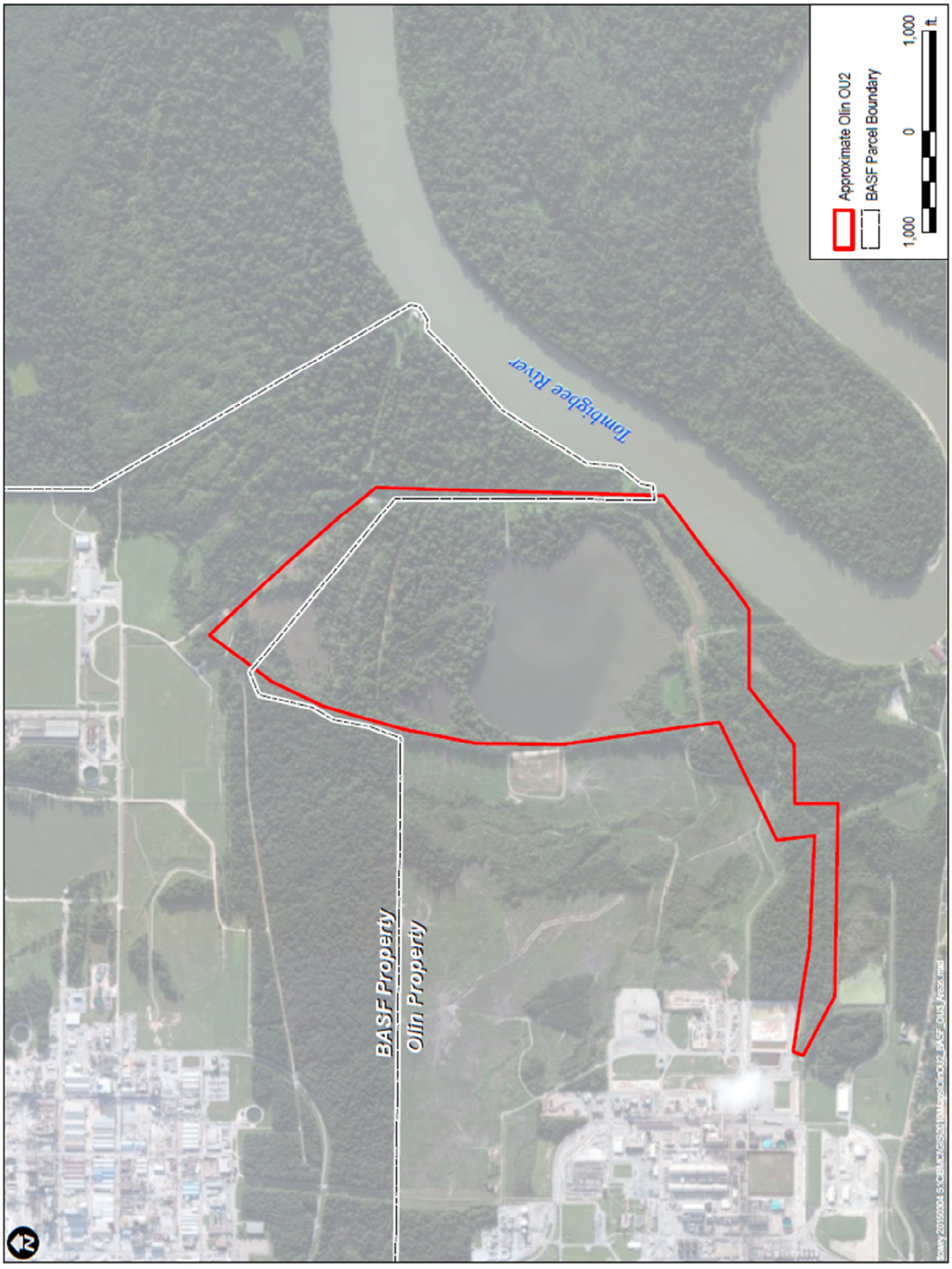


Figure 2. Operable Unit Locations

ATTACHMENT 3 – Comparison of Approximate Boundary of Olin OU2 with Olin-BASF Property Boundary (per Survey)



ATTACHMENT 4 – April 22, 2015 Email Request from EPA

From: "King, Charles" <King.CharlesL@epa.gov>
To: Stephen Havlik <steve.havlik@basf.com>
Cc: "Denman, Bill" <Denman.Bill@epa.gov>, "Ellis, Lisa" <Ellis.Lisa@epa.gov>, "Thoms, Sharon" <Thoms.Sharon@epa.gov>, "Dan Herrema (dherrema@limno.com)" <dherrema@limno.com>
Date: 04/22/2015 02:40 PM
Subject: FW: Request for Electronic Data at the Ciba site

Steve,

I think I sent the message below to your old email address a few minutes ago. It just came back undeliverable. I hope this one gets through. Please give me a call at (404) 431-1755 if you have any questions or concerns.

Charles King

From: King, Charles
Sent: Wednesday, April 22, 2015 2:31 PM
To: Havlik Steve LE US
Cc: Denman, Bill; Ellis, Lisa; King, Charles; Thoms, Sharon; Sonja Favors
Subject: Request for Electronic Data at the Ciba site
Importance: High

Steve,

The April 1, 2015 letter from Franklin Hill, Superfund Division Director, to Linda Brenneman, Esq, indicates that EPA has determined that the current soil/sediment cleanup level for DDTR at the Ciba site must be revised to ensure that remedial actions are protective of human health and the environment. The letter also included additional investigations and analysis of contamination and resultant impacts to ecological receptors that must be conducted on the Ciba and Olin sites.

EPA understands that over the past 30 years, Ciba-Geigy/BASF has collected a large volume of site related data. Before we ask you collect additional data, we would like to make sure that we have electronic copies of all of the data you currently have. Providing this data electronically will help us to determine where additional or more current data is needed. We would like you to provide electronic data with spatial coordinates.

After speaking with our risk assessment group, we have determined that we currently have electronic data in a desired format for the 2007 Basis of Design report and groundwater data from the 2011 Five Year Review report. The older data from the RI/FS and the 1997 Remedial Design is what we are seeking. We are primarily interested in the soil, sediment, surface water and biota data for OU-3. We do not mind if it is in Excel or in Access database. We would prefer to have the data all together in a single database in Access rather than as a collection of files.

EPA is available to have a technical meeting with you to discuss alternatives for moving forward cooperatively in the floodplain in June 2015. Please provide some dates in June that your team is available to meet, for us to consider.

I am available to talk or meet as soon as possible to discuss our regularly scheduled monitoring and/or inspections in the floodplain.

If you have questions, or need additional information, please contact me at (404) 431-1755.

Charles King

ATTACHMENT 3

Letter from Steve Havlik to Beth Walden to express concern regarding application of Olin OU2 goals to BASF OU3. December 21, 2017.

Stephen K. Havlik
Sr. Remediation Specialist
Telephone: 973-245-5271
Fax: 973-307-2309
E-mail: steve.havlik@basf.com

December 21, 2017

Via E-Mail: walden.beth@epa.gov

Ms. Elizabeth Walden
Remedial Project Manager
U.S. Environmental Protection Agency
Region IV
61 Forsyth Street, S.W.
Atlanta, GA 30303-8960

Subject: Remedial Goals for OU3 at the
Ciba-Geigy Superfund Site, McIntosh, AL
Operable Unit No. 3, EPA I.D. No. ALD001221902

Dear Ms. Walden:

BASF is writing to express significant concern, based on comments made during our September 13, 2017 conference call, that EPA is considering developing new Remedial Goals (RGs) for Operable Unit 3 (OU3) at the Ciba-Geigy Superfund Site in McIntosh, Alabama, based on the Olin OU2 RGs, rather than on the best available current data and sound science.

During our conference call on September 13, 2017, everyone on the call was in agreement that implementation of the cover remedy in 2008 has resulted in a substantial reduction of DDTR levels in the floodplain and associated biota. You conveyed that, apart from some possible work in the former effluent ditch, EPA did not see the need for substantial additional remediation in OU3 in the near term. Nonetheless, you indicated that EPA was proceeding with development of an Explanation of Significant Differences for the BASF OU3 Record of Decision (ROD) that would incorporate the RGs from the Olin OU2 ROD for use on the Ciba-Geigy site.

BASF strongly objects to the adoption of the Olin OU2 RGs as the Ciba-Geigy OU3 RGs. As EPA is aware, BASF has previously expressed significant concerns regarding the technical approach used to develop the RGs in the Olin ROD. Additionally, moving ahead with the incorporation of the Olin RGs prior to the completion of the BASF OU3 Supplement Remedial Investigation (SRI) currently underway is inconsistent with the communication that BASF has received from EPA since 2015.

Olin DDTR RGs Are Not Based on Sound Science and Therefore Arbitrary

BASF has communicated its technical concerns regarding Olin RGs on numerous occasions (BASF's June 2015 presentation to EPA, BASF Response to Comments on the 2015 Biota Sampling Plan, 2015 Year-end Report, 2016 Year-end Report):

- The sediment to biota accumulation factors that form the basis of the Olin OU2 DDTR RGs were developed by EPA from 11 sample tissue/sediment pairs collected by both Olin and BASF in the floodplain over a time period that straddled the 2008 installation of an approximately 45 acre cap installed on the BASF and Olin properties. **EPA derived these accumulation factors based on an assumption that the biota DDTR levels were only impacted by very local sediment concentrations, and that food chain DDTR from elsewhere in the floodplain would not affect tissue levels. However, given that the sediment DDTR levels varied by orders of magnitude within the floodplain and the fact that biota move freely throughout the floodplain, this assumption was incorrect.**

- ADEM also expressed concern regarding EPA's use of this data for setting the RGs in its formal comments on the Proposed Plan dated September 18, 2103. In that letter, ADEM stated, "The proposed PRG for DDTR …may not be appropriately calculated due to the use of the historical data applied to generate the remediation values. *The use of historical data that does not account for remedial actions completed that improve the bioavailable concentration of DDTR may yield a remediation value that is not accurately calculated*." In the responsiveness summary In EPA's responsiveness summary, EPA summarily dismissed ADEM's concern, stating that "[w]hile DDTR concentrations in site sediment and fish tissue in OU-2 may have decreased since the data were originally collected, the BSAF, which defines the relationship between sediment and tissue concentrations, is not expected to vary significantly over time." **However, data collected since the cover was installed demonstrates that sediment:tissue ratios have, in fact, varied significantly over time, and thus confirm that ADEM's concerns were well-founded, that EPA's assumptions were incorrect, and thus, the RGs derived from this data are not technically defensible.**

  As acknowledged by EPA, biota samples collected throughout the floodplain have shown dramatic reductions in DDTR levels since the cover was installed in 2008, including areas well outside of the cover. Since the cover was installed, DDTR concentrations in Gambusia in Round Pond have declined by 97%, and in largemouth bass in Olin Basin have declined by 80%. Both of these reductions occurred without any substantial activities to reduce local sediment DDTR levels outside the cover. Assuming that the sediment concentration remain relatively constant from 2009-2016,[1] an accumulation factor calculated in 2009, when the biota was still heavily influenced by pre-cover exposures, would be 30 times

[1] Limited data available from Round Pond suggests a marginal increase in sediment DDTR levels over this time frame. However, only 3 samples are available over this timeframe.

higher than an accumulation factor calculated in 2016. **An evaluation, based on the best available, current site-specific data would likely result in a sediment RG several times higher than the current Olin OU2 sediment RG for DDTR.**

- As BASF has previously noted, for exactly this reason, applicable EPA guidance specifically recommends against collecting sediment:biota paired data for the purpose of establishing RGs while the ecosystem is in flux. *Estimation Of Biota Sediment Accumulation Factor (BSAF) From Paired Observations of Chemical Concentrations in Biota and Sediment*[4] ("EPA's BSAF Guidance") states, "BSAFs should be determined from spatially and temporally coordinated organism and surficial sediment samples under conditions in which recent loadings of the chemicals to ecosystem are relatively unchanged." As indicated by EPA's own BSAF Guidance, and confirmed site-specific data, collection of sediment:biota data pairs while the system is in flux for the purpose of establishing RGs is not technically appropriate and does not reflect sound science. Data collection shows that biota tissue levels continue to drop - but are more closely reflective of a "steady state" condition than the samples used by EPA in the Olin RGs. **If EPA intends to use BSAFs for deriving revised RGs for the site, the analysis should be performed using the best available data that is more closely reflective of steady state conditions following installation of the cap -- specifically the latest post-cover data where the biota has been least impacted by sediment concentrations present prior to cover installation.**

- While BASF objects to the overall approach used by EPA as outlined above, we note that EPA eliminated an influential sample pair in its sediment to forage fish accumulation factor calculation without technical justification or explanation. Given the relatively few number of sample pairs used for the calculation, every pair is influential and should not be removed simply because it changes the relationship. In fact, the sample pair EPA removed was probably the most representative of actual bioaccumulation conditions because it was taken in the area of highest concentration in the floodplain and would not have been influenced by biological transport from other areas with higher DDTR levels. Had EPA included this sample pair, the fit of the regression on the entire data set would have improved (R-squared improves to 0.87 from 0.72), and the coefficient relating forage fish to sediment from would have decreased from 1.1 to 0.52. **Exclusion of this sample pair was arbitrary, and not based on sound science. Inclusion of this sample pair, with no other modifications to the RG development approach, would have increased the sediment RG from 0.21 mg/kg to 0.44 mg/kg.**

- The soil to insect DDTR accumulation model used to develop the Olin soil RG had no predictive power (R-squared=0.0003). An R-squared value in this range indicates no relationship at all – a random multiplier would be as effective to accurately relate insect concentrations and soil concentrations as the selected ratio. In fact, insect samples collected in 2015 confirm that this accumulation factor dramatically over-predicts the actual DDTR levels in insects, and thus was

arbitrary and not technically supported. **The best available data shows that there is no current risk to insect-eating birds from DDTR in insects and soil in the floodplain. If an RG was calculated based on current data, it would be several times higher than the Olin RG.**

In addition to the concerns above that have been raised on multiple occasions, BASF also has concerns with the use of the t-TEL from the Beckvar et al. 2005 publication[1] ("Beckvar 2005") as a reliable threshold for adverse effects to predatory fish. The studies summarized by Beckvar 2005 all were published before 1982 and included several studies that were not peer reviewed. At least two of the non-peer-reviewed studies used by Beckvar 2005 had significant quality control issues and should have been excluded from the evaluation (e.g., one study had up to a 40% difference between the fish counts in the tanks at the end of the study and what they had expected based on their mortality counts). The Beckvar 2005 publication itself notes that "[f]or this review, we were unable to meet the minimum 20 data point requirement specified in the sediment TEL guidelines". Elsewhere in the paper it states, "[t]herefore, these DDT tissue residue-effect numbers should be considered provisional and used carefully." In a follow up paper in 2011[2], Beckvar and Lofuto reiterate that "data used in this [Beckvar 2005] analysis were mostly older studies reporting lethal effects so the calculated thresholds were considered provisional." EPA cited three additional studies in the ROD in addition to those summarized by Beckvar 2005. However, those studies were all based on acute rather than chronic toxicity, followed by the application of an acute to chronic ratio (ACR). The summary study[3] that was used to develop the ACR notes that across all of the included studies, ACRs ranged from 1.1 to 18,550 – indicating no consistent relationship between acute and chronic toxicity. Thus, EPA's use of these studies only served to further increase the uncertainty around the appropriate threshold effects value. EPA's use of Beckvar 2005 and the other cited studies resulted in a highly uncertain threshold effect for fish for setting RGs for the floodplain.

Given both the paucity of data for the target species and the low quality of the studies available to assess DDTR effects on fish as confirmed by the authors of the studies, predatory fish should not be used as the end-receptor used to define a sediment RG. EPA should have continued with the approach EPA set forth in the Proposed Plan and used wading birds, as opposed to predatory fish, as the ecological end receptor to determine the sediment RG. A great deal more reliable research is available to assess DDTR effects to birds than to fish (see the EPA Ecological Soil Screening document[4]). Additionally, the effects levels to wading birds are based on DDTR dose rather than tissue level, and the dose can be measured easily through forage fish. Using wading birds as the relevant end receptor eliminates the most uncertain accumulation step of the RG development – the link between DDTR tissue levels in predatory fish to the DDTR levels in forage fish. The predatory fish live for many years and integrate many years of exposure. In an environment when DDTR exposures are changing substantially, as evidenced by the consistent decline in forage fish concentrations, calculating a reliable accumulation factor is not possible. **In summary, the change in approach for determining a sediment RG from the Proposed Plan to the ROD significantly increased the uncertainty around both the relevant effect threshold and the relevant accumulation relationships, was arbitrary, not based on sound science and technically inappropriate**.

Use of the Olin DDTR RGs Directly Contradicts Prior EPA Statements to BASF

Since 2015, BASF has spent significant time and expense to develop and complete the SRI. BASF has developed multiple sampling plans; collected a variety of biota, soil, sediment, and surface water samples; submitted comprehensive reports describing and analyzing the sampling results; and submitted a detailed Quality Assurance Project Plan specifically focused on the SRI sampling. Both EPA and BASF understood that the SRI was being performed with the intention of developing new goals for OU3, if the results of the sampling indicated they were needed. Moving to adopt the Olin OU2 RGs for the BASF OU3 prior to the completion of the BASF OU3 SRI is inconsistent with the communication that BASF has received from EPA since 2015.

- In a letter dated April 1, 2015 and a follow-up letter dated May 21, 2015 from Franklin Hill, EPA required BASF to undertake a Supplemental RI including "an updated Ecological Risk Assessment that shall be prepared after close consultation with EPA Region 4 subject matter experts."
- In meetings with EPA R4 administration in October 2015, the BASF legal and technical team was assured that BASF would have the opportunity to complete the SRI and supplemental ERA, and that the Olin OU2 RGs would not be applied to BASF's OU3 as a foregone conclusion.
- EPA comments on OU3 monitoring plans dated August 31, 2015 and July 14, 2016, recommend sampling to calculate new accumulation factors that would result in new RGs, consistent with our understanding of the process that was agreed to be followed. In its August 2015 EPA comments specifically notes uncertainty in the accumulation factors used in the Olin ROD and the sampling needed to refine that value: "The Olin OU2 ROD cleanup level for protection of predatory fish (largemouth bass [*Micropterus salmoides*]) was calculated by taking the Beckvar et al. (2005) fish tissue residue value of 0.64 mg/kg and dividing it by the observed biomagnification factor in largemouth bass of 3. The result was the Olin OU2 ROD DDTR cleanup level of 0.23 mg/kg in tissues of *Gambusia* and/or brook silversides (*Labidesthes sicculus*). Uncertainty in the biomagnification factor of 3 can be reduced by collecting paired data for *Gambusia*/silversides and largemouth bass." EPA's 2016 comments also included several recommendations to collect sediments in the same locations as *Gambusia* and predatory fish, presumably for the same purpose.

EPA directed BASF to conduct an SRI, and BASF has complied. BASF has collected soil, sediment, surface water, insects, forage fish, bluegill, and largemouth bass. We have collected samples from Cypress Swamp, Round Pond, Olin Basin, the former effluent ditch, and elsewhere in the floodplain. The results from this sampling have clearly demonstrated that implementation of the cover in 2008 over the area of high concentration DDTR has had a significant beneficial effect on biota DDTR levels throughout the floodplain. An ERA conducted based on newer samples that are not impacted by this high concentration area, and while the ecosystem is closer to steady state will be significantly more reliable than the ERA used to develop the RGs in the Olin OU2 ROD. As noted above, EPA's own BSAF Guidance[5] states, *"BSAFs should be determined from spatially and temporally coordinated organism and surficial sediment samples under conditions in which recent loadings of the chemicals to ecosystem are*

relatively unchanged." The loadings to the system in 2010, when many of the Olin ROD samples were collected, were changing dramatically. Use of this data for establishing the RGs was arbitrary.

EPA's Adoption of the Olin DDTR RGs Was Procedurally Flawed From the Outset and Cannot Now Be Imposed in Another ROD.

BASF's obligations are defined by its Consent Decree (CD) for OU3 and the NCP. Further, BASF believes there were fundamental problems with the process followed in the Olin ROD that have compounded an already complex situation. The approaches EPA used to develop the Olin RGs and specifically the DDTR RGs were modified substantially between publication of the Olin OU2 Proposed Plan and the issuance of the Olin OU2 ROD. In particular, the relevant end receptor for sediment DDTR was changed, new accumulation factors were calculated, and the sediment RG was decreased from a range (0.33 to 1.7 mg/kg) to 0.23 mg/kg. Despite these very significant modifications, these proposed changes were never made available for public comment -- including by Olin or BASF, so that these concerns could have been timely addressed prior to issuance of the Olin ROD. Evaluation of more recent data from the site confirms that the concerns raised by ADEM, BASF and Olin regarding the process used to derive the Olin RGs were well-founded and that the technical approach used by EPA was inconsistent with EPA's own guidance and fundamentally flawed, resulting in overly stringent RGs that are not reflective of sound science.

BASF is pleased that EPA acknowledges the substantial progress made in the OU3 floodplain in reducing DDTR levels. It is also encouraging that outside of some potential work in the former effluent ditch, there is consensus that additional remediation to address DDTR in the floodplain is unlikely to be necessary in the near term. However, the adoption of overly conservative RGs that are not supported by the best available science, and were developed without BASF's participation as contemplated by our CD, is inappropriate and arbitrary.

In conclusion, we believe that the most appropriate path forward is for BASF and EPA to resume technical meetings to discuss what sampling is needed to complete the SRI and then to collaborate on the development of new, technically defensible RGs that include the most recent site-specific data. As you know, the data collection process has been ongoing, as contemplated in our prior meetings and the Five Year Review process, and we are moving forward with the supplemental ERA.

Sincerely,

Stephen K. Havlik
Senior Remediation Specialist

[1]Beckvar, N., T.M. Dillon and L.B. Reads. 2005. Approaches for linking whole-body fish tissue residues of mercury or DDT to biological effect thresholds. Environ. Toxicol. Chem. 24(8):2094-2105.

[2]Beckvar, N. Lotufo, G. 2011. DDT and Other Organohalogen Pesticides in Aquatic Organisms. Published in Environmental Contaminants in Biota: Interpreting Tissue Concentrations, 2nd edition, ed. W. Nelson Beyer & James P. Meador (Boca Raton: CRC).

[3]Raimondo, S., B.J. Montague, M.G. Barron. 2007. Determinants of variability in acute to chronic toxicity ratios for aquatic invertebrates and fish. Environ. Toxicol. Chem. 26(9):2019-23.

[4]U.S. Environmental Protection Agency. 2007. Ecological Soil Screening Levels for DDT and Metabolites. OSWER Directive 9285.7-57. Office of Solid Waste and Emergency Response, Washington, D.C.

[5]Burkhard. 2009. Estimation of Biota Sediment Accumulation Factor (BSAF) From Paired Observations of Chemical Concentrations in Biota and Sediment. U.S. Environmental Protection Agency, Ecological Risk Assessment Support Center, Cincinnati OH. EPA/600/R-06/047.

ATTACHMENT 4

Letter from Steve Havlik to Beth Walden presenting Adaptive Management Plan for OU3 Floodplain.
August 9, 2018.

Stephen K. Havlik
Sr. Remediation Specialist
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August 9, 2018

Via E-Mail: walden.beth@epa.gov

Ms. Elizabeth Walden
Remedial Project Manager
U.S. Environmental Protection Agency
Region IV
61 Forsyth Street, S.W.
Atlanta, GA 30303-8960

Subject: Cleanup Levels for OU3 at the
Ciba-Geigy Superfund Site, McIntosh, AL
Operable Unit No. 3, EPA I.D. No. ALD001221902

Dear Ms. Walden:

BASF is writing in response to EPA's March 12, 2018 letter and to reiterate our strong objection to EPA's planned application of Olin OU2 ROD DDTR cleanup levels to BASF's OU3 ROD. A follow-up letter will provide detailed point-by-point responses to each EPA technical comment from the March 12, 2018 letter.

We agree with EPA comments during previous telephone conversations that additional remedial activities for DDTR in the floodplain may be needed, including further assessment and remediation of the former effluent ditch. However, applying EPA's proposed soil and sediment cleanup levels across the entire 400 acres of the floodplain will require ecologically disruptive remediation over a very large area where, based on BASF's technical evaluations, there is no demonstrated risk to ecological receptors. The costs for this remedy are large and will likely exceed the thresholds that trigger review by both the National Remedy Review Board and the EPA Administrator.

Despite our technical disagreements with EPA and our very serious concerns with the application of the proposed DDTR cleanup levels, BASF wants to expeditiously move forward with additional remedial actions in the floodplain. In this spirit, we have developed a proposal for additional investigation and remedial action, coupled with a robust monitoring program to evaluate performance and identify if further action is needed following the proposed remedial actions.

I was very disappointed that on our call yesterday, you rejected BASF's proposal and plan out-right -- without even reviewing it -- and said we should not submit it. Our proposal to implement additional remedial actions, evaluate their effectiveness and use

these results to steer any additional actions reflects an Adaptive Management approach to the floodplain, consistent with EPA's most recent guidance, including July 2018 recommendations from the Superfund Task Force regarding remediation of complex sediment sites. As an attachment to this letter, a preliminary Adaptive Management Plan for the OU3 floodplain is provided. BASF hopes that it will provide the basis for discussion and collaboration on a remedy for the floodplain that is protective of human health and the environment. A key component of our proposal for the floodplain is the use of EPA's DDTR risk thresholds for end-receptors (predatory fish, piscivorous birds, and insect-eating birds) as benchmarks for the effectiveness of the floodplain remedy. These values are superior to the soil and sediment cleanup levels that have been included in the Olin OU2 ROD, since the soil and sediment values are based on modeled relationships between biota and soil/sediment, and utilize assumptions to address areas of significant uncertainty. Using these biota as the measure of the effectiveness of the remedy eliminates these uncertainties.

On our call yesterday, you indicated that biota tissue concentrations, without accompanying soil / sediment concentrations, could not be used as remedial goals for a ROD. An Adaptive Management approach is implemented through an *interim* ROD which incorporates "intentional learning" to evaluate the response of the biota to remedial action(s). Final sediment and soil remedial goals are set in a *final* ROD – once efficacy of remedial actions has been evaluated. This insures that sediment/soil numbers will, in fact, be protective of human health and the environment.

As you will see in our point by point response to your March 12, 2018 letter, we do not believe that additional evaluation of the existing data will resolve our technical points of disagreement. A more productive path forward is to work together to finalize the scope of investigation, remedial action and a structured monitoring program under an Adaptive Management framework. With an agreed upon scope of these activities, BASF and EPA can renew the cooperative approach that was critical to reducing biota DDTR concentrations by 99% over a relatively short period of time.

The program we have developed for the floodplain:

- Allows EPA and BASF to set aside our technical disagreements and immediately proceed with meaningful actions to further address DDTR in the floodplain;
- By further controlling upland and floodplain DDTR sources, BASF will minimize or eliminate concerns with recontamination of Olin's OU2, thereby removing any impediment to the mercury cleanup that EPA or Olin may perceive;
- Continues the past remedial approach that has led to the dramatic DDTR reductions seen in *Gambusia* to date;
- Is consistent with and recommended by EPA guidance on remediation of sediment sites (see list of references in the attached proposal).
- Through continuous evaluation and iterative action, it is certain to be protective when complete

Remedy implementation at large, complex sites using an Adaptive Management approach has been embraced by EPA. This approach will be implemented at the Berry's Creek

Superfund Site, and is under consideration for the Upper 9 Miles of the Lower Passaic River Superfund Site. As stated in the Proposed Plan for Berry's Creek:

> *"Uncertainties remain regarding both the response of the BCSA system to potential remedial actions and the mechanisms that contribute to exposure, risk and the rate of natural recovery in the BCSA marshes."*

Replace "BCSA" with "the McIntosh floodplain", and this describes the current situation at the Site.

However, EPA has an approach addressing these uncertainties:

> *"To address these uncertainties in a planned and systematic way, an adaptive management approach will be used to: a) promote intentional learning during the design and implementation of the Phase 1 interim remedial action to respond to changes and new information, and ensure the remedy achieves the objectives, b) collect and evaluate additional information to reduce uncertainties associated with the recovery of the marshes and downstream segments resulting from source removal, and c) support evaluation and selection of additional remedial actions."*

EPA's Contaminated Sediments Technical Advisory Group (CSTAG) review for each of these sites recognized the benefits of a site specific, data-driven, structured combination of interim remedies and post-remediation monitoring to evaluate the Conceptual Site Model and guarantee a protective outcome. Using this same approach for the McIntosh floodplain, BASF will perform necessary remediation to achieve a data-driven and protective outcome.

As noted in the July 2018 memorandum, EPA is developing a pilot project program and will be seeking candidate projects from the Regions in October. The pilot projects will be used in the development of new Adaptive Management guidance, targeted for December 2019. Because the previous activities at BASF McIntosh OU3 – iterative remedies with continuous re-evaluation - are consistent with an Adaptive Management approach and the criteria that we understand are being considered for the pilot program, we feel that it would be an excellent candidate for the pilot project program. Additional activities are needed to reduce site uncertainties, a major component of the new working definition of Adaptive Management.

BASF is willing to commit to the additional training and documentation requirements required for the pilot program. However, even if OU3 is not selected for the pilot program, BASF feels that an Adaptive Management approach is the clear path forward to continue site progress.

In conclusion, BASF remains committed to ensuring the protection of the floodplain ecosystem. We believe that the path forward for ensuring protectiveness is a collaborative effort with EPA to develop and implement an Adaptive Management framework. Despite your comments yesterday, BASF asks that the Agency please review this proposed Plan and give it full and careful consideration, as we believe it offers the opportunity to move forward immediately, in collaboration, and in a manner that addresses all parties' concerns regarding the floodplain. We would like to schedule a mutually agreed date to further discuss this matter. Please let us know your availability for a meeting.

Sincerely,

Stephen K. Havlik
Senior Remediation Specialist

cc: Austin Pierce, ADEM

Preliminary Adaptive Management Plan for DDTR at BASF McIntosh

Introduction

EPA and BASF share the common goal of implementing a remedy for the Operating Unit 3 (OU3) floodplain (the "floodplain") of the McIntosh, Alabama site that is protective of public health and the environment. As EPA is aware, BASF has implemented several phases of interim remedies focused on this goal. It is clear that EPA and BASF disagree on issues critical to developing and implementing the remedy. Implementation of an Adaptive Management approach to the floodplain and these issues will allow BASF and Region IV to move forward collaboratively and immediately with additional remedial action in the floodplain using a fresh approach that has been embraced and advocated by the Agency in its efforts to reform the Superfund program (USEPA, 2018a and 2018b).

BASF has prepared this plan for collaboration with EPA at the site. Under this plan, BASF will conduct additional characterization and remedial activities and, utilizing Adaptive Management, evaluate the effectiveness of the additional remedial activities and, as needed, perform further actions such that a protective remedy is implemented for the floodplain on both BASF and Olin properties.

This approach provides many important benefits to the project:

- It provides a path to collectively resolve our technical differences and move forward on the project on an expedited basis.
- Additional remedial actions, and therefore risk reduction, will be conducted within a short time period.
- The ultimate scope of the remedy is certain to be protective of human health and the environment; and
- The approach continues the remedy implementation in the floodplain that has led to a dramatic reduction in mosquitofish (*Gambusia*) DDTR levels.
- The remedy will be consistent with options to address mercury in Olin's OU2 and therefore will allow EPA and Olin to move forward with any planned mercury remediation.

Again, use of the Adaptive Management approach will provide EPA, Olin and BASF the data needed to make sound decisions regarding the floodplain remedial action.

There is a great deal of uncertainty surrounding ecological exposures in the floodplain. In a complex ecosystem like the floodplain, it is not possible to precisely quantify exposure mechanisms, elimination rates, home ranges, and multiple other factors that relate sediment and biota contaminant levels. Adaptive Management recognizes these inherent uncertainties and acknowledges it is not necessary to address all uncertainty prior to the implementation of a management action.

This memorandum presents a plan for pursuing an Adaptive Management approach for the floodplain in McIntosh. The memorandum is organized as follows:

- EPA Guidance encouraging Adaptive Management

- McIntosh floodplain as an example of a successful Adaptive Management approach
- Floodplain Conceptual Site Model overview
- Path forward using Adaptive Management
    - Remedial action objectives
    - Specification of key indicators, trigger criteria, and non-attainment actions
    - Proposed data collection to inform CSM and implement the Adaptive Management approach
    - Potential early remedial actions

EPA Guidance on Adaptive Management

EPA guidance has recommended the use of Adaptive Management in multiple guidance documents:

- *Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* issued in 1999 (OSWER 9200.l -23P);
- *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* issued in 2005 (OSWE R Directive 9355 .0-85); and
- *Remediating Contaminated Sediment Sites - Clarification of Several Key Remedial Investigation/Feasibility Study and Risk Management Recommendations, and Updated Contaminated Sediment Technical Advisory Group Operating Procedures* issued in 2017 (OLEM Directive 9200.1-130 – subsequently referred to as the 2017 Guidance Clarification).
- *Superfund Task Force Recommendation #3: Broaden the Use of Adaptive Management,* July 2018 (OLEM 9200.3-120)
- *2018 Update to the Superfund Task Force Report* (July 23, 2018)

The 2017 Guidance Clarification document states:

> *The Sediment Remediation Guidance encourages site managers to use an Adaptive Management approach, "especially at complex sites to provide additional certainty of information to support decisions." An adaptive approach could include early removal or remedial actions …, an interim ROD, a contingency ROD, or could be done as part of the remedy implementation.*

Given the intermittent inundation of the floodplain, the degree to which hydraulic connectivity among waterbodies changes with changing water levels, and the dynamic nature of the floodplain ecosystem, BASF McIntosh clearly represents a complex site that would merit an Adaptive Management approach. Additionally, the guidance provides great flexibility for how and when an Adaptive Management approach is incorporated into remedial planning.

McIntosh Floodplain as an Example "Adaptive Management" Providing a Path to a Successful Remedy

Dramatic improvements in the DDTR concentrations in ecological receptors have occurred over the past 20 years. The process that led to these improvements was characterized by iterative remedial action, data-driven decisions, hypothesis testing, continual evaluation of remedy performance, an emphasis on biological endpoints, and a high level of cooperation between BASF and the EPA and ADEM regulators. All of these are characteristics of a successful Adaptive Management approach.

In the original Record of Decision (ROD), a risk-management threshold was set as the remedial goal for soil and sediment to avoid the need to destroy many acres of cypress-tupelo forest. During remedial design, an ecological-risk-based target was added to ensure that remedial actions based on the risk-management approach were sufficiently protective. The ecological risk goal was a whole body *Gambusia* DDTR level of 1.5 mg/kg. In 1998 an Interim Remedy consisting of excavation of approximately 14 acres (19,000 cubic yards) of the most contaminated sediment was performed. The effectiveness was evaluated by sampling small forage fish (*Gambusia*). While the DDTR levels in *Gambusia* did decline in the years after the 1998 remedy, the levels plateaued above the 1.5 mg/kg goal. The 2006 Five-year Review (FYR) included a recommendation for additional remediation. BASF, in coordination with EPA and ADEM, moved rapidly to conduct additional investigation and design a remedy that was expected to achieve the ecological-risk-based goal. A 42 acre cover remedy was designed, approved, and implemented within two years of the FYR recommendation.

The performance of the cover was again evaluated to determine if it was achieving the *Gambusia* goal. Within 3 years, *Gambusia* in Round Pond were meeting the 1.5 mg/kg goal. Within 5 years, the *Gambusia* in Cypress Swamp also met the goal. In subsequent years, the *Gambusia* DDTR levels continued to decline and are now at or below 0.2 mg/kg in all of the floodplain waterbodies where *Gambusia* are present (Cypress Swamp, Round Pond, and Olin Basin). In Cypress Swamp, this represents a 99% decline from pre-cover levels.

Floodplain Conceptual Site Model Overview

Prior to the implementation of the cover remedy, a Conceptual Site Model was developed to describe the conditions in the floodplain (LimnoTech, 2007). The major conclusions of the 2007 CSM were:

- The DDTR footprint in the floodplain sediments was relatively stable and consistent with past investigations.
- Natural recovery is occurring.
- Sediment transport to the Tombigbee River is not occurring, and any DDTR transport is minimal and localized within the ecologically sensitive areas that were not remediated in the initial cleanup phase conducted in 1998 (i.e., the Focus Area), to the south of the former effluent ditch and north of the Olin berm.

The CSM was updated recently, approximately a decade after the implementation of the cover remedy. The major conclusions from the updated CSM were:

- DDTR has declined substantially in all monitored biological receptors following the cover remedy.
- 2007 CSM conclusion of a low energy system has been confirmed with minor exceptions:
    - Stormwater runoff over the bluff may occasionally cause erosion.
    - Erosion along the east edge of Cypress Swamp can occur if regular drainage pathways are constrained.
        - Most of the eastern cover area is heavily revegetated.
        - The erosion that occasionally occurs in this area is on the floodplain access road rather than the cover.
- Prior to the cover installation, suspension and resettling of a detritus/fluff layer within the floodplain may have resulted in the movement of DDTR from areas of high concentration throughout much of the floodplain. This process may be ongoing, though BASF is not aware of any large areas of elevated DDTR remaining in the floodplain.
- Revegetation has made erosion even more unlikely over almost the entire cover area, as confirmed by stake inspections.
- Results of the DDTR analysis of cover sediments and *Gambusia* do not indicate substantial recontamination of the cover, though a slight increase in concentration has been observed.
- The currently available data do not indicate the presence of any large, contiguous areas of elevated DDTR levels in surface sediments anywhere in the floodplain, however large areas have not been sampled since the 1990s.
- Currently available data do not indicate an unacceptable risk to terrestrial animals, such as insect-eating birds.
- Some higher trophic level aquatic organisms contain DDTR above acceptable risk levels put forth in the Olin ROD.
    - The DDTR exposures to aquatic organisms include (Figure 1):
        - Direct absorption from the water column,
        - Incidental sediment ingestion,
        - Ingestion of detritus and algae,
        - Ingestion of benthic invertebrates,
        - Ingestion of eggs and larvae, and
        - Ingestion of lower trophic-level fish.
    - These exposure pathways have widely varying areas of influence (forage fish example shown in Figure 2).
        - Direct sediment exposures limited to home range of the forage fish species.

  - Dissolved chemical exposures extend to the water column mixing zone, which is dependent on water level and hydraulic connectivity. Following hydraulic disconnection, the mixing extent is largely limited to the extent of the individual water body.
  - Food chain exposures extend to limit of home range of species that contribute to the food supply of forage fish (directly or through eggs and larvae).
- Additional sampling and modeling will not provide sufficient clarity to separate the contributions from each pathway.
- However, a consistent and continuing decline in biota DDTR levels provides strong evidence that a large percentage of the DDTR is from recirculation within the food-chain and not from contemporaneous and localized sediment-related exposures.

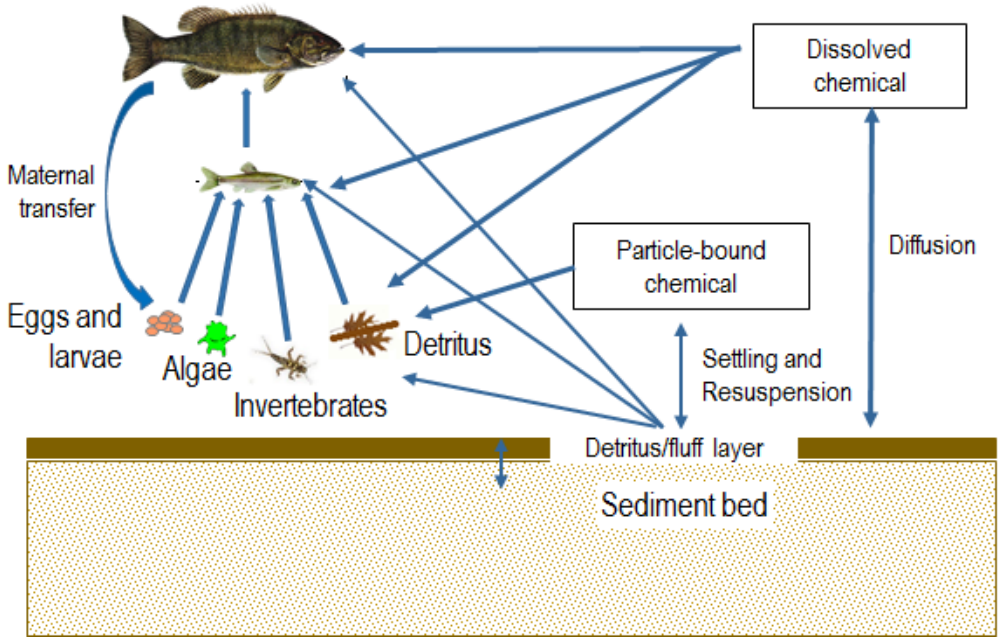

Figure 1. DDTR exposures for fish in McIntosh floodplain.

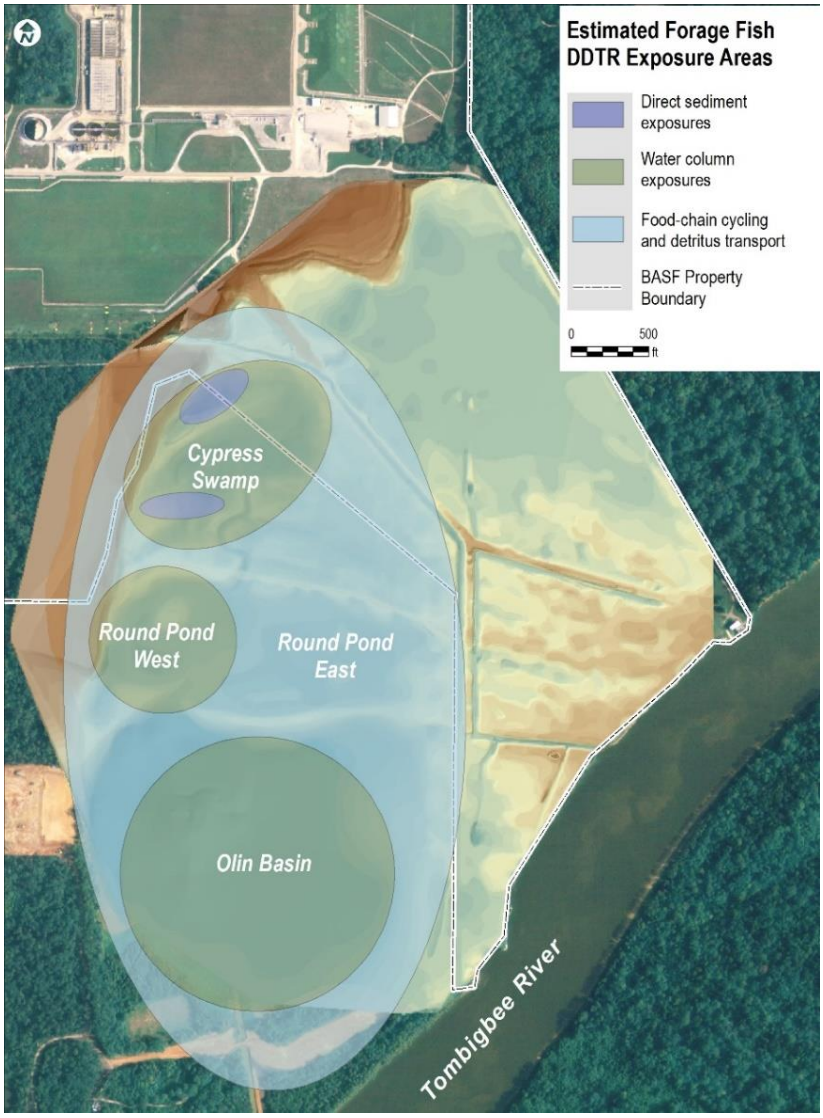

Figure 2. Estimated spatial extents of DDTR exposure for forage fish in McIntosh floodplain.

Under an Adaptive Management framework, the quantification of the contribution of each exposure pathway is unnecessary.

Path Forward Using Adaptive Management

In the 2017 Guidance Clarification document, EPA lays out the following steps for utilizing Adaptive Management:

i. *Establish measurable remedial action objectives; (i.e., what levels are expected to be achieved in what media over what area, and in what timeframe?)*

ii. *Establish an Adaptive Management plan that:*

   a. *Specifies key indicators (i.e., monitored parameters that are tied to the remedial action objectives),*

   b. *Selects specific trigger criteria (i.e., concentrations and timeframes) of those key indicators that might trigger a change in the remedy, and*

   c. *Specifies the specific actions based on attainment or non-attainment of trigger criteria;*

iii. *Implement remedial action that has reasonable expectation of meeting the goals; and*

iv. *Monitor the response action and implement the Adaptive Management plan:*

   a. *Monitor and compare collected data to timeframes and trigger criteria, and*

   b. *Take action as specified if trigger criteria were not met, (i.e., remedial objectives were not achieved in stated timeframe).*

To support the Adaptive Management approach in the floodplain, BASF proposes to implement an Interim Remedy (IR) that will consist of a site wide sampling program, remediation of all areas in excess of 4 mg/kg in sediment, and additional remediation of the sediment in the former effluent ditch; evaluation of any potential ongoing source, and a structured monitoring program to provide data on the response of the system to the IR. BASF has integrated the proposed tasks into an outline of a draft Adaptive Management plan for the floodplain.

Establish Measurable, Meaningful Remedial Active Objectives

Based on the DDTR ecological risk assessments performed previously in the floodplain performed by BASF (Ciba, 1994; Ciba, 1998), Olin (AMEC, 2012) and EPA (EPA, 2014), the RAOs to protect the most sensitive ecological receptors are the protection of predatory fish, insectivorous birds, and piscivorous birds. Additionally, based on recent communications with EPA, limiting recontamination of the previously remediated areas is an important objective.

The risk to predatory fish can be measured directly through predatory fish tissue levels. Based on site observation, bluegill appear to be the most common predatory fish present in all floodplain waterbodies. The risk to insect-eating birds can be measured by measuring the paired invertebrate and soil samples. The soil samples are relevant due to the contribution of incidental ingestion of soil.

The following RAOs for the floodplain build on the biota end-receptor cleanup levels included in the Olin OU2 ROD:

1) Protection of Predatory Fish - Bluegill DDTR levels less than 0.64 mg/kg within a three year timeframe of the remedial or management action, or a statistically significant decline without plateau

2) Protection of Insectivorous Birds - Hazard Quotient <1 for Carolina wren exposure to DDTR in the areas that are not continually inundated within the first two years of remedial or management action

3) Protection of Piscivorous Birds: the protection of fish-eating birds can be assessed by measuring the dose to piscivorous birds through forage fish. Forage fish DDTR levels less than 0.52 mg/kg
4) Limiting recontamination: potential as indicated by a statistically significant increase in forage fish DDTR levels by at least 50% per year for two consecutive years

Develop Plan with Key Indicators, Trigger Criteria, and Specific Non-attainment Actions

Key indicators

1) Predatory fish: whole body bluegill (9 to 15 cm) within each waterbody
2) Carolina wren HQ: Combined insect/spider and soil levels (based on incidental ingestion) in areas of highest historical residual DDTR in soil
    - Insect types to be established based on discussions with EPA regarding contribution to risk and availability of various insect classes
3) Forage fish: whole body *Gambusia*, no size restriction, in each floodplain waterbody
4) Limiting recontamination: whole body *Gambusia*, no size restriction, in areas where remediation has been performed
    - *Gambusia* serve to integrate the DDTR levels over a broad area and avoid the "nugget" of DDTR that can create outlier values in soil and sediment samples

Trigger criteria

1) Predatory fish DDTR levels less than 0.64 mg/kg within each floodplain waterbody
    - Mean bluegill DDTR levels less than 0.64 mg/kg within each floodplain waterbody (Cypress Swamp, Round Pond, Olin Basin, former effluent ditch) within three years; or
    - A statistically significant declining trend of at least 25% per year without plateau
2) Combined insect and soil levels (based on incidental ingestion) with an HQ<1 for Carolina wren

- Combined insect and soil levels (based on incidental ingestion) with a mean HQ value less than 1 for DDTR within two years of a remedial or management action

3) Forage fish DDTR levels less than 0.52 mg/kg (for the protection of wading birds)
    - Whole body *Gambusia* concentrations less than 0.52 mg/kg in all floodplain waterbodies where *Gambusia* are consistently present (Cypress Swamp, Round Pond, Olin Basin)
4) Limiting recontamination
    - Whole body *Gambusia* concentrations in Cypress Swamp do not increase by a statistically significant percentage of at least 50% for two consecutive years

Actions based on attainment or non-attainment of trigger criteria;

1) Non-attainment of predatory fish goal
    - Determine additional percent reduction in whole fish concentration needed to attain goal
    - Conduct additional sediment characterization
    - Design a remedy to attain comparable reduction in sediment SWAC for relevant home range
    - Consider additional measures to reduce surface water or detritus concentrations over a broader area
2) Non-attainment of insect-eating birds goal
    - Evaluate drivers of non-protectiveness (incidental soil ingestion or insect consumption)
    - Conduct additional characterization of soils
    - Design remedy to reduce soil DDTR levels to reduce risk
3) Non-attainment of wading birds goal
    - Determine additional percent reduction in forage fish concentration needed to attain goal
    - Conduct additional sediment characterization
        - Design a remedy to attain comparable reduction in sediment DDTR.

- Consider additional measures to reduce surface water concentrations over a broader area

4) Non-attainment of limiting recontamination

    1. Conduct additional study to assess sources of recontamination (surface water, upland sediments, etc.)
    2. Design remedy to address relevant sources

Monitor the Response Action and Implement the Adaptive Management Plan

Although monitoring the response and implementing the plan is step *iv* in the EPA outline (following step *iii, Implement remedial action that has reasonable expectation of meeting the goals)*, the most appropriate next step in the McIntosh floodplain is data collection. Additional data collection will inform the Conceptual Site Model (CSM), allow for the assessment of current conditions compared to trigger criteria, and provide information about areas of the floodplain that have not been sampled in many years.

BASF will work with EPA to develop a plan for additional monitoring. Based on the previously identified key indicators, additional data collection may include:

- Predatory fish sampling in Cypress Swamp, Round Pond, Olin Basin, and the former effluent ditch;
- Combined invertebrate and soil sampling to assess risk to insect-eating birds;
- *Gambusia* sampling in Cypress Swamp, Round Pond, and Olin Basin;
- Data to assess recontamination potential (in addition to *Gambusia* samples in Cypress Swamp used to compare to recontamination trigger criteria); and
- Floodplain-wide soil and sediment sampling to better understand current DDTR levels, particularly in locations that have been sparsely sampled since the 1990s.

Additional *Gambusia* sampling will be performed to assess whether the long-term decline in DDTR concentrations has continued and whether *Gambusia* present an unacceptable risk to wading birds. Additionally, the Cypress Swamp *Gambusia* can be used to assess whether cover recontamination is adversely affecting biota. The *Gambusia* sampling will be performed in a manner consistent with the sampling performed from 2009 to 2014.

The predatory fish samples will be used to assess long-term trends and compared to the Adaptive Management trigger criteria, based on risk to the predatory fish. The predatory fish sampling will be performed in a manner consistent with the sampling performed in 2015 and 2016.

BASF will work with EPA to develop a paired insect and soil sampling plan. In particular, BASF will coordinate with EPA to make decisions regarding the appropriate sampling methodology when insufficient numbers of certain insect types are available at

a particular location. The results of the paired sampling will be compared to the Adaptive Management trigger criteria for insect-eating birds.

A four-inch surface sampling interval is proposed for future floodplain sampling to be consistent with the sediment samples collected in the Olin ROD and recent sediment samples collected by BASF.

The floodplain-wide soil and sediment sampling will assist in:

- Informing the risk to insect-eating birds via incidental ingestion;
- Initial identification of soil and sediment hot spots;
- The calculation of floodplain-wide and individual water body SWAC values;
- Development of a remedial strategy (if needed) to reduce SWAC, either floodplain-wide, in specific areas, or in individual waterbodies, as indicated by the data.

To assess potential sources of recontamination to the floodplain series of turf-mats, similar to what were deployed in the 2007 Basis of Design Report (LimnoTech, 2007), will be installed along the bluffline and south of the ditch to assess the potential for cover recontamination due to uplands solids transport. The turfmats will be installed for several months, including periods of flooding during any solids transport would accumulate on the mat. The solids collected on the turf mats will then be analyzed for DDTR.

Implement Remedial Action that has Reasonable Expectation of Meeting Goals

Under an Adaptive Management framework, BASF is committed to taking additional Interim Action to address areas where the data indicate the potential for retarding recovery of the system. BASF proposes four tasks that are expected to increase the rate of recovery of the system, provide data that will improve the understanding of the CSM and address known areas where there may be an unacceptable ecological risk. The following are proposed:

- Evaluation of the upland storm water to determine if ongoing sources remain an issue.
- Site wide sampling will be performed using a 100 foot on center triangular grid. The top 4 inches of sediment, an interval consistent with recent sediment sampling by BASF and Olin, will be analyzed for DDTR and TOC.
- Development of a RD workplan that will address:
    - Additional remedy in the former effluent ditch;
    - Cover all sediment found to contain >4 mg/kg in order to address secondary source of DDTR.
- Implementation of the remedial design.

The final scope of the RD for the proposed interim action will be dependent on the results of additional data collection. However, based on previously collected data BASF provides the following information to explain the basis for the IR.

Sitewide Sampling and Secondary Source Management

Based on the information developed following the 1998 and 2008 interim remedies and the data obtained during subsequent monitoring program, the system has shown that isolation of sediment containing high concentrations of DDTR has resulted in a significant reduction of DDTR in the biota found across the site. Figure 3 shows the DDTR levels pre-cover and the area covered by the 2008 remedy. Figure 4 shows the decline in Cypress Swamp *Gambusia* following the implementation of the remedy. Therefore, the goal of the sitewide sampling is to identify other areas that may be acting as a secondary source of DDTR to the system and retarding recovery.

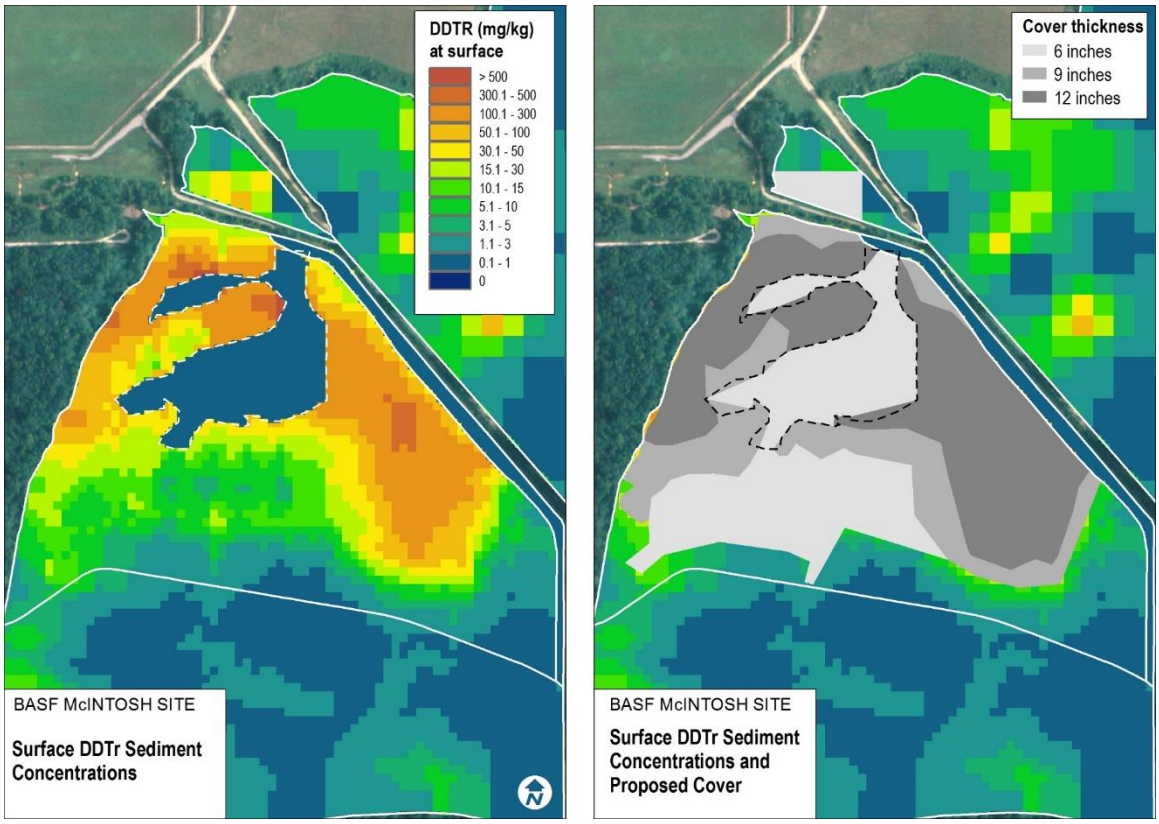

Figure 3. DDTR covered in 2008 cover remedy.

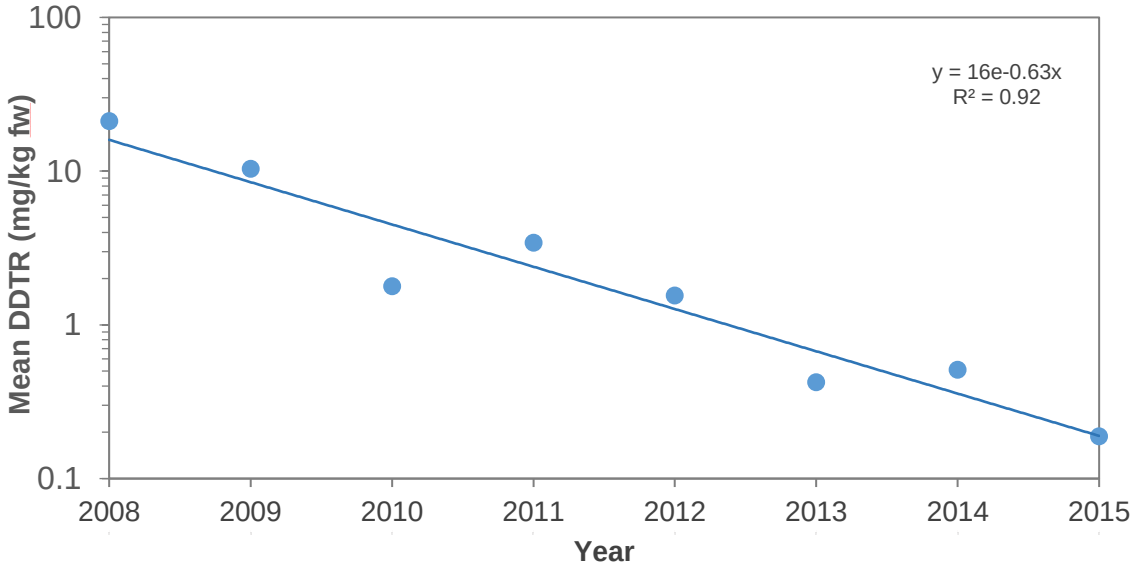

Figure 4. Decline in Cypress Swamp *Gambusia* DDTR following cover remedy.

BASF proposes to implement a sampling program based on a 100 foot on center triangular grid (Figure 5). Approximately 1600 samples will be collected from the zero to four inch (0-10 cm) interval and analyzed for DDTR and organic carbon.

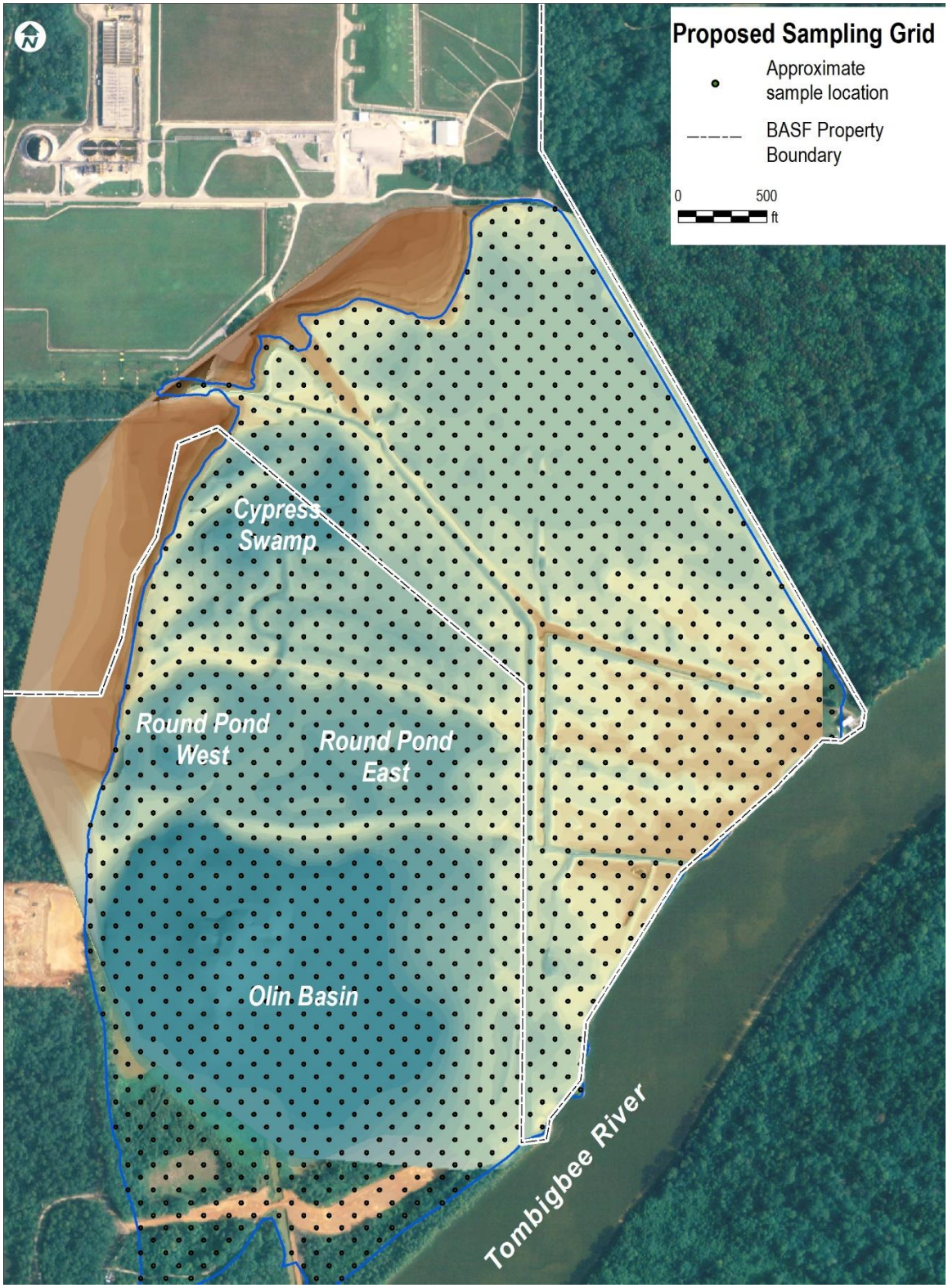

Figure 5. Proposed OU3 sampling grid.

BASF proposes to remediate each sample that exceeds 4 mg/kg DDTR. The proposed level is based on the lessons learned from the 2008 work in Cypress Swamp that resulted in significant reductions in fish tissue concentrations. The 2008 IR covered sediments greater than approximately 4 mg/kg in the vicinity of Cypress Swamp. Therefore, BASF is proposing a 4 mg/kg threshold for the entire floodplain.

The results of site-wide sampling will be used to identify areas contain DDTR more than the 4 mg/kg threshold. The proposed remediation will include application of 6 inches of compost-amended sand over the 10,000-square foot area represented by each sample that exceeds 4 mg/kg.

Remediation of the Former Effluent Ditch

The former effluent ditch was remediated in 1998. The majority of the ditch was excavated, backfilled, and covered with a geotextile liner and armoring stone. However, during the period from 1998 to 2008, elevated levels of DDTR were present in the sediments immediately adjacent to the former effluent ditch.

Three sediment samples were collected in the former effluent ditch in 2016 and analyzed for DDTR. Two of the three samples were higher than sediment DDTR typically found at other site locations; specifically the sample closest to Cypress Swamp and sample closest to the highest historic DDTR levels (prior to the 2008 cover). Table 1 and Figure 6 present the results of the former effluent ditch sampling results.

Table 1. Results of DDTR analysis for sediment collected in the former effluent ditch, 2016

Location	Date	DDTR (mg/kg)	TOC (mg/kg)
Ditch 1	7/22/16	6.8	0.28
Ditch 2	7/22/16	1.6	2.6
Ditch 3	7/22/16	0.06	1.7
Mean		**2.8**	**1.5**

Table 2 presents bluegill sampling results from 2016, which also confirm that the DDTR measured in the bluegill collected from the ditch were slightly higher than the proposed cleanup level of 0.64 mg/kg.

Table 2. Results of DDTR analysis for bluegill collected in the former effluent ditch, 2016

Sample ID	Location	Date	DDTR (mg/kg) [Detected Values]	DDTR (mg/kg) [ND=0.5*DL]	Percent Lipids	Length (in)
BG8-DITCH-071916	Ditch 1	7/19/16	0.68	0.69	1.3	5.5
BG9-DITCH-071916	Ditch 1	7/19/16	1.6	1.6	2	5.1
BG34-DITCH-072016	Ditch 1	7/20/16	0.11	0.13	3.1	7.9
BG35-DITCH-072116	Ditch 2	7/21/16	2.5	2.5	1.2	5.4
BG37-DITCH-072116	Ditch 2	7/21/16	0.76	0.77	0.92	4.9
BG48-DITCH-072616	Ditch 3	7/26/16	1.3	1.3	2.2	5.1
BG49-DITCH-072616	Ditch 3	7/26/16	0.94	0.95	1.6	5.8
Mean			**1.1**	**1.1**	**1.8**	**5.7**

In 2017, EPA provided a preliminary sampling plan for investigating DDTR in the former effluent ditch. The plan recommended the collection of 11 sediment samples along the length of the ditch that would be analyzed for DDTR, total organic carbon (TOC), grain size, and percent moisture, based on a 3 scoop composite. A subset would also be analyzed for other floodplain COCs (Copper, Chromium, Ametryn, Atrazine, Butylbenzyphthalate, Chlorobenzene, Diazinon, Prometon, Prometryn, Propazine, Simazine, Simetryn, Terbuthylazine, Terbutryn, Tolban). The proposed approach to ditch characterization seems appropriate. BASF accepts this recommended sampling, and would perform this sampling in addition to the Adaptive Management sampling noted above.

In addition to the sampling recommended by EPA, BASF recommends the collection of additional bluegill samples from the former effluent ditch to assess time trends. The samples collected in 2016 were the first biota samples from the ditch, so no other information is available to assess trends.

Based on the additional data collection and collaboration with EPA, BASF would design a remedy with a reasonable likelihood of meeting the previously identified RAOs.

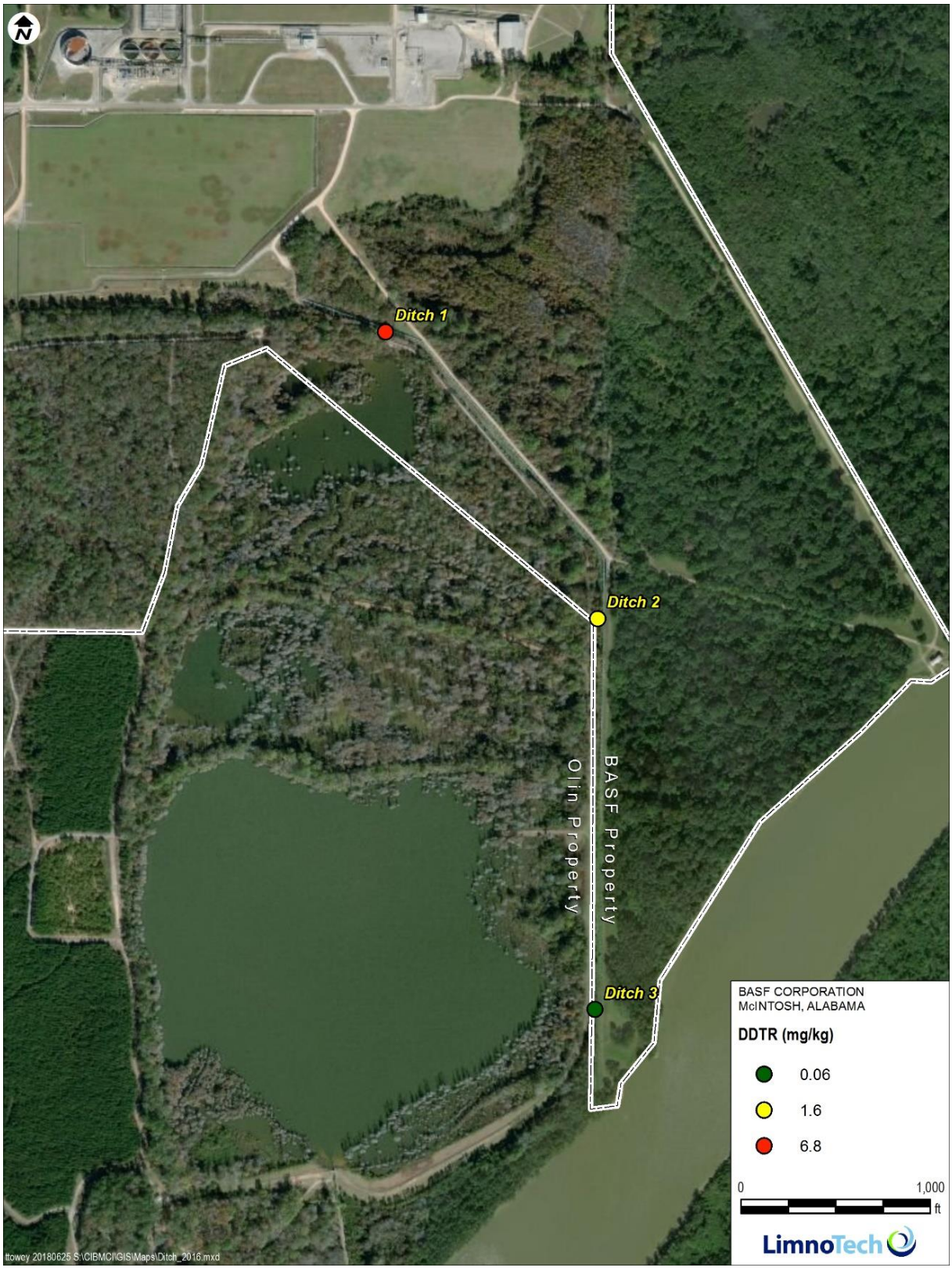

Figure 6. Ditch sediment sampling locations.

Addressing Remedial Action Objective 4 - Limiting recontamination

By assuring that upland sources of DDTR have been eliminated and by addressing secondary source areas the potential for recontamination will be minimized.

To assess upland sources, a series of turf-mats will be installed along the bluffline and south of the former effluent ditch. The turfmats will capture sediments and detritus from overland stormwater runoff along the bluffline and stormwater overflow from the former effluent ditch. The turfmats will be installed for several months, including periods of flooding during any solids transport would accumulate on the mat. The solids collected on the turf mats will then be analyzed for DDTR.

Any existing secondary sources within the floodplain will be addressed through the floodplain-wide sampling and remediation program.

The concentration of DDTR in the detritus/fluff layer is expected to recover quickly, once the sources have been managed. This will eliminate the spread of the DDTR throughout the system and limit the potential for recontamination.

The proposed program to address DDTR in the floodplain is consistent with, and may expedite, the mercury and hexachlorobenzene cleanup in Olin OU2. Based on the existing data trends, BASF believes that the hypothetical risk of recontamination of an Olin remedy is minimal at best. However, we acknowledge that Olin and EPA have expressed a concern regarding this issue. Although it is unlikely that even under current conditions the DDTR in the floodplain represents a recontamination risk to Olin, BASF offers the following additional support:

- The additional remedial actions that will be conducted by BASF in the ditch and the floodplain will further reduce the potential for DDTR transport onto the Olin OU2 cover, essentially eliminating the recontamination possibility;
- BASF has committed to EPA repeatedly, through the OU3 Consent Decree and otherwise, to address DDTR throughout the floodplain. In the unlikely event that data demonstrates unacceptable new risks, BASF will address those risks;
- Ongoing monitoring of ecological receptors will provide a basis to determine whether and to what extent any DDTR from the BASF OU3 has been transported onto the Olin OU2 cover whenever Olin conducts the cleanup for hexachlorobenzene and mercury in the floodplain.

References

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Ciba, 1994. Remedial Investigation/Feasibility Study Remedial Investigation Report Addendum: Ecological Assessment Report. April 1994.

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USEPA, 1999. *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*. United State Environmental Protection Agency, Office of Solid Waste and Emergency Response. EPA 540-R-98-031. July 1999.

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USEPA, 2017. *Remediating Contaminated Sediment Sites - Clarification of Several Key Remedial Investigation/Feasibility Study and Risk Management Recommendations, and Updated Contaminated Sediment Technical Advisory Group Operating Procedures* Office of Land and Emergency Management. OLEM 9200.3-130. January 2017.

USEPA, 2018a. *Superfund Task Force Recommendation #3: Broaden the Use of Adaptive Management.* Office of Land and Emergency Management. OLEM 9200.3-120. July 2018.

USEPA, 2018b. *Superfund Task Force Recommendations: 2018 Update.* Andrew Wheeler, Acting Administrator. July 2018.

ATTACHMENT 5

Letter from Steve Havlik to Beth Walden Response to Technical Comments. August 10, 2018.

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August 10, 2018

Via E-Mail: walden.beth@epa.gov

Ms. Elizabeth Walden
Remedial Project Manager
U.S. Environmental Protection Agency
Region IV
61 Forsyth Street, S.W.
Atlanta, GA 30303-8960

Subject: Response to Technical Comments
Cleanup Levels for OU3 at the
Ciba-Geigy Superfund Site, McIntosh, AL
Operable Unit No. 3, EPA I.D. No. ALD001221902

Dear Ms. Walden:

BASF has attached detailed responses to each of the EPA technical comments provided in their letter dated March 12, 2018. BASF does not believe that our technical disagreements with EPA can be resolved through additional evaluation of the currently available data. As such, we have developed and submitted under separate cover a *Preliminary Adaptive Management Plan for DDTR at BASF McIntosh* which we believe provides a path for continued progress in addressing unacceptable ecological risks in the McIntosh floodplain.

BASF remains committed to ensuring the protection of the floodplain ecosystem. We believe that the path forward for ensuring protectiveness is a collaborative effort with EPA to develop and implement an Adaptive Management framework. As noted in yesterday's correspondence, we look forward to hearing from you regarding potential meeting dates.

Sincerely,

SK Havlik

Stephen K. Havlik
Senior Remediation Specialist

cc: Austin Pierce, ADEM

Technical Responses to EPA Comments

Note: BASF's current technical responses to EPA's March 12, 2018 technical comments are in italics. For background and convenience, prior correspondence of both parties is included and appears in regular text. Dates of prior comments are noted.

INTRODUCTION

BASF and Region 4 agree upon the need for a remedy that is protective of public health and the environment. BASF's commitment to this goal is demonstrated by the actions that have already been performed, and our willingness to perform additional actions, as necessary, to achieve DDTR goals for ecological receptors. Further, BASF acknowledges that the DDT in the area included within Olin OU2 is within the BASF McIntosh Site for which BASF is responsible under BASF's Consent Decree for OU3 (the "Site").

The impact of the interim remedies performed in 1998 and 2008 on concentrations of DDTR (sum of the 2,4'- and 4,4'-isomers of DDT, DDD, and DDE) in fish tissue has been significant, with declines as high as 99% and continues to show improvement. Data available at the time of writing shows very limited impact of DDTR on insects in the study area.

However, BASF and Region 4 have a fundamental disagreement regarding the two most important technical issues influencing selection of the appropriate DDTR cleanup criterion for further response action in the floodplain:

1. *The mechanism(s) by which DDTR is transferred from sediment to Gambusia, the prey fish in the waterbodies; and*

2. *The potential for risk to insect-eating birds from the consumption of spiders and insects in the flood plain.*

Understanding these issues, will provide the basis for an effective remediation strategy. Therefore, determining the factors that control the uptake of contaminants by Gambusia and insects is critical to overall remedial success. This understanding is expressed in the conceptual site model (CSM) that is used to integrate the data collected at the Site and the understanding of fate and transport of contaminants in the system.

The EPA's proposed sediment and soil remedial goals are based upon a conceptual site model that assumes a direct relationship between local sediment concentrations and concentration of DDTR in Gambusia and insects. This relationship, the bioaccumulation factor (BAF), has been used by EPA to back-calculate a sediment based cleanup level that is projected, based on the EPA's CSM is based on model projections that are only as good as the assumptions used to develop the inputs to the model.

BASF also has an overarching concern with Region 4's apparent willingness to select data that supports its apparent CSM and conclusions, while disregarding data collected by BASF that are contrary to those conclusions. We understand that there may be different interpretations of data, but arbitrarily dismissing data does not support a collaborative approach to determining the appropriate path forward for this Site nor does it reflect a sound technical approach.

BASF's CSM recognizes that the sources of DDTR to the fish is a complex mixture of DDTR in local sediments, residual DDTR in biological materials such as fish eggs, DDTR in the water column, either dissolved or adsorbed on material that is more mobile than the sediment. Thus, the total concentration of DDTR in the fish is greater than that which comes from local sediment alone. This CSM suggests that sediment based Remedial Goals based on a BSAF approach would result in an overly conservative value.

Cleanup Goal based on Sediment/Gambusia BAF

Based on EPA's March 12, 2018 correspondence, it is apparent that EPA believes that the one factor influencing the Gambusia DDTR - is the DDTR concentration in sediment at the specific time and location the Gambusia were collected. The EPA letter makes this understanding of the CSM clear through the following:

- *The development of a BAF based solely on the relationship between local sediment and Gambusia,*
- *The utilization of a small home range for Gambusia (0.2 acres) and the assumption the Gambusia DDTR exposure is limited to this area,*
- *The erroneous assertion that the Gambusia DDTR levels have plateaued, and*
- *The statement that it is unlikely that historic sources could be influencing fish DDTR levels in 2015 and 2016.*

Based on this oversimplified conceptual model, EPA presents paired data sets for sediment and Gambusia DDTR levels from specific locations to develop a BAF and then use the BAF to establish a cleanup level for sediment. BASF understands that BAFs are commonly used as a simplified representation of multiple exposure routes, based on an assumption that various media and pathways are roughly in equilibrium. However, BASF's CSM recognizes at least three additional sources of DDTR to fish that put into question the use of a BAF for the floodplain because the data from the site indicates that these DDTR sources are not necessarily in equilibrium with the sediment directly below them at the time of sampling . These inputs are:

- *A detritus or fluff layer that is a thin layer of light weight, organic rich material that is more mobile than the sediment and is commonly a source of food, and therefore DDTR, for biota. In BASF's CSM the detritus/fluff layer, because it is lower density and less consolidated than the rest of the sediment, is periodically brought up into the water column and transported to new locations within the floodplain, thereby acted as a transport media for DDTR from the areas of higher sediment contamination to areas of lower contamination. Upon completion of the interim remedy at the site, the sediment with the highest concentrations sourcing the detritus/fluff layer was removed and through natural attenuation processes the concentrations in the detritus/fluff layer are in the process of recovery, leading to the decline of the concentration in the fish.*

- *The water column also sources DDTR to the fish. Although the solubility of DDTR in water is low the water column plays a key role in the BASF CSM, first as a source (probably minor) of DDTR to the fish and second a as process whereby DDTR is eliminated from the detritus/fluff layer, supporting MNA. The cycling of DDTR in the fish tissue, eggs, etc. Biota in the system concentrate DDTR during their lives, but also reintroduce DDTR into the system through excretion, the cycling of fats in the fish, production of eggs, and upon death of the organisms. Other organisms eat the byproducts and thereby consume DDTR not directly associated with the local sediment. For example, Gambusia feed on the eggs of larger, longer-lived fish with greater home ranges. The transfer of DDTR in fish eggs is well established, so the Gambusia are, in fact, being exposed to historical sources of DDTR well beyond the limited home range.*

Because these contributions to Gambusia DDTR body-burden were not considered, the calculated BAF is too high, resulting in a sediment cleanup goal that is far below that needed to be protective of both Gambusia and predatory fish.

Using a more complete conceptual model that accounts for other factors influencing the transfer of DDTR to Gambusia, a different picture of the cleanup goal needed to be protective is obtained. The data strongly support a conclusion that historic DDTR concentrations from outside individual exposure areas have influenced, and continue to influence, the DDTR in Gambusia. The influence of historical sources beyond the home range results in higher DDTR concentrations in Gambusia than would be the case if the only exposure was from the localized sediment, and, thus, a higher BAF and a lower cleanup goal than is needed to be protective.

This is why it is so important to consider the use a remedial approach that focusing on the risk relevant endpoints as indication of a successful remediation rather than using a BAF that fails to recognize the potential importance of all the sources of DDTR in the system..

There are several lines of evidence supporting this conclusion, and they are further discussed in our response:

- *Reductions in Gambusia DDTR in Cypress Swamp, Round Pond West, and Round Pond East have been steady, with no sign of leveling off through the most recent sample collections in 2015 and 2016 as shown in Figure 1 in this response document. These declines are occurring during a period when no additional remedial actions have been performed. It is clear that the effects of prior remedial actions are continuing to be observed, showing that there is a historical component to current Gambusia DDTR concentrations.*

- *Notably, Round Pond East Gambusia levels have decreased at a rate of 50% per year in response to the prior remedial action in Cypress Swamp. Round Pond East is well outside of the 0.2-acre Gambusia home range cited by EPA, supporting a conclusion that DDTR in sediment beyond the 0.2-acre home range has influenced, and continues to influence, current Gambusia DDTR concentrations.*

- *Predatory fish DDTR concentrations in Olin Basin fell by 80% in the first few years following the remediation of Cypress Swamp. Olin Basin is located well outside of Cypress Swamp, and, as has been noted by the EPA, the primary source of DDTR in the predatory fish is ingestion of Gambusia. Thus, the observed decline in predatory fish DDTR concentrations in Olin Basin again demonstrates the influence of DDTR concentrations in locations beyond the limited home range identified by EPA.*

There are a number of technically valid and supported reasons why historic DDTR levels in a relatively large area would affect DDTR levels in a short-lived fish with a relatively small home range. These are developed more in this response, but they include the fact that Gambusia feed on the eggs of larger, longer-lived fish with greater home ranges. The transfer of DDTR in fish eggs is well established, so the Gambusia are, in fact, being exposed to historical sources of DDTR well beyond the limited home range. The contribution to Gambusia DDTR from water column exposures also are not included in the BAF calculation.

Risks to Insect-Eating Birds from Spider and Insect Ingestion

BASF understands that Region 4 has rejected the results of BASF's 2015 insect and spider sampling based on its misperception that: a) the type of insect sampling was unspecified, and b) that the types of invertebrates collected by BASF were not the type that can be used to prove that DDTR accumulation is low in spiders and detritivores.

These are critical data, and BASF continues to believe that they are valid and should not be ignored in the development of remedial goals. The mix of invertebrates collected was presented to EPA (see Table 8 in the 2015 OU3 Year-end Report provided to EPA on January 22, 2016), and, as shown in that table, all four of the invertebrate samples included both detritivores and spiders/predatory insects and were sampled in a manner consistent with what was discussed with EPA personnel. Two of the samples were composed of greater than 50% spiders/predatory insects and detritivores. We have provided this table in Follow-up response #6.

The reason that these data are so important is that they show no risk to insect eating birds, even in areas of highest flood plain concentrations. Not considering these results clearly overestimates the risk to birds and, therefore, causes the DDTR concentration in soil in the Olin OU2 ROD to be much lower than needed to be protective.

Use of All Available Data

In addition to rejecting the invertebrate data above, EPA has not considered several other key pieces of information:

- *There is an ongoing decline in DDTR concentrations in Gambusia. EPA stated in its comments that the decline had stopped. This is not correct (see Figure 1), and the ongoing*

decline supports BASF's conceptual model rather than the simplified conceptual model used by EPA.

- *In its calculation of the ratio of biota to sediment using 2015 data, EPA included data pairs where sediment concentrations were below the detection limit but excluded data pairs where Gambusia concentrations were below the detection limit. This has the result of increasing the BAF and reducing the cleanup level. Non-detects for sediment and fish tissue should be handled consistently, preferably using a Kaplan-Meier estimator or Regression on Ordered Statistics.*

- *As noted in the December 2017 letter from BASF, EPA omitted the pre-cover data pair from Cypress Swamp. This is the only historical sampling pair that was not influenced by higher concentration DDTR sediments elsewhere in the floodplain.*

Path Forward

It is important to restate BASF's commitment to addressing the DDTR throughout the floodplain, so that the environment is protected. BASF and EPA do, however, disagree on some fundamental considerations with regard to the key issues of how DDTR is transferred to the Gambusia, and whether there is a risk to insect-eating birds.

The system is showing remarkable recovery after implementation of the Interim Remedies. The data obtained to date strongly support BASF's CSM and do not support selection of a cleanup level based on a BAF. Development of a program that focuses on biota cleanup levels will prove to be protective of human health and the environment and does not require modeling or developing assumptions related to fate and transport mechanisms and is consistent with most recent EPA guidance regarding best methods for addressing complex sediment sites such as the McIntosh floodplain.

It is clear that further evaluation of the current data is not going to resolve our differences. As such, BASF has submitted under a separate cover a program that will be performed under an Adaptive Management framework and includes an action plan that includes additional investigation, remedial action, and post-remediation monitoring and sampling. The program is focused on the collection and analysis of biota – Gambusia, predatory fish and invertebrates – in order to directly assess the effectiveness of prior and planned remedial actions.

We look forward to discussing the program with EPA, and working together to address the DDTR at the McIntosh Site.

U.S. EPA Region 4, Superfund Division, Response to Comments provided by Steve Havlik, BASF, by letter dated December 21, 2017, regarding Ciba-Geigy OU3 Superfund Site (McIntosh, AL)

NOTE: Comments in BASF's December 21, 2017 letter were not numbered. The EPA has numbered the comments for ease of reference. BASF's comments used the term "remedial goal" (RG) as equivalent to the term "cleanup level." For clarity, the EPA's responses use the term "cleanup level."

BASF Comment #1 (December 2017)**:** The sediment to biota accumulation factors that form the basis of the Olin OU2 DDTR RGs were developed by EPA from 11 sample tissue/sediment pairs collected by both Olin and BASF in the floodplain over a time period that straddled the 2008 installation of an approximately 45-acre cap installed on the BASF and Olin properties. EPA derived these accumulation factors based on an assumption that the biota DDTR levels were only impacted by very local sediment concentrations, and that food chain DDTR from elsewhere in the floodplain would not affect tissue levels. However, given that the sediment DDTR levels varied by orders of magnitude within the floodplain and the fact that biota move freely throughout the floodplain, this assumption was incorrect.

EPA Response #1 [March 2018]: EPA correctly performed the bioaccumulation factor (BAF) calculations. BASF's comment incorrectly states the process and assumptions used by EPA in derivation of the BAFs.

- **EPA took into account relevant fish exposure areas when calculating the BAFs.**
- ***Gambusia* samples represent composites collected across an exposure area.**
- **Sediment was averaged over an exposure area, either through collection of composite samples, or by averaging multiple individual samples across the exposure area.**
- **The 2015/2016 BASF-collected data confirm the BAFs from the Olin OU2 ROD.**

BASF appears to be arguing that EPA does not acknowledge that fish are mobile within the floodplain, and that EPA did not consider the correct exposure areas for the fish evaluated in the BAF calculations. BASF's own sediment and fish sampling protocol is based the concept of small exposure areas for *Gambusia*. BASF's draft Monitoring, Inspection, and Maintenance Plan submitted to EPA specifies that *Gambusia* be collected approximately 6 weeks after the pools in Cypress Swamp became isolated. The procedure was developed by BASF to allow for isolation of the *Gambusia* and sufficient time to take up DDTR into their tissues from exposure to contaminated sediment. While *Gambusia* are confined to the pools, they are exposed to local sediment conditions. Pyke (2005) reported, "Except when undergoing dispersal, individual *Gambusia* remain resident in relatively small areas." Booth (1980), for example, followed marked fish that moved, over the course of 1-2 hours, up to 30 m along the edge of a water body, but never venturing more than about 2 m from the shore." Minns (1995) developed allometric formulas for estimating fish home range size based on the length of the fish in both riverine and lake environments. These equations were used by Amir (2017) to estimate the size of a fish home range for the purpose of deriving biota-sediment accumulation factors. According to the formula for fish in a lake environment, a 5 cm mosquitofish has an average home range of approximately 0.2 acres when not colonizing new areas. A 25 cm bluegill is estimated to have a home range of about 3

acres, while a 76.2-cm largemouth bass is estimated to have a home range of 18 acres. Home ranges in riverine systems are smaller than those in lakes. EPA recognizes that during flood conditions, fish may disperse to new areas. *Gambusia* in particular are inhabitants of shallow waters near the shoreline and move with the floodwaters to remain in the shallow areas. However, fish used in the data pairs were all collected during non-flood conditions.

BASF Follow-up Response #1 [July 2018]: EPA's simple regression model assumes Gambusia DDTR levels are influenced solely by localized conditions does not account for the more complex relationship between overall site DDTR and Gambusia DDTR. Site-specific data show that both historic DDTR and DDTR in locations well beyond the Gambusia home range affect Gambusia DDTR concentrations. Therefore, the Gambusia concentrations used by EPA in the BAF are higher than would be the case of only the localized sediment affected the Gambusia.

BASF does not believe EPA adequately reflected the relevant exposure areas for floodplain biota as demonstrated by the site-specific data. Literature values for home ranges vary substantially – telemetry studies estimate the home range of largemouth bass at 41 acres (Ridgway, 2002) and bluegill home ranges of up to 425 acres (Paukert et al, 2003). Given this variability, combined with the complexity of the intermittent hydraulic connections of the floodplain, site-specific data should be used to inform decisions regarding appropriate exposure areas.

For example, site-specific data show that Gambusia are integrating exposures over a much larger area than 0.2 acres. As noted by EPA, the BASF Gambusia sampling protocol was developed to allow for monitoring of small exposure areas. BASF has consistently collected Gambusia from three separate areas within Cypress Swamp since 2011. With rare exceptions, no statistically significant differences among the mean Gambusia DDTR levels collected in the three separate areas were observed (Table 1). Very little variation of Gambusia levels is observable in Cypress Swamp, which is approximately 15 acres in area.

Table 1. Mean Gambusia DDTR in Cypress Swamp Regions and T-test results (p-Values less than 0.05 indicate a statistically significant difference)

	Gambusia DDTR Mean					
Area	**2011**	**2012**	**2013**	**2014**	**2015**	**Combined Years**
NW Isolation (NWI)	3.62	1.23	0.566	0.599	0.158	1.26
North/NW Bank (NNWB)	3.88	2.16	0.360	0.561	0.168	1.50
East & South Banks (ESB)	2.65	1.34	0.308	0.360	0.250	0.896
	T-test p-Values					
Comparison	**2011**	**2012**	**2013**	**2014**	**2015**	**Combined Years**
NWI to NNWB	0.683	0.009	0.792	0.783	0.531	0.586
NWI to ESB	0.126	0.333	0.170	0.137	0.150	0.390
ESB to NNWB	0.026	0.020	0.344	0.151	0.185	0.130

In the 2008 Pilot Study to determine the Gambusia sampling protocol, the Gambusia collected were divided into Cypress Swamp East and Cypress Swamp West. No statistically significant difference in DDTR levels was observed between the two regions of Cypress Swamp. The Pilot Study was conducted during a period when the Cypress Swamp sediment concentrations varied by orders of magnitude. The fact that the Gambusia levels did not vary significantly during this period indicates that forage fish DDTR exposures are distributed over relatively large areas.

Additionally, the dramatic declines in the Round Pond Gambusia following the cover implementation show that the historically elevated DDTR affected the biota outside of Cypress Swamp. Figure 1 below shows that the rate of decline in Round Pond East and Cypress Swamp are essentially the same (~50% per year). This is strong evidence that that all or nearly all of the Round Pond East Gambusia DDTR exposure was cut off when Cypress Swamp was remediated. As an additional line of evidence, the predatory fish concentrations in Olin Basin fell by 80% in the few years following the remediation of Cypress Swamp, further demonstrating that the historically elevated Cypress Swamp DDTR concentrations had an impact well outside of Cypress Swamp.

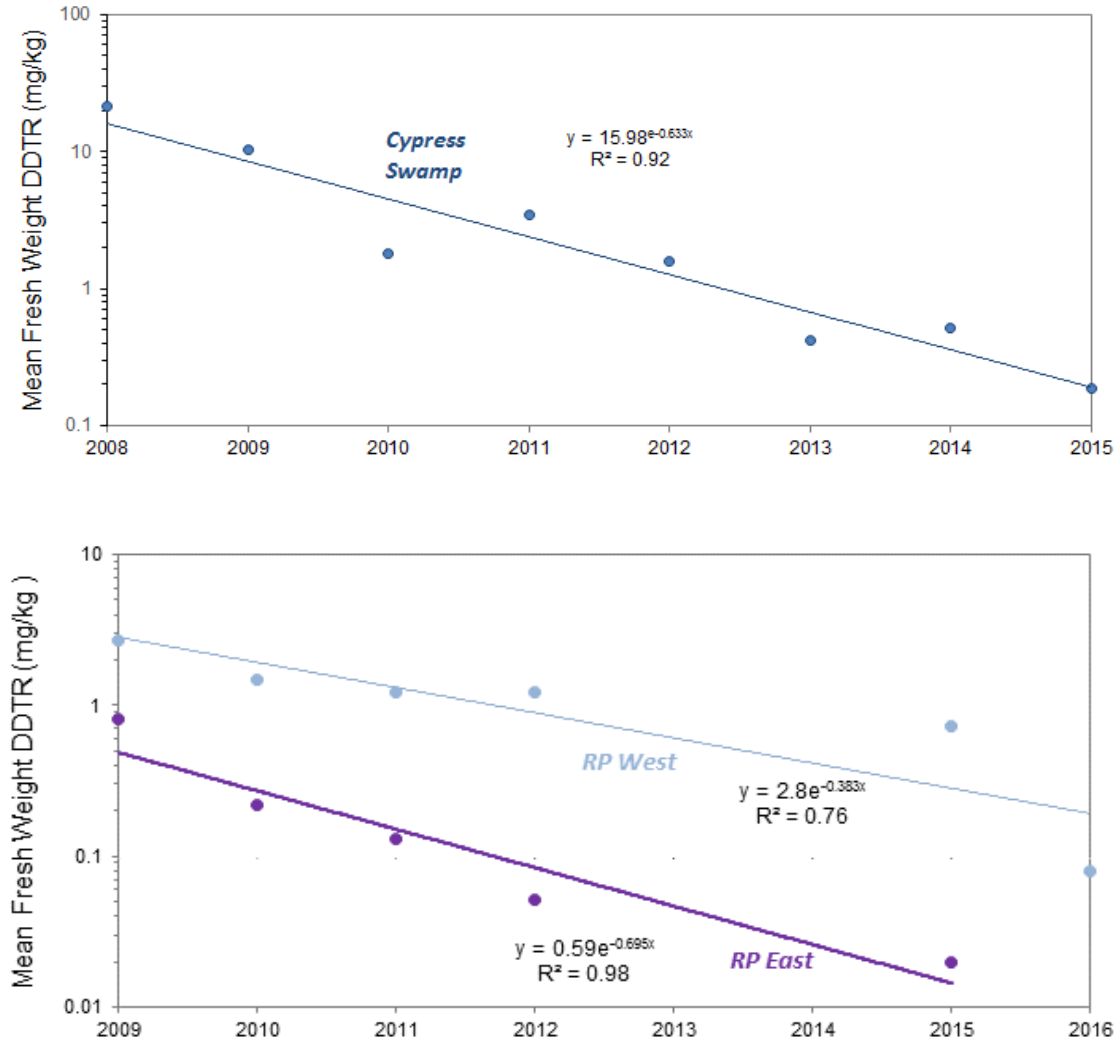


Figure 1. Decline in Gambusia tissue concentrations in Cypress Swamp and Round Pond since 2008.

There are valid technical reasons as to why historical DDTR concentrations well beyond the Gambusia home range remain responsible for Gambusia DDTR concentrations today. Gambusia diet includes mosquito larvae, eggs from larger fish, and tadpoles (Johnson, 2008; Meffe and Snelson, 1989; Goodsell and Kats, 1999). Maternal transfer of persistent contaminants to their eggs is well-established (Arnot and Gobas, 2004; Russell et al, 1999; Chiuchiolo, 2004). All of the parent species have much larger home ranges than 0.2 acres, so a larger exposure area should be expected. For this reason, an area with peak contaminant concentrations that are significantly higher than anywhere else in the floodplain should be expected to affect biota concentrations outside of an extremely small home range, as demonstrated by site-specific data.

The 2015 Round Pond East Gambusia samples were below detection limits. This indicates that historic Cypress Swamp contributions are now largely negligible outside of Cypress Swamp. The declines Moving forward, BASF believes Gambusia data in all locations could be suitable for calculating BAFs. However, an Adaptive Management approach would allow BASF and EPA to move forward without agreeing to a specific BAF.

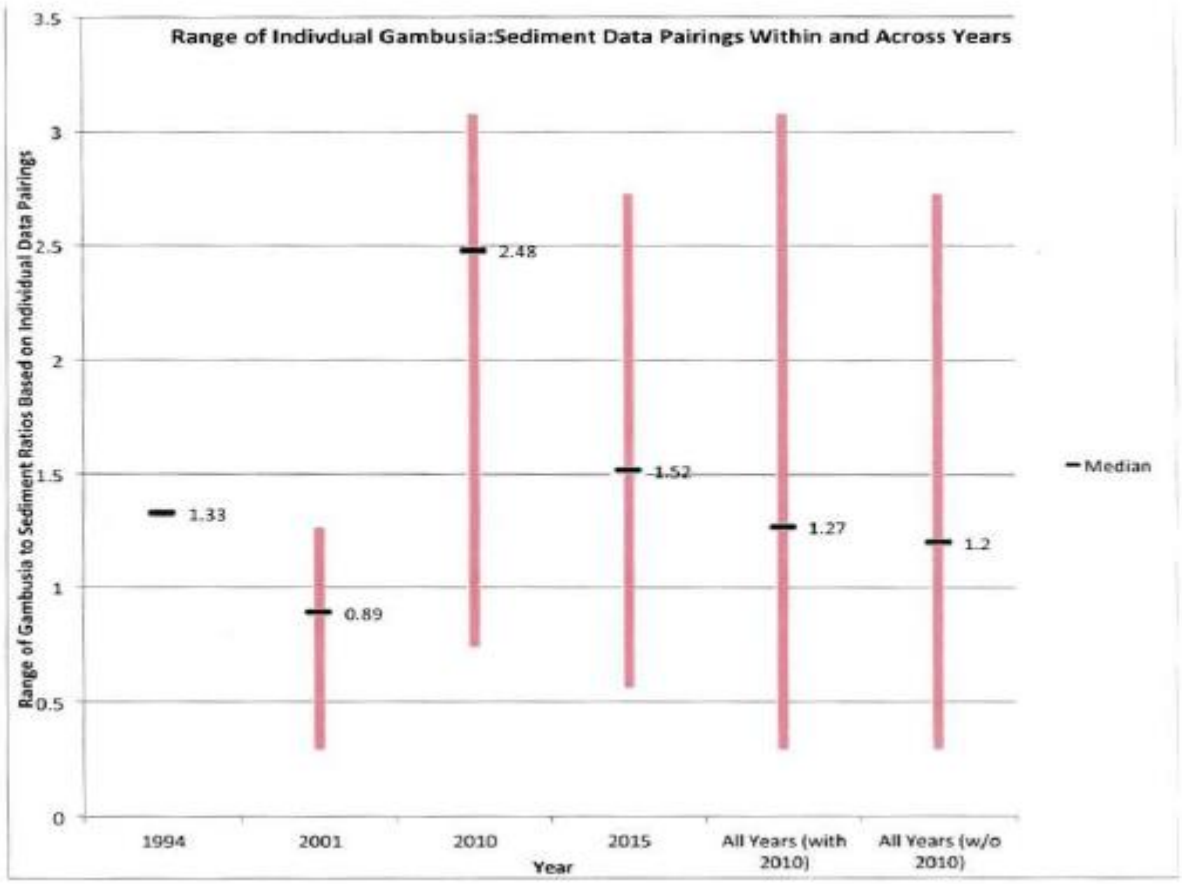
BASF Comment #2 [December 2017]**:** ADEM also expressed concern regarding EPA's use of this data for setting the RGs [cleanup levels] in its formal comments on the Proposed Plan dated September 18, 2013. In that letter, ADEM stated, "The proposed PRG for DDTR ...may not be appropriately calculated due to the use of the historical data applied to generate the remediation values. *The use of historical data that does not account for remedial actions completed that improve the bioavailable concentration of DDTR may yield a remediation value that is not accurately calculated*." In EPA's responsiveness summary, EPA summarily dismissed ADEM's concern, stating th at "[w]hile DDTR concentrations in site sediment and fish tissue in OU-2 may have decreased since the data were originally collected, the BSAF, which defines the relationship between sediment and tissue concentrations, is not expected to vary significantly over time." However, data collected since the cover was installed demonstrates that sediment:tissue ratios have, in fact, varied significantly over time, and thus confirm that ADEM's concerns were well-founded, that EPA's assumptions were incorrect, and thus, the RGs derived from this data are not technically defensible.

EPA Response [March 2018]: EPA's use of a sediment to forage fish BAF derived from historical (1994-2010) data is technically appropriate. The BASF comment suggests that using data collected only through 2010 would result in overestimation of the BAF due to temporal variability in the data. This argument is not correct for the following reasons:

- **The principal source of variability observed in the data set is spatial, not temporal.**
- **Inclusion of the 2015/2016 BASF-collected data does not significantly change the average BAFs as calculated in the Olin OU2 ROD.**
- **The use of a BAF derived from a regression relationship is appropriate to define representative bioaccumulation across a naturally variable system.**

The data collected across multiple years in the floodplain indicate that the data pairs exhibit variability both spatially and temporally, and given the inherent uncertainty in estimating average exposures across an area with heterogeneous DDTR concentrations, the use of an average BAF across the system is technically appropriate. Analysis of the within-year variability of individual

ratios shows that the primary source of the variability is spatial, not temporal. Figure 1 shows the variability of individual *Gambusia*:sediment ratios within years and across years from 1994 to 2015. The red bars in the figure represent the range of *Gambusia*:sediment ratios of individual data pairs within the data sets. The black line across each red bar is the median ratio. As seen in Figure 1, the 2010 median ratio is shifted higher when compared to 2001 and 2015 data, but inclusion of the 2010 data has little effect on the overall median value when the data are combined across all years. Use of the median ratio to represent the site BAF also results in a slightly higher BAF value (1.2) than obtained from the linear regression of the ratios used in the Olin OU2 ROD (1.1). See Appendix 1, Figure 2 of the Olin OU2 ROD. See the Response to Comment #4 for further discussion of the lack of effect of inclusion of the 2010 data on the BAF regression analysis. Both regression analysis and median values support the use of a sediment to *Gambusia* BAF of approximately 1.



EPA Figure 1. Variability of *Gambusia*:Sediment Pairs Within and Across Years

***BASF Follow-up Response #2 [July 2018]**: EPA's analysis is skewed by its apparent assumption that the source of DDTR in Gambusia is the local sediments. With few exceptions, all of the Gambusia samples used by EPA in the sediment:biota accumulation calculations were affected by the high DDTR concentrations in Cypress Swamp prior to the cover installation, including both historic and recent samples. As such, the Gambusia concentrations used by EPA are higher than they would be if the only contributing source was the local sediment. EPA's approach understates the degree of temporal variability in biota to sediment ratios by not evaluating any data between 2009 and 2014, minimizing*

the importance of this factor. The effects of the historical contribution to Gambusia DDTR levels is illustrated by the dramatic and consistent ongoing decline in Gambusia DDTR levels since 2008 (~50%/yr), while sediment levels have remained relatively constant. As we have noted previously, the timing of sample collection is critical and cannot be neglected.

EPA clearly understates the recent temporal variability in biota:sediment ratios, minimizing the importance of sample collection timing. The dataset from Cypress Swamp is the most robust Gambusia dataset in the floodplain – fish were collected annually from 2008 through 2015. As noted in BASF Follow-up Response #1, there are not typically statistically significant differences among the means in the Gambusia collected from different parts of Cypress Swamp, so the samples can be treated as a single population. Sediment data has not been collected every year in conjunction with Gambusia sampling, but systematic, cover-wide sampling performed in 2010 and 2015 show a very gradual increase in concentration from approximately 0.1 mg/kg to 0.15 mg/kg. A value of 0.125 can reasonably represent the sediment concentration in Cypress Swamp for all years between 2009 and 2015. Figure 2 below shows the biota to sediment ratio from 2008 through 2015 in Cypress Swamp.

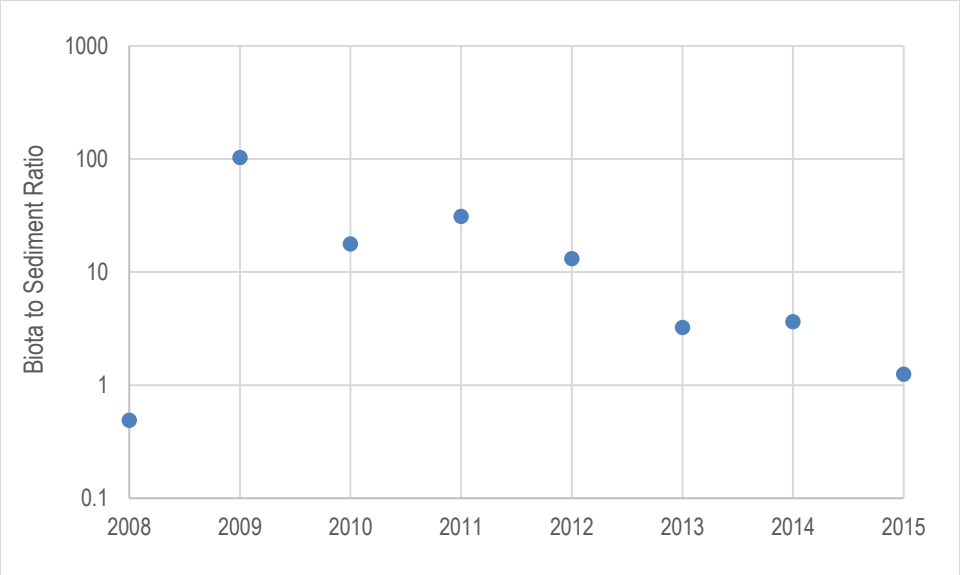


Figure 2. Biota-sediment accumulation factors based on Cypress Swamp data.

The Gambusia data from Cypress Swamp show that biota to sediment ratios have fluctuated by approximately two orders of magnitude since 2008. While the BAF based on data collected in 2015 are much closer to the level observed in 2008, they have not yet reached the 2008 level. BASF understands that EPA did not include any of the 2008 to 2014 Cypress Swamp data in its regression, however EPA's response to BASF comment #2 minimizes the importance of considering sample collection timing. Under BASF's CSM, we would expect that additional data collection would demonstrate further declines in Cypress Swamp.

BASF believes that most of the Gambusia data collected prior to 2010 was also affected by the peak DDTR levels in Cypress Swamp that were orders of magnitude higher than the concentrations elsewhere in the

floodplain. Only a handful of samples ever collected in the floodplain are likely to have little to no influence from historic Cypress Swamp exposures, and so only a handful of samples are appropriate for the calculation of BAFs. As requested by BASF in its initial letter, additional data collection is needed to complete a supplemental risk assessment prior to the finalization of the soil and sediment cleanup levels Alternately, an Adaptive Management approach that is not dependent on modeled values would avoid the need to finalize a BAF prior to moving forward with remedial actions.

BASF Comment #3 [December 2017]**:** As acknowledged by EPA, biota samples collected throughout the floodplain have shown dramatic reductions in DDTR levels since the cover was installed in 2008, including areas well outside of the cover. Since the cover was installed, DDTR concentrations in *Gambusia* in Round Pond have declined by 97%, and in largemouth bass in Olin Basin have declined by 80%. Both of these reductions occurred without any substantial activities to reduce local sediment DDTR levels outside the cover. Assuming that the sediment concentrations remain relatively constant from 2009-2016, an accumulation factor calculated in 2009, when the biota was still heavily influenced by pre-cover exposures, would be 30 times higher than an accumulation factor calculated in 2016. An evaluation, based on the best available, current site-specific data would likely result in a sediment RG several times higher than the current Olin OU2 sediment RG for DDTR.

EPA Response [March 2018]: EPA's approach to cleanup level derivation in the Olin OU2 ROD was correct and is confirmed by BASF's 2015/2016 data. Using only the most recent BASF collected data in 2015/2016, as suggested in the comment, results in an average BAF of 1.4, compared to the BAF of 1.1 used in the Olin ROD. A higher BAF would result in a lower, more stringent cleanup level than identified in the Olin ROD, not several times higher as stated in the BASF comment.

- **The use of data collected across multiple years provides a more reliable BAF than data collected from any single year.**
- **Although *Gambusia* DDTR concentrations declined rapidly in 2009 and 2010, concentrations in *Gambusia* have since leveled off.**
- **Recalculation of the BAF without 2010 data from Cypress Swamp or Round Pond did not significantly change the average BAF calculated using linear regression of sediment and *Gambusia* data pairs.**

Gambusia are short-lived fish with females having an average lifespan of less than 1.5 years, and males having an even shorter average life span (Haynes and Cashner, 1995). Thus, the predicted response in *Gambusia* DDTR tissue concentrations following remedial action is expected to occur relatively quickly. The BASF statement that an evaluation based on current site-specific data would likely result in a sediment cleanup level several times higher than the current Olin OU2 sediment cleanup level for DDTR is also not supported by the most recent data. The five sediment:forage fish data pairs from the most recent (2015) data are shown in the table below. The 2015 sediment samples represent a single composite sample from each area, and are paired with the average of the multiple composite Gambusia samples collected from each area, with the exception of CS East/South, where CS East sediment and CS South sediment samples were averaged to be consistent with the *Gambusia* samples, which were simply designated "CS East/South".

EPA Table 1.

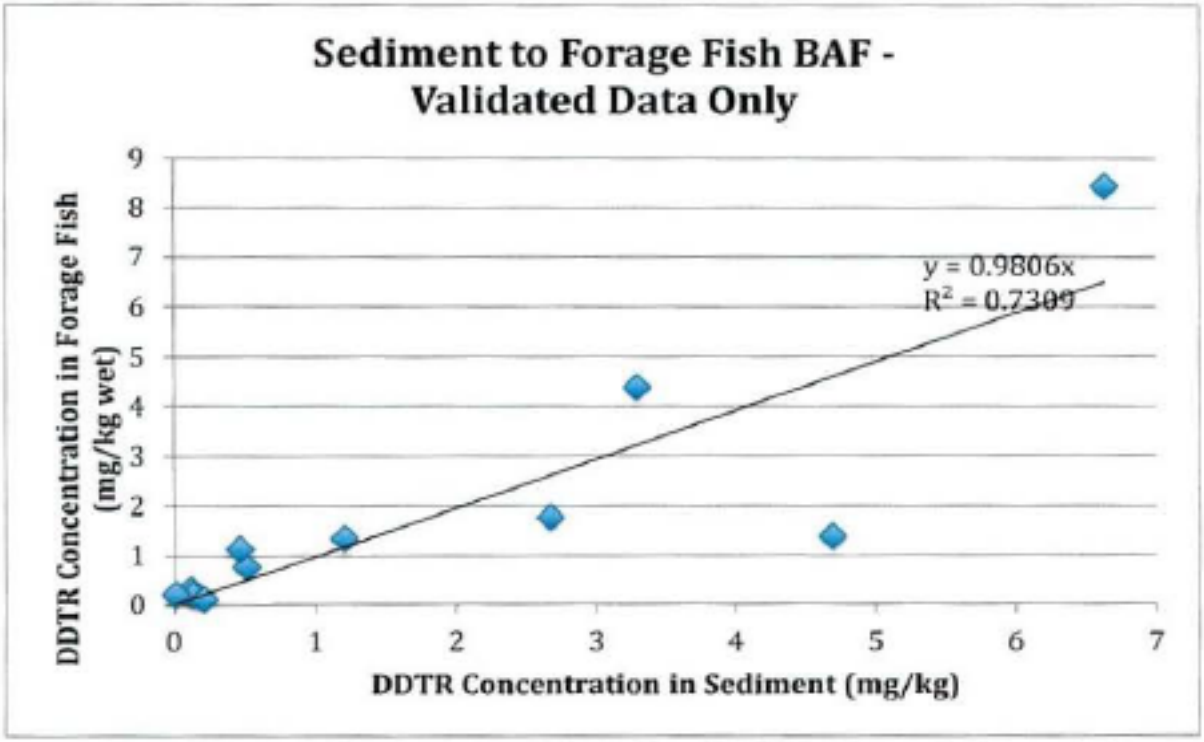
Table 1. 2015 Sediment and *Gambusia* Data Pairs

Year	Area	Average Sediment (mg/kg)	Average Forage Fish (mg/kg)	Sediment to *Gambusia* Ratio
2015	CS East/South	0.116	0.317	2.7
2015	CS North	0.039*	0.224	5.7
2015	CS NW Iso	0.033*	0.212	6.4
2015	Round Pond West	0.508	0.77	1.5
2015	Olin Basin South	0.209	0.118	0.6
2015 Average (detected locations)		0.278	0.402	1.4

*Non-detect. DDTR value represents sum of ½ the reporting limits

A regression analysis of the five 2015 sediment:*Gambusia* data pairs results in a BAF based on the slope of the line of 1.47 with an R2 value of 0.57. The ratio between average tissue and sediment from the three 2015 locations where DDTR was detected in both sediment and tissue yields a BAF of 1.4.

A recalculation of the sediment to *Gambusia* BAF adding the 2015/2016 BASF collected data to the data pairs included in the Olin OU2 ROD, and omitting data pairs based on unvalidated data (including the 2010 Cypress Swamp and Round Pond pairs), yields a BAF of 0.98 (Figure 2), which is similar to the BAF of 1.1 derived in the Olin OU2 ROD.



EPA Figure 2. Sediment to *Gambusia* BAF Including 2015/2016 Data Pairs (omitting unvalidated data from 2006-2011.

BASF Follow-up Response #3 [July 2018]: As noted in the follow-up responses #1 and #2, BASF's analysis supports a conclusion that the floodplain biota DDTR continues to be heavily influenced by the historical high DDTR concentrations that are now covered. The DDTR is gradually being eliminated from the food-chain, and it is predicted that, with time, Gambusia concentrations will continue to decline while sediment concentrations remain stable. As this occurs, the BAF will continue to decline.

BASF has four specific comments:

- ***The EPA statement that the Gambusia decline slowed after 2010 is incorrect (see Figure 1). This is a key issue with regard to the two different conceptual models.***
- ***The DDTR in floodplain Gambusia can be well explained with a simple model of food chain elimination that depends on time since cover implementation and distance from the peak concentration area. This model demonstrates that it is not appropriate to exclude the influence of the peak sediment concentration area in the development of a BAF.***
- ***The results of this simple model imply that of the existing dataset, only a small handful of samples would not have been influenced by the peak concentration area and therefore would be appropriate for assessing the DDTR contribution from local sediments.***
- ***Selective exclusion of data outside of Cypress Swamp results in a significant overestimation of the ratio of DDTR in Gambusia to sediment using recent samples.***

In the response to BASF's initial comment, EPA stated that the Gambusia DDTR declined slowed after 2010. The declines in Gambusia tissue concentrations have continued at roughly the same rate through the most recent data collection (see Figure 1). The Gambusia in Cypress Swamp and Round Pond East have steadily declined at a rate of approximately 50% per year. Round Pond West Gambusia have declined at a rate of approximately 32% per year. The most recent sample from each of these water bodies is at or below the long-term trend and there is no period where the decline appears to be slowing. EPA's statement is not supported by the data. The decline did not level off after 2010 and has continued at least through the most recent sampling event in 2016.

Understanding that the DDTR biota levels have steadily declined and have not plateaued is critical to understanding the recent dynamics of DDTR in the floodplain and the most representative Conceptual Site Model. EPA's misconception about this issue is the source of most of the disagreement between BASF and EPA regarding the development of appropriate bioaccumulation factors from sediment. The continued, steady decline is the most conspicuous trend in recent biota data.

To demonstrate that the now-covered high concentration DDTR area is an important factor for understanding Gambusia DDTR levels, BASF developed a simple model of Gambusia DDTR concentrations with only two variables: time since the peak concentration area was covered and the distance from the peak concentration area. There are two primary implications from the model results:

- *A model based on time since cover remedy and distance from the peak concentration area shows better agreement with the Gambusia DDTR data than any sediment:Gambusia regression model.*

- *An understanding of the biota DDTR exposures consistent with this model implies that most of the currently available data from the floodplain were impacted by the historical high concentration area and are not suitable for use in the development of a BAF based only on local sediment concentrations.*

The model has the form:

$$G_{est}=C_0 * \underbrace{exp(-k*t)}_{\text{Decrease with time}} * \underbrace{exp(-kd*d)}_{\text{Decrease with distance}}$$

Where:
G_{est} is the predicted Gambusia concentration
C_0 is an estimate of initial Gambusia concentration (16 mg/kg)
k is the annual rate of decline observed in Gambusia in Cypress Swamp and Round Pond East (0.63/yr)
t is the years after 2008
kd is the decline associated with distance from the peak concentration area in Cypress Swamp (0.0027/m)
d is the approximate distance from the peak DDTR area (m)
Predicted values less than 0.1 are automatically set to 0.1, approximately the detection limit

The model has two primary components – time and distance from the peak concentration area. The decline in Gambusia DDTR levels are modeled to follow first order kinetics for both time and distance (i.e, DDTR levels decrease at constant percentages per unit of time and distance)

The time component was based on the previous analysis of Gambusia DDTR time trends in samples collected since the cover remedy (Figure 1). The initial concentration (C_0) comes from the Cypress Swamp trendline. The decay rate (k) is consistent with the trendline values fit for both Cypress Swamp and Round Pond East and results in a 50% decline in concentration per year.. The time component only applies to the time since the cover was installed. Although Gambusia concentrations did decline prior to 2008, the decline was relatively slow. For simplicity, all samples from 2008 and prior were treated equally in terms of the time component.

The concentration component was also modeled as a first order function. Modeling a concentration decline with distance as first-order attenuation is common in groundwater and atmospheric modeling (ASTM, 1998; Newell et al, 2002; Environ, 2012). An EPA Ground Water Issue Paper describes using first order attenuation as a function of distance to represent

dispersion, biodegradation and other attenuation process (Newell et al, 2002). In this application, the decline with distance is a result of contaminant dispersion likely associated with surface water mixing and biological transport away from the peak concentration area. The attenuation constant (kd – 0.0027/m) was determined based on the best fit to the available data. The attenuation constant yields an approximately 50% decline per 250 meters from the peak concentration area. Thus, a Gambusia sample collected 500 meters from Cypress Swamp would be predicted to have approximately 25% of the DDTR compared to Gambusia collected in Cypress Swamp in the same year.

A chart showing the observed and predicted Gambusia levels is presented as Figure 3, and the model inputs and results are presented in Table 2.

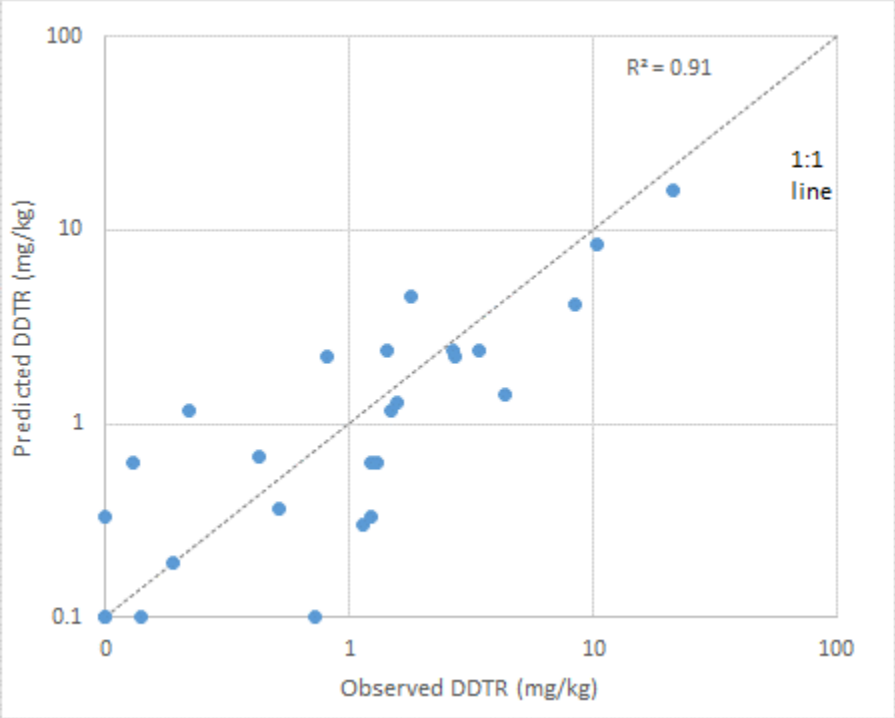


Figure 3. Predicted and observed DDTR levels in floodplain Gambusia.

Table 2. Inputs and results for simple Gambusia DDTR model.

Year	Location	Years after 2008	Approximate Distance from Peak DDTR (m)	Observed Gambusia DDTR (mg/kg)	Predicted Gambusia DDTR (mg/kg)
2001	Round Pond	0	500	8.44	4.15
1994	Olin Basin	0	900	4.39	1.41
2001	SE Olin Basin	0	1200	1.31	0.63
2001	NW Olin Basin	0	700	2.67	2.42
2001	NE Olin basin	0	700	1.42	2.42
2010	Olin Basin	2	1000	1.14	0.31
2008	Cypress Swamp	0	0	21.14	16.00
2009	Cypress Swamp	1	0	10.35	8.52
2010	Cypress Swamp	2	0	1.78	4.54
2011	Cypress Swamp	3	0	3.43	2.42
2012	Cypress Swamp	4	0	1.58	1.29
2013	Cypress Swamp	5	0	0.42	0.69
2014	Cypress Swamp	6	0	0.51	0.37
2015	Cypress Swamp	7	0	0.19	0.19
2009	2009 RP West	1	500	2.69	2.21
2010	2010 RP West	2	500	1.48	1.18
2011	2011 RP West	3	500	1.23	0.63
2012	2012 RP West	4	500	1.23	0.33
2015	2015 RP West	7	500	0.72	0.10
2016	2016 RP West	8	500	0.08	0.10
2009	2009 RP East	1	500	0.82	2.21
2010	2010 RP East	2	500	0.22	1.18
2011	2011 RP East	3	500	0.13	0.63
2012	2012 RP East	4	500	0.10	0.33
2015	2015 RP East	7	500	0.10	0.10
2015	Olin Basin North	7	700	0.10	0.10
2015	Olin Basin South	7	1200	0.14	0.10

The model has an R-squared of 0.91, which indicates a strong fit to the observed data. The R-squared of 0.91 shows a better fit to the data than any of the regressions relating Gambusia to sediment that EPA has developed. Additionally, it was not necessary for BASF to selectively exclude Gambusia data from this analysis. The results of this model suggest that time and distance from the peak DDTR concentration area are more important explanatory factors for Gambusia DDTR levels than local sediment concentrations.

BASF understands that, to some extent, sediment concentrations are also associated with time and distance from the peak concentration area. The sediment DDTR levels tend to decline with distance from Cypress Swamp and have gradually decreased with time as a function of natural recovery. But it is notable that sediment concentrations are not needed to have a model that accurately predicts Gambusia levels, and that this model accurately predicts Gambusia concentrations where sediment concentrations would not (e.g., Cypress Swamp from 2009 to 2014). While sediment concentrations may play some role in the high predictive capability in this model, the corollary is also true: the relationship between sediment and Gambusia in the EPA biota to sediment regressions is clearly due, at least in part, to the correlation with time and distance from the peak DDTR exposure area.

As noted on many occasions, it is not possible to precisely separate the contributions from historical exposures and current sediment exposures with the available data. However, the model results show that developing a BAF without considering the influence of the pre-cover, high-concentration sediment area, a factor that can independently explain almost all of the variability in Gambusia concentrations, is not technically appropriate.

Additionally, the model results have implications for which data may be appropriate to assess the relationship between Gambusia and local sediment. Where the model predicts values less than 0.1, the predicted value is automatically set to 0.1 – approximately a non-detect value. These samples can be considered to have negligible contribution from the historical high concentration area. The model predicts that only five samples would not be impacted by peak historical DDTR based on the prediction of a DDTR level at or below 0.1. These are the samples collected outside of Cypress Swamp in 2015 and 2016 (see final column in Table 2). However, in the future, the effects of historical exposures on Gambusia would be negligible, including in Cypress Swamp. Under an adaptive management framework, the development of a BAF would not be necessary. However, if EPA is committed to the use of BAF to develop a sediment cleanup level, additional monitoring is needed to calculate a reliable BAF from samples that are not impacted by the historical high concentration area.

EPA calculates the ratio of Gambusia to sediment as 1.4 based on recent data. However, that value is dependent on EPA including data pairs where sediment values are below the detection limit, excluding data pairs where Gambusia are below the detection limit, substituting half the detection limit for all non-detected isomers, and forcing the Cypress Swamp samples to dominate the small dataset by including three regions in Cypress Swamp. Table 3 presents a more complete picture of the recently collected data, knowing that the locations in Cypress Swamp are more appropriately treated as a single population, as noted in the BASF Follow –up Response #1.

Table 3. Sediment and biota collected in OU3 in 2015 and 2016.

Year	Location	Gambusia DDTR (mg/kg)		Sediment DDTR (mg/kg)	
		Detects only	Non-detect at 1/2 DL	Detects only	Non-detect at 1/2 DL
2015	Cypress Swamp	0.19	0.26	0.0375	0.075
2015	Round Pond West 2015	0.72	0.77	0.49	0.51
2016	Round Pond West 2016*	0.1	0.13	0.49	0.51
2015	Round Pond East	0	0.1	0.02	0.06
2016	Olin Basin North	0	0.1	0	0.04
2016	Olin Basin South	0.038	0.128	0.19	0.21
	Mean all locations	0.175	0.248	0.205	0.234
	Mean CS Excluded	0.172	0.246	0.238	0.266
	Mean OBN and CS Excluded	0.214	0.282	0.298	0.323
	Ratio all locations	0.85	1.06		
	Ratio CS excluded	0.72	0.92		
	Ratio OBN and CS excluded	0.72	0.87		

**Uses Round Pond West samples collected from the southwest bank in a location consistent with the 2015 Round Pond West Gambusia and sediment samples, the most appropriate available samples.*

The calculated ratio using only detected isomers, using a more complete dataset, and treating the Cypress Swamp sample as a single population results in a ratio of 0.85, about 60% of the EPA calculated value of 1.4. Eliminating the single Cypress Swamp sample because of the likely influence of historical contamination results in an even lower ratio – 0.72. The selective exclusion of some data pairs and forcing Cypress Swamp samples to dominate the dataset had a large effect on the EPA analysis.

Substituting non-detects at half the detection limit tends to increase the biota-sediment ratio as there are more isomers consistently below detection limits in biota than sediment (e.g., 4,4'- and 2,4'- DDT have not been detected in a floodplain Gambusia sample since 2010) and the detection limits in biota samples are typically slightly higher. As part of planning with EPA for additional data collection, a discussion regarding the appropriate handling of isomers below the detection limits will be needed. For calculating means, it may be appropriate to use a Kaplan-Meier estimator or a Robust Regression on Ordered Statistics (ROS).

BASF Comment #4: [December 2017] As BASF has previously noted, for exactly this reason, applicable EPA guidance specifically recommends against collecting sediment:biota paired data for the purpose of establishing RGs while the ecosystem is in flux. *Estimation Of Biota Sediment Accumulation Factor (BSAF) From Paired Observations of Chemical Concentrations in Biota and Sediment* ("EPA's BSAF Guidance") states, "BSAFs should be determined from spatially and temporally coordinated organism and surficial sediment samples under conditions in which recent

loadings of the chemicals to ecosystem are relatively unchanged." As indicated by EPA's own BSAF Guidance, and confirmed site-specific data, collection of sediment:biota data pairs while the system is in flux for the purpose of establishing RGs is not technically appropriate and does not reflect sound science. Data collection shows that biota tissue levels continue to drop - but are more closely reflective of a "steady state" condition than the samples used by EPA in the Olin RGs. **If EPA intends to use BSAFs for deriving revised RGs for the site, the analysis should be performed using the best available data that is more closely reflective of steady state conditions following installation of the cap -- specifically the latest post-cover data where the biota has been least impacted by sediment concentrations present prior to cover installation.**

EPA Response [March 2018]: As previously stated in the response to comment #3, the use of data collected across multiple years provides a more reliable BAF than data collected from any single year. As suggested in the BASF comment, use of only the "latest post-cover data" (i.e., 2015/2016) sediment and *Gambusia* data results in a sediment to *Gambusia* BAF of 1.4, which is slightly higher than the BAF derived in the Olin OU2 ROD. The use of a BAF based on only the 2015/2016 sediment data would result in a lower cleanup level for the site, not a higher cleanup level as implied by BASF.

Studies of the progression of DDT bioaccumulation in fish over time suggest that the time required for a predatory fish to lose its body burden is about 1 to 2 years. First-order elimination rate constants for DDT in fish have ranged from 0.015/day for rainbow trout (Adolfsson-Ericki, 2012) to 0.002/day to 0.06/day for mangrove snapper (Wang and Wang, 2005; Kwong et al. 2008). At these rates, trout would lose its body burden in 5 months, while a snapper would lose its body burden between 1 month and 2 years. The uptake rate into fish is fairly rapid, taking place over a matter of months (Martyniuk et al. 2016). The depuration rate for a chemical with a high log octanol water partition coefficient like DDT is slow. While it may take a year or more for fish tissue burdens to decline, it is unlikely that DDT measured in fish in 2015 and 2016 is from historical contamination for the following reasons: I) those fish were collected 7 to 8 years since cover installation, 2) the site is swept by floodwaters annually flushing fish out of the focus area, 3) during flooding, clean sediments are deposited on top of historical deposits. EPA agrees that current contamination in fish reflects recent exposures. See also response to previous comment.

BASF Follow-up Response #4 [July 2018]: The EPA response clearly demonstrates the problem with EPA's misconception that the decline in Gambusia DDTR concentrations slowed after 2010. This understanding of the fairly rapid elimination of DDTR from the floodplain biota could be justified if Gambusia DDTR decline had slowed, but instead the data show progressive and continuing decreases of approximately 50% per year since 2008. The EPA's more simplified Conceptual Site Model in which the Gambusia DDTR is influenced solely by the localized sediment and DDTR is rapidly eliminated from the system does not fit the site-specific data. A more representative Conceptual Site Model acknowledges that DDTR is being recirculated in the food-chain, and Gambusia DDTR concentrations continue to be influenced by historical inputs to the system. EPA's approach has overestimated the BAFs and resulted in cleanup goals that are lower than needed to be protective.

BASF agrees that the site is inundated with by floodwaters, flushing some fish out of the focus area and that during flooding some clean sediments are deposited on top of historical deposits.

This process will help to ensure that recontamination is never more than a minor issue in the floodplain. However, it is important to note that those same processes were occurring prior to 2008 and the Gambusia tissue concentrations were largely unchanged. Only after the cover was installed did the Gambusia concentrations decline by approximately 50% per year for at least 7 years. As noted previously, the DDTR in sediments in Cypress Swamp was flat or increased in concentration slightly over this period.

However, during this period, DDTR continued to gradually decline in the food chain. The food chain includes the maternal transfer of persistent organic pollutants into their eggs, which is well-established in the literature (Arnot and Gobas, 2004; Russell et al, 1999; Chiuchiolo, 2004). Gambusia feed on the eggs of longer-lived species (Johnson, 2008; Meffe and Snelson, 1989; Goodsell and Kats, 1999). The predatory fish then feed on Gambusia and the DDTR continues to cycle. In a situation when sediment exposures are flat or increasing but biota levels are steadily decreasing, the decrease is best explained by the gradual elimination of the historical levels in the food-chain supply.

This aspect of the Conceptual Site Model is a fundamental source of disagreement between BASF and EPA. If the Conceptual Site Model corresponding to the approach to establishing cleanup levels proposed by EPA were correct, the data would show a biota response to remediation only in Cypress Swamp and the response would be complete after 1 or 2 years (immediately after the sharp decline in sediment DDTR concentrations). The decline would appear as a step function rather than a smooth first-order decline (note: first order declines are linear when plotted on a logarithmic y-axis such as in Figure 1). Instead the data show a steady decline in Gambusia concentrations in multiple locations at a rate of approximately 50%/year for at least seven years. The EPA assertion that it is "unlikely that DDT measured in fish in 2015 and 2016 is from historical contamination" is not consistent with site-specific data.

As noted in multiple BASF Follow-up Responses, site-specific data show strong evidence of food-chain cycling of DDTR. The DDTR in predatory fish is transferred to the eggs and larvae, forage fish feed on those eggs and larvae, and then predatory fish feed on the forage fish. The elimination rate from individual fish cannot alone predict the timeframe for a persistent pollutant to be removed from the ecological food-chain.

There is broad understanding in the sediment remediation community that biota do not respond immediately to remediation actions (Gustavson et al., 2008; Southworth et al., 2011). It is also established that the food-chain can serve as a reservoir of persistent contaminants (MacLeod et al., 2011; Evans et al., 1991). The biota contaminant levels in BASF OU3 have declined more rapidly in response to remediation than at any sediment cleanup site of which BASF is aware.

BASF Comment #5 [December 2017]**:** While BASF objects to the overall approach used by EPA as outlined above, we note that EPA eliminated an influential sample pair in its sediment to forage fish accumulation factor calculation without technical justification or explanation. Given the relatively few number of sample pairs used for the calculation, every pair is influential and should not be removed simply because it changes the relationship. In fact, the sample pair EPA removed was probably the most representative of actual bioaccumulation conditions because it was taken

in the area of highest concentration in the floodplain and would not have been influenced by biological transport from other areas with higher DDTR levels. Had EPA included this sample pair, the fit of the regression on the entire data set would have improved (R-squared improves to 0.87 from 0.72), and the coefficient relating forage fish to sediment from would have decreased from 1.1 to 0.52. Exclusion of this sample pair was arbitrary, and not based on sound science. Inclusion of this sample pair, with no other modifications to the RG development approach, would have increased the sediment RG from 0.21 mg/kg to 0.44 mg/kg.

EPA Response [March 2018]: EPA technically justified in omitting a data pair from the sediment to forage fish derivation. The data pair was based on what appears to be BASF's interpolation of 2008 pre-remedial concentrations in the Focus Area and was estimated from data collected over many years. The interpolated data pair is unreliable because it does not represent spatially and temporally correlated samples; and therefore, does not represent actual bioaccumulation conditions as suggested in BASF's comment. Additionally, Burkhard (2009) recommends the fish and sediment data be collected at the same point in time.

The referenced data pair was omitted from the sediment to forage fish regression because:

- **The data pair is based on extreme x and y values when compared to the rest of the data pairs, and does not represent concentrations currently observed in surface sediment and forage fish within OU3.**
- **Inclusion of the extreme interpolated data point strongly skews the regression relationship towards that data point and away from the ten data points of relevant spatial and temporal concordance.**

Use of a linear regression-based BAF based on omission of the interpolated data point adequately defines the sediment-forage fish relationship when DDTR concentrations in sediment are less than about 10 mg/kg, as is the current situation in Ciba OU3 and Olin OU2.

BASF Follow-up Response #5 [July 2018]: The data pair should be included as it is one of the few samples that has not been impacted by higher concentrations elsewhere in the floodplain, as it represents the highest concentration area prior to the cover installation. *The sediment value in this data pair was based on an interpolation of sample points that was representative of an appropriate exposure area for Cypress Swamp. As noted previously, it is not appropriate to remove a data point because it is influential – the literature on trophic magnification warns that it is possible to manipulate accumulation factors through careful inclusion or exclusion of data points (McLeod, 2015). Notably, the biota:sediment ratio in this sample pair (0.5) is much closer to the ratio observed in the recent samples that are unlikely to be impacted by historic exposures (0.7).*

BASF Comment #6 [December 2017]**:** The soil to insect DDTR accumulation model used to develop the Olin soil RG had no predictive power (R-squared=0.0003). An R-squared value in this range indicates no relationship at all — a random multiplier would be as effective to accurately relate insect concentrations and soil concentrations as the selected ratio. In fact, insect samples collected in 2015 confirm that this accumulation factor dramatically over-predicts the actual DDTR levels in insects, and thus was arbitrary and not technically supported. The best available

data shows that there is no current risk to insect-eating birds from DDTR in insects and soil in the floodplain. If an RG was calculated based on current data, it would be several times higher than the Olin RG.

EPA Response [March 2018]: The EPA's approach to cleanup level derivation in the Olin OU2 ROD was correct, technically supported, and not arbitrary. The regression with the low R-squared that was indicated in BASF's comment was not used by the EPA. The 2015 BASF-collected insect data fails to address the question of current risk to the Carolina wren, because BASF did not collect the invertebrate samples of spiders the EPA requested. Unspecified insects collected by BASF in 2015 did not measure the specific exposure pathway to the Carolina wren, which consumes a large portion of spiders in its diet and represents the bird that is most susceptible to harmful effects of DDTR in floodplain soils.

The BASF comment on the lack of predictive power in one specific soil to insect accumulation model is not relevant to the cleanup level derivation. The cleanup level for floodplain soil to protect ground-foraging, invertebrate-eating birds developed in the Olin ROD was not based on the regression model referenced in BASF's comment. BASF's comment incorrectly states that EPA used a regression model with R-squared = 0.0003 to derive the Olin soil cleanup level. EPA evaluated insect bioaccumulation using several normalized and non-normalized data approaches, and ultimately selected a normalized ratio based on flying insects, crawling insects, and spiders.

BASF's comment incorrectly states that 2015 data confirm a low accumulation factor. Use of the 2015 BASF collected data is not appropriate because the type of insects included in the analysis is unspecified.

The degree of DDTR accumulation depends on the type of invertebrate collected. Insects that feed on plants do not accumulate DDTR. DDTR residues in unspecified insects collected by BASF in 2015 are not the type of invertebrate samples necessary to prove that DDTR accumulation is low in spiders and detritivore insects in the diet of the Carolina wren. The best available data indicate a potential risk to the ground-foraging, invertebrate-eating bird exposed to DDTR in floodplain soils in the vicinity of Round Pond.

- The EPA added a cleanup level for DDTR in floodplain soils in the Olin OU2 ROD on account of historically elevated concentrations of DDTR in soils southwest of Round Pond. DDTR concentrations in soils southwest of Round Pond had not been characterized since the 1990s.

- The cleanup level for floodplain soil is based on ground-foraging birds that feed on a variety of invertebrates (e.g. spiders) and not just insects.

BASF Follow-up Response #6 [July 2018]: BASF has three primary comments regarding the EPA response on development of the soil cleanup level:

- ***BASF understood that EPA did not use a regression model, but the ratio it did use has no predictive power for relating soil and insects***

- ***EPA's assertions that BASF did not specify the types of invertebrates collected and may not have included spiders are not correct***

- ***The samples collected by BASF in 2015 are appropriate for use, show that the EPA model over-predicts invertebrate levels, and demonstrate that there is not an unacceptable risk to insect-eating birds in the floodplain***

BASF understood that EPA used a ratio model rather than a regression to develop the Olin soil cleanup level. While it was not a regression, it is still a model used to predict the concentration in insects based on the concentration in soil. The R-squared can still be used to assess how well the model is predicting the actual insect concentrations. The R-squared when comparing the actual insect concentrations to the predicted insect concentrations is 0.0003 (Figure 4), indicating a model with no predictive power.

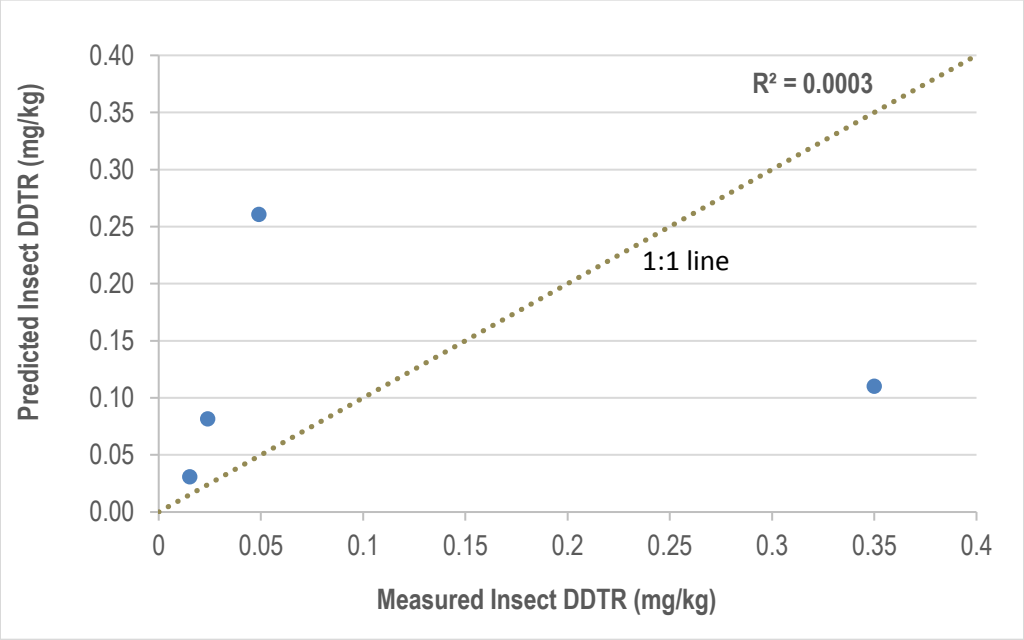


Figure 4. Comparison of measured and modeled insect levels using EPA ratio used to set Olin soil cleanup level for DDTR.

The graph shows that even when only considering the data used in the Olin ROD, the ratio is over-predicting the actual insect concentration in 3 out of 4 samples.

EPA's statement that the insect and spider samples collected by BASF were unspecified is not correct. The types of invertebrates included in the analysis were given in Table 8 of the 2015 McIntosh OU3 Year-end Report (LimnoTech, 2016) provided to EPA and ADEM on January 22, 2016. Additionally, EPA expressed concern that detritivores and spiders may not have been included. Each of the invertebrate samples submitted for analysis included both of those groups. EPA has no reason to dismiss the use of these samples. The specific table from the 2015 Report providing this information to EPA is reproduced below:

Table 3. Table 8 from the 2015 Year-end Report - Composition of insect and spider samples by mass.

Sample ID	Sample Mass (g)	Spiders and Predatory Insects (%)	Herbivores (%)	Detritivores (%)
Northeast Area	26.1	36.0	57.5	6.5
Near Midpoint of Ditch	22.6	24.3	40.7	35.0
Near Round Pond	22.1	14.0	39.4	46.6
Historically Elevated Insect	19.8	12.1	83.8	4.1

Using the EPA model for soil to insect accumulation and the mean soil concentration from each of the locations where DDTR was detected, the expected concentration in the insects should have ranged from 0.08 mg/kg to 0.92 mg/kg. The actual detected DDTR ranged from non-detect to 0.089 mg/kg, and three of the four samples contained no detectable DDTR. The BASF samples collected in 2015 provide further evidence that the ratio used to develop the soil cleanup level grossly over-predicts invertebrate concentrations, thereby resulting in a lower soil cleanup level than is needed.

BASF understands that the soil cleanup level was added because of the potential risk to insect-eating birds in the vicinity of Round Pond and acknowledges that at the time of the Olin ROD the area had not been characterized since the 1990s. For this reason, BASF specifically collected paired soil and insect/spider samples in this area as a part of its 2015 sampling. Three soil samples were collected, as well as a combined insect and spider sample, based on a sampling approach recommended by EPA as described below. The invertebrate sample in this location was composed of 60% spiders/predatory insects and detritivores by mass, the classes of insects that are of concern to EPA.

The combined insect and spider sample in this area was below detection limits. The Hazard Quotient calculated using the mean concentration of the three soil samples (1.8 mg/kg), the insect sample concentration assuming DDTR level at half of the detection limits, the conservative no-adverse effect level, and the same assumptions as used in the Olin ROD, is 0.27 - well below the value of 1 that indicates a possible adverse risk. The best available data do not indicate a risk to insect-eating birds in this area. In fact, as noted in the December 2017 letter, no invertebrate:soil data pairs ever collected anywhere in the floodplain indicate a risk to insect-eating birds.

During the sample collection effort in 2015, BASF met with Charles King and Mark Sprenger from EPA at the Site. BASF communicated the fact that it would not be possible to collect a full sample of each insect type at each location due to insufficient mass of certain insect types. For example, detritivores were extremely rare in the areas that were covered with tall grass like the Northeast Area. BASF proposed collecting either the dominant insect type at each location or a mix that was reasonably representative of the invertebrates found at each location. Based on feedback from EPA in the field, the decision was made to submit a reasonably representative sample at each location.

If EPA is unwilling to accept the 2015 invertebrate samples, BASF is willing to perform additional monitoring prior to the issuance of an ESD. Given the uncertainty surrounding the accumulation factors, the hundred-plus acres of soil that could be affected by a soil cleanup level in OU3, and EPA's recent revelation that it is rejecting the previously collected BASF samples for erroneous reasons, a request to collect additional data is not unreasonable. Under an adaptive management approach, it would not be necessary to predict the invertebrate concentrations from the soil concentrations. However, additional invertebrate collection would still be needed to assess the risk to insect-eating birds.

BASF Comment #7 [December 2017]**:** In addition to the concerns above that have been raised on multiple occasions, BASF also has concerns with the use of the t-TEL from the Beckvar et al. 2005 publication ("Beckvar 2005") as a reliable threshold for adverse effects to predatory fish. The studies summarized by Beckvar 2005 all were published before 1982 and included several studies that were not peer reviewed. At least two of the non-peer-reviewed studies used by Beckvar 2005 had significant quality control issues and should have been excluded from the evaluation (e.g., one study had up to a 40% difference between the fish counts in the tanks at the end of the study and what they had expected based on their mortality counts). The Beckvar 2005 publication itself notes that "[f]or this review, we were unable to meet the minimum 20 data point requirement specified in the sediment TEL guidelines". Elsewhere in the paper it states, "[t]herefore, these DDT tissue residue-effect numbers should be considered provisional and used carefully." In a follow up paper in 2011, Beckvar and Lofuto reiterate that "data used in this [Beckvar 2005] analysis were mostly older studies reporting lethal effects so the calculated thresholds were considered provisional." EPA cited three additional studies in the ROD in addition to those summarized by Beckvar 2005. However, those studies were all based on acute rather than chronic toxicity, followed by the application of an acute to chronic ratio (ACR). The summary study that was used to develop the ACR notes that across all of the included studies, ACRs ranged from 1.1 to 18,550 — indicating no consistent relationship between acute and chronic toxicity. Thus, EPA's use of these studies only served to further increase the uncertainty around the appropriate threshold effects value. EPA's use of Beckvar 2005 and the other cited studies resulted in a highly uncertain threshold effect for fish for setting RGs for the floodplain.

Given both the paucity of data for the target species and the low quality of the studies available to assess DDTR effects on fish as confirmed by the authors of the studies, predatory fish should not be used as the end-receptor used to define a sediment RG. EPA should have continued with the approach EPA set forth in the Proposed Plan and used wading birds, as opposed to predatory fish, as the ecological end receptor to determine the sediment RG. A great deal more reliable research is available to assess DDTR effects to birds than to fish (see the EPA Ecological Soil Screening document). Additionally, the effects levels to wading birds are based on DDTR dose rather than tissue level, and the dose can be measured easily through forage fish. Using wading birds as the relevant end receptor eliminates the most uncertain accumulation step of the RG development — the link between DDTR tissue levels in predatory fish to the DDTR levels in forage fish. The predatory fish live for many years and integrate many years of exposure. In an environment when DDTR exposures are changing substantially, as evidenced by the consistent decline in forage fish concentrations, calculating a reliable accumulation factor is not possible. In summary, the change in approach for determining a sediment RG from the Proposed Plan to the ROD significantly

increased the uncertainty around both the relevant effect threshold and the relevant accumulation relationships, was arbitrary, not based on sound science and technically inappropriate.

EPA Response [March 2018]: The EPA's use of predatory fish as the species for determining the sediment cleanup level was appropriate because:

- **Direct measurements of DDTR concentrations in fish are a reliable method to estimate exposure to fish compared with the indirect estimate of exposure to wading birds, which requires a model with multiple assumptions.**
- **Largemouth bass accumulate DDTR rapidly, within a matter of months, and depurate DDTR slowly (up to two years), making predatory fish suitable to assess changing conditions on an annual basis. See response to Comment #4.**
- **The EPA's use of a biomagnification factor of 3 to link DDTR tissue levels in predatory fish to DDTR levels in forage fish is supported by the**
- **2015/2016 fish tissue data collected by BASF. See response to Comment #8.**
- **Toxic effects of DDTR have been observed in biologically relevant species at concentrations in tissue similar to the tissue threshold effect level (t-TEL) from Beckvar et al. (2005).**
- **The use of the t-TEL from Beckvar et al. (2005) is consistent with, and supported by other literature, including more recent studies.**

The EPA acknowledges the limitations associated with the recommendations provided by Beckvar et al. (2005). Beckvar et al. (2005) suggested that the residue effects values of 0.64 mg/kg might not be sufficiently protective and that the use of an additional safety factor may be appropriate. The EPA did not use an additional safety factor in directing the use of the DDTR t-TEL derived by Beckvar, which would have resulted in a lower cleanup level.

More recent research on DDTR has examined non-lethal reproductive effects of DDTR exposure in fish. Lake Apopka, Florida studies involved the fish species present at the Ciba Site. These studies are discussed to highlight how toxic effects were observed in target (biologically relevant) species. Studies of Lake Apopka contaminated by DDT from farming, revealed altered reproductive endpoints in *Gambusia* (Toft et al. 2003) and altered spermatogenesis in male *Gambusia* resulting in reduced fertility (Edwards et al. 2013). Comparison of brown bullheads (*Ameriurus nebulosus*) from sites in Lake Apopka reported altered sex steroid hormones in female bullheads and elevated estrogen in the blood of male bullheads compared to the reference lake (Gallagher et al. 2001). These effects occurred at concentrations of DDTR in fillets of 0.0366 mg/kg wet weight. Assuming the ratio of DDTR in filets to whole body largemouth bass of 14 observed in the Olin 2001 data, this would translate to a whole body concentration of about 0.5 mg/kg, which is more stringent than the effects level derived by Beckvar.

Johnson et al. (2014) provided a comprehensive review paper in *Fish Physiology* detailing the current state of the science in endocrine disruption in fish from several classes of chemicals, including DDTR and other chlorinated pesticides. Though the toxicity information presented in this review is not always easily translatable into fish body burdens, several recent studies have been published looking at endocrine disruption and estrogenic effects resulting in intersex conditions in fish associated with DDTR exposure (Sun et al, 2016; Monteiro et al, 2014). In particular, Sun et al. (2016) reported effects on gonad development associated with fish body burdens of 0.057 mg/kg 2,4'-DDT, and 0.272 mg/kg 4,4'-DDE. These concentrations have been

observed in several of the most recent (2015/2016) BASF collected mosquitofish samples, over half of the bluegill samples, and nearly all of the most recent bass samples.

A study of DDTR body burdens of common carp (Cyprinus carpio) by Jenkins et al. (2018) found significantly lower keto-testosterone levels at an average fish body burden level of 0.107 mg/kg. Among the various chemicals detected in carp, the chemical having the most influence on the carp's hormones, sperm quality, and appearance of the testes under a microscope, was o,p'-DDE. Concentrations of o,p'-DDE in carp from Las Vegas Bay, of Lake Mead, Nevada, the most contaminated sub-basin of Lake Mead, where effects were most evident, was 0.00052 mg/kg. Analytical detection limits in the BASF collected 2015/2016 data were 40 — 70 times too high to quantify o,p'-DDE at the threshold of 0.00052 mg/kg, but when o,p'-DDE concentrations were detected in OU3 fish, the concentrations always exceeded the 0.00052 mg/kg threshold.

A summary of various fish tissue studies and the LOAEL/LOEC concentrations derived by those studies are presented in Table 2. The value of 0.64 mg/kg selected by the EPA as the basis for the fish tissue cleanup level in the floodplain is supported by the range of toxicity values presented in Table 2. Table 2 is a selection of studies highlighting chronic effects on early life stages and recent studies. Risk assessors typically develop a tissue-based toxicity value by fitting a probability distribution to the available studies on different species and taking a percentile protective of 85% or 90% of species, as was done by Beckvar et al. (2005). Table 2 illustrates that the EPA's choice of the tissue-based toxicity value from the Beckvar et al. (2005) study was not the most conservative among available studies.

Table 2. Risk-based concentrations for DDT and its degradation products in fish				
	Endpoint	Tissue Concentration (mg/kg)	Notes	Reference
Observed LOECs for fish exposed in early life				
Japanese medaka	gonadal development	0.005	o,p'-DDE in eggs	Papoulias et al. 2003
Japanese medaka 58 (Pop'DDTs)	intersex and altered gene expression	0.057	Σ o,p'-DDTs	Sun et al. (2016)
Japanese medaka	intersex, increased plasma estradiol, altered gene expression	0.272	p,'p-DDE	Sun et al. (2016)
Japanese medaka	mortality (exposure dose)	0.0018 (regression LOAEL); 0.5 exposure LOAEL	o,p'-DDE in eggs	Villalobos et al. 2003
9 Studies, 7 species	survival	0.89 - 2.4	p,p'-DDTR	Beckvar et al. (2005)
Published estimated safe tissue concentrations for fish themselves				
Adult fish	provisional due to insufficient sub-lethal data	0.6	DDTR	Beckvar et al. (2005)
Fish early life stages	provisional due to insufficient sub-lethal data	0.7	DDTR	Beckvar et al. (2005)

BASF Follow-up Response #7 [July 2018]: BASF still has concerns with the quality of the studies used in the Beckvar manuscript. Additionally, BASF notes that sub-lethal endpoints were not used in the development of the cleanup levels for mercury or HCB in the Olin ROD. In regard to the additional studies that EPA cites, BASF notes that Lake Apopka fish had multiple chemical inputs, so these field studies are not directly applicable to developing a tissue threshold. Alterations in gene expression is an area of active research with uncertain ecological implications. These effects are not suitable for developing threshold effects levels at this point in our scientific understanding. Nonetheless, BASF could be willing to accept the predatory fish endpoint under an Adaptive Management framework.

BASF Comment #8 [December 2017]**:** EPA comments on OU3 monitoring plans dated August 31, 2015 and July 14, 2016, recommend sampling to calculate new accumulation factors that would result in new RGs, consistent with our understanding of the process that was agreed to be followed. In its August 2015 EPA comments specifically notes uncertainty in the accumulation factors used in the Olin ROD and the sampling needed to refine that value: "The Olin OU2 ROD cleanup level for protection of predatory fish (largemouth bass [*Micrapterus salmoides*]) was calculated by taking the Beckvar et al. (2005) fish tissue residue value of 0.64 mg/kg and dividing it by the observed biomagnification factor in largemouth bass of 3. The result was the Olin OU2 ROD

DDTR cleanup level of 0.23 mg/kg in tissues of *Gambusia* and/or brook silversides (*Labidesthes sicculus*). Uncertainty in the biomagnification factor of 3 can be reduced by collecting paired data for *Gambusia*/silversides and largemouth bass." EPA's 2016 comments also included several recommendations to collect sediments in the same locations as *Gambusia* and predatory fish, presumably for the same purpose.

EPA Response [March 2018]: The EPA's use of a biomagnification factor of 3 between forage fish and bass is supported by the 2015/2016 fish tissue data collected by BASF.

- **Inclusion of the 2015/2016 BASF collected data in the derivation of the biomagnification factor confirms the biomagnification of 3 used in the Olin OU2 ROD**

- EPA has evaluated the 2015 and 2016 *Gambusia*, bluegill, and largemouth bass data in the context of previous biomagnification determinations presented in the Olin OU2 ROD. Inclusion of the 2015/2016 data pairs does not change the slope of the regression line (Figure 6), Four *Gambusia*/bass pairs from 2015 and three bluegill/bass pairs from 2016 were included with the historical data pairs in the revised regression, with a resulting slope of 3.06 and a R2 value of 0.83. Of the seven new data pairs, four fell above the slope of the regression line and three fell below the slope. Therefore, the newer data do not change the biomagnification factor of 3 derived in the Olin ROD.

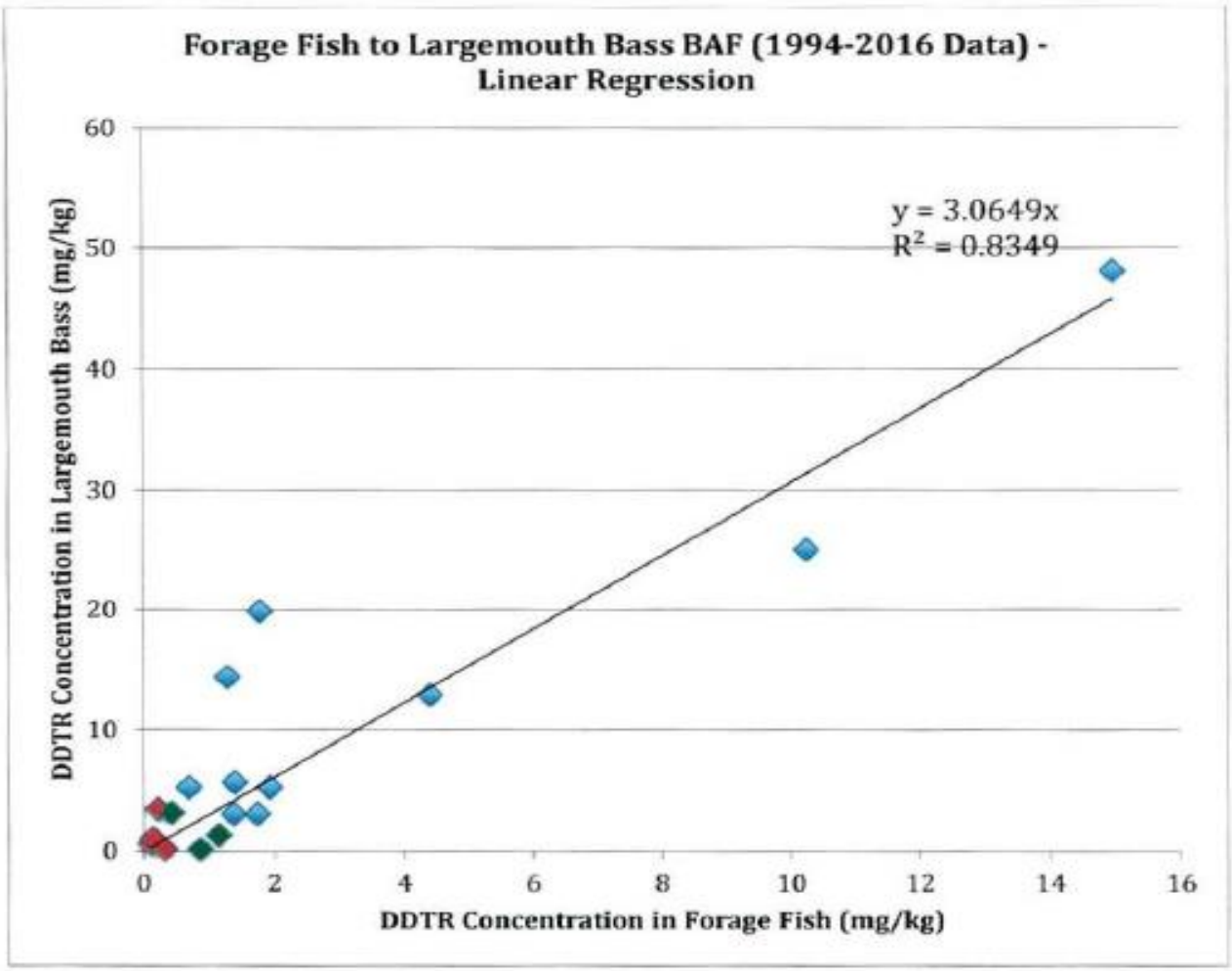


Figure 6. Biomagnification Between Forage Fish and Largemouth Bass in Olin OU2 and Ciba OU3. (Red = 2015 *Gambusia*/Bass pairs; Green = 2016 Bluegill/Bass pairs; Blue = historical forage fish/bass pairs)

BASF Follow-up Response #8 [July 2018]: The relationship between forage fish and predatory fish is inherently uncertain. Forage fish can be used as an early indication of a response to remedy and evaluating trends. However, determining a direct relationship between forage fish and predatory fish and setting a cleanup-level based on the relationship to forage fish is unnecessary as compliance with a predatory fish goal can be monitored directly.

The use of smaller fish to evaluate remedy impacts is appropriate as they are short-lived and will respond more quickly to remediation (Gustavson et al., 2008; MacLeod, 2001). The data collected in the OU3 floodplain are consistent with that finding: the Gambusia DDTR concentrations have come down relatively quickly despite continued impacts from the food-chain supply. As would be expected, recent OU3 data actually show a ratio higher than 3 because predatory fish are longer-lived and have more DDTR from historic exposures. Additional data collection would assess whether the declining trends observed in the recent data have continued.

In the development of sediment to forage fish BAF, EPA removed the sample pair from Cypress Swamp because it no longer reflects the current range of concentrations in the floodplain and because it had a strong effect on the regression. In Response #5, EPA states:

"The referenced data pair was omitted from the sediment to forage fish regression because:

- The data pair is based on extreme x and y values when compared to the rest of the data pairs, and does not represent concentrations currently observed in surface sediment and forage fish within OU3.
- Inclusion of the extreme interpolated data point strongly skews the regression relationship towards that data point and away from the ten data points of relevant spatial and temporal concordance."

BASF notes the high concentration pair in this forage fish to predatory fish evaluation is well outside of any values currently observed in the floodplain. Removal of that data pair causes the R-squared of this regression to drop to approximately 0.1, indicating a very weak relationship. Using EPA's own criteria for sample inclusion demonstrates that this relationship is not reliable.

These biomagnification relationships are inherently uncertain and based on modeling. In its response, EPA notes its preference to avoid modeling for the development of cleanup levels ("Direct measurements of DDTR concentrations in fish are a reliable method to estimate exposure to fish compared with the indirect estimate of exposure to wading birds, which requires a model with multiple assumptions" – EPA Response #7). Direct monitoring of fish DDTR without modeled relationships to forage fish and sediment is the most appropriate path forward.

BASF Comment #9 [December 2017]**:** The approaches EPA used to develop the Olin RGs and specifically the DDTR RGs were modified substantially between publication of the Olin OU2 Proposed Plan and the issuance of the Olin OU2 ROD. In particular, the relevant end receptor for sediment DDTR was changed, new accumulation factors were calculated, and the sediment RG was decreased from a range (0.33 to 1.7 mg/kg) to 0.23 mg/kg. Despite these very significant modifications, these proposed changes were never made available for public comment -- including by Olin or BASF, so that these concerns could have been timely addressed prior to issuance of the Olin ROD. Evaluation of more recent data from the site confirms that the concerns raised by ADEM, BASF and Olin regarding the process used to derive the Olin RGs were well-founded and that the technical approach used by EPA was inconsistent with EPA's own guidance and fundamentally flawed, resulting in overly stringent RGs that are not reflective of sound science.

EPA Response [March 2018]: The EPA's derivation of a sediment level protective of fish in the Olin OU2 ROD was based on the fish tissue clean-up level presented in the Olin OU2 Proposed Plan, and did not represent a fundamental change to the selected remedy.

The Olin OU2 Proposed Plan included the fish tissue cleanup level of 0.64 mg/kg from the Beckvar et al. (2005) paper, but did not include a sediment cleanup level associated with that tissue cleanup level. The Olin OU2 ROD calculated the associated sediment cleanup level associated with a bass whole-body tissue concentration of 0.64 mg/kg by deriving fish BAF and biomagnification factors and using those factors to back-calculate a sediment concentration protective of fish. The use of the sediment cleanup level associated with protection of fish in lieu of the wildlife-based goals

presented in the Proposed Plan did not change the selected remedy for Olin OU2 and did not represent a fundamental change requiring additional public comment. In addition, soil cleanup levels were made less stringent between the Olin OU2 Proposed Plan and the ROD due to application of different toxicity criteria for passerine birds than originally used in the Olin OU2 risk assessment. Again, this change did not represent a fundamental change to the remedy documented in the ROD.

BASF Response [July 2018]: BASF disagrees. A decrease in cleanup level from a range of 0.33 to 1.7 mg/kg to 0.23 mg/kg and a dramatic change in the sediment cleanup level approach reflect a significant change to the scope (physical area of response, remediation goals, and type and volume of waste to be addressed) as well as the likely cost of the remedy should have been made available for public comment under the NCP.

CONCLUSION

It is apparent that EPA and BASF disagree on two fundamental, critical issues influencing the derivation of cleanup goals for DDTR in soil and sediment. Our disagreements are based on different conceptual models regarding the contribution of historical sol and sediment concentrations to current tissue concentrations. It is unlikely that, without additional data collection, these differences can be resolved.

BASF is preparing and will submit to EPA a plan to conduct additional investigation, remediation (as needed) and monitoring to evaluate the effectiveness of the previous and proposed remedial actions under an Adaptive Management Framework.

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ATTACHMENT 6

Letter from Doug Reid-Green to Randall Chaffins with Proposed ESD Revisions. December 13, 2018.

From: John Douglas Reid-Green
Sent: Thursday, December 13, 2018 6:13 AM
To: Chaffins, Randall <Chaffins.Randall@epa.gov>; Clark, Meredith <Clark.Meredith@epa.gov>; Walden, Beth <walden.beth@epa.gov>
Cc: Hill, Franklin <Hill.Franklin@epa.gov>; Linda Mirsky Brenneman <linda.brenneman@basf.com>; Stephen K Havlik <steve.havlik@basf.com>; Lockett, Laurel <llockett@carltonfields.com>; Finch, Rhelyn <Finch.Rhelyn@epa.gov>; Woolford.james@epa.gov; Gustavson, Karl <Gustavson.Karl@epa.gov>
Subject: proposed revisions to the ESD for Ciba-Geigy Superfund Site McIntosh, AL

Dear Randall,

I am writing you on the direction Beth Walden provided during our December 6, 2018 introductory discussion of the proposed optimization study for the former Ciba McIntosh, Alabama site (OU-3). BASF is interested in participating in this study, but strongly believes that the results of the study should be considered by Region 4 in its Explanation of Significant Differences (ESD) for OU-3. Therefore, BASF requests that Region 4 postpone adoption of the ESD until such time as the optimization study is completed.

In November, BASF presented to Region 4 an adaptive management program that laid out an efficient, cooperative, and guaranteed path to meeting our shared goal of protecting human health and ecology, by focusing on achieving the risk-based biota performance standards and the surface water ARAR. Region 4 provided insight into why the draft ESD included sediment and soil cleanup goals. The uncertainty inherent in the development of the cleanup numbers and difficulties related to their use at the site were discussed in detail, and we collectively agreed that meeting the biota performance standards for the site will determine the effectiveness of the remedy and allow the EPA to then set soil and sediment cleanup remediation goals that are proven to be protective. Meredith Clark recommended that BASF provide comments to the draft ESD that would allow the site to be managed adaptively and recognized the EPA's concerns. Attached are a draft of BASF's technical comments. As you will see, they are relatively minor and, in our opinion, reflect the discussions and agreements regarding the priority of the biota performance-based standards.

At the same meeting, Beth discussed the optimization study, and last week she led an interesting discussion that introduced BASF to EPA's optimization program and team. The presentation stated that the purpose of the program was identifying areas where the remediation program can gain efficiency in achieving remedial goals. The addition of OU3 to the proposed optimization program is attractive to BASF. OU-3 was identified as an area of focus for the BASF McIntosh optimization study because of the potential for upland impacts. We noted that EPA's optimization experts were familiar with adaptive management and had recommended its use in other reviews. The optimization program is consistent with the key elements of BASF's program that Beth and I have discussed, such as the evaluation and control of ongoing sources, potential for groundwater impact on OU-3, and impacts on the biota. BASF agrees that a detailed review of the conceptual site model is important and would provide valuable information to advance the remediation of the site. However, the results of the optimization study ought to be considered in developing the ESD.

Based on the above, BASF recommends that Region 4 either accept the edits to the ESD provided by BASF to incorporate adaptive management or place the ESD on hold until the optimization study has been completed (estimated by EPA at 6 to 8 weeks) so the findings can be incorporated into the ESD. In either case, BASF remains committed to remediating the floodplain as we are required to do under our existing Consent Decree; however, we are concerned that if the proposed ESD is not modified, we will have no option but to invoke dispute resolution to protect BASF. We look forward to moving forward and achieving our shared goals. Please do not hesitate to contact me if there is anything you need.

Sincerely,

Doug
J. Douglas Reid-Green, Expert, Remediation Group, BASF Corporation, 100 Park Ave., Florham Park, NJ 07932, 908-507-882

BASF DRAFT REVISIONS TO THE PROPOSED ESD

Explanation of Significant Differences
October 2018

Site Name: **Ciba-Geigy Corporation Superfund Site**
CERCLA ID #: **ALD001221902**
Site Location: **McIntosh, Washington County, Alabama**
Support Agency: **Alabama Department of Environmental Management**
Lead Agency: **EPA, Region 4**

I. Introduction

The U.S. Environmental Protection Agency (EPA) invites comments on this proposed Explanation of Significant Differences (ESD) for the Ciba-Geigy Corporation (Ciba) Superfund Site (Site) Operable Unit 3 (OU3) Record of Decision (ROD) issued by the U.S. Environmental Protection Agency in July 1995.

The EPA issues an ESD in accordance with § 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), § 300.435(c)(2)(i). The Director of the Superfund Division has been delegated the authority to sign ESDs.

The proposed ESD, when finalized, will become part of the Administrative Record for the Site (NCP § 300.825(a)(2)), which has been developed in accordance with § 113 (k) of CERCLA, 42 U.S.C. § 9613 (k).

The Administrative Record is available for review at McIntosh Town Hall, 206 Commerce Street, McIntosh, AL 36553 Monday - Friday, 8:00 a.m. to 4:30 p.m. and at the U.S. EPA Region 4, 11th Floor Library, 61 Forsyth Street SW, Atlanta, Georgia 30303, Monday - Friday, 7:30 a.m. to 4:30 p.m.

II. Statement of Purpose

The purpose of the proposed ESD is to document a change from the risk-management based soil/sediment cleanup levels established in the 1995 ROD to risk-based ~~cleanup levels~~biota performance standards and interim soil and sediment cleanup levels derived from the performance standards, and changes to fish tissue performance standards contained in the 2008 ESD for Dichlorodiphenyltrichloroethane (DDT) along with its metabolites (DDD and DDE), collectively referred to as DDTR. This ESD also documents the current chemical-specific "applicable or relevant and appropriate requirement" (ARAR) for DDTR in surface water and modifies the Remedial Action Objectives (RAOs) for protection of surface water and reduction of ecological risk to fish, fish-eating birds and mammals, and insectivorous birds exposed to DDTR present in Site media.

The EPA prepares an ESD in accordance with NCP § 300.435(c)(2)(i) when the Agency makes changes to the original selected remedy that are significant, but do not fundamentally alter

the remedy selected in the ROD with respect to scope, performance, or cost. The proposed ESD explains changes to the cleanup goals and clarifies RAOs, but does not fundamentally alter the overall cleanup approach.

III. Site History and Contamination

The Ciba Site is located on the Tombigbee River two miles northeast of McIntosh, Alabama and 50 miles north of Mobile, Alabama (Figure 1). The ~~entire~~ Ciba Site, as described in the OU3 Consent Decree, is approximately 1500 acres, ~~of which~~ 1130 acres of which consist of the developed plant site and 370 acres of which consist of undeveloped swamp and bottomland located in the Tombigbee floodplain. Of those 370 acres in the floodplain, approximately 200 acres are located on adjacent property owned by the Olin Corporation. The former Ciba Site is currently owned and operated by BASF, which acquired the Ciba Specialty Chemicals ~~Geigy~~ Corporation in 2009. Originally, the Geigy Corporation built the facility in the 1950's and began operations in October 1952 with the manufacture of one product, DDT, for which production was discontinued in the 1960s. Through 1970, Geigy Corporation expanded its products by adding the production of fluorescent brighteners, herbicides, insecticides, agricultural chelating agents, and sequestering agents for industry. In 1971, Geigy Chemical Corporation merged with Ciba Corporation to create Ciba-Geigy Corporation. The product line was expanded to include the manufacture of resins and additives used in the plastics industry, anti-oxidants, and small volume specialty chemical products. In 1999, agricultural chelating and sequestering agent production was phased out and closed. In 2003, herbicide and insecticide production was closed.

The EPA began environmental investigations at the Ciba Site in 1982 with identification of soil and groundwater contamination on the Site resulting from past waste management operations. The Site was placed on the National Priorities List (NPL) in 1984. Due to the size and complexity of the Site, the EPA identified four operable units (OUs)(Figure 2):

- OU1 –Shallow alluvial ground water aquifer;
- OU2 Soils at ten of eleven former waste management units;
- OU3 Tombigbee ~~F~~floodplain, including the effluent ditch (including the effluent ditch and the floodplain lying south of the effluent ditch)~~and areas in the Tombigbee floodplain within close proximity to the Site~~; and
- OU4 Former waste management area designated as Site 8 (or bluff line site) and the upland portion of the dilute ditch.

Remedial actions under EPA oversight have been performed for all four OUs and each OU is monitored annually to measure remedy effectiveness. Four Five Year Reviews have been conducted to evaluate the effectiveness of the remedies for each OU. The most recent Five Year Review (September 2016) states that the remedies for OU1, OU2, and OU4 continue to mostly function as intended and remain protective of human health and the environment in the short term. A protectiveness determination for the OU3 remedy was deferred pending the completion of the actions described in this ESD and the collection of additional performance monitoring data.

The Record of Decision (ROD) addressing contamination in OU3 was issued in 1995. The selected remedy was excavation of soils in the floodplain or wetlands with concentrations above 15 mg/kg DDTR in order to mitigate residual risks to fish-eating birds feeding in the floodplain and what was, at the time, believed to be old growth cypress-tupelo forest. The initial cleanup of OU3 was conducted in 1998 (Figure 3). OU3 was not included in the First Five Year Review (September 2001) as there was insufficient monitoring data on which to base a protectiveness determination.

The Second Five Year Review (September 2006) concluded that the remedy as implemented, was not protective of the environment. Although progress had been made toward the remedial goals, additional remediation of contaminated sediment was recommended to achieve the remedial goals for OU3. Two site inspections conducted in support of the Second Five Year Review found that the OU3 overstory is co-dominated, if not dominated, by sugarberry (*Celtis laevigata*), not cypress-tupelo. Although other native bottomland hardwood and cypress trees were observed in the forested areas, they were not the dominant species. Additionally, the biologically available DDTR in sediment may harm the wildlife and the habitat may act as an attractive nuisance. Thus, the rationale included in the 1995 ROD for utilizing a risk-management based cleanup level of 15 mg/kg (to protect sensitive habitat) rather than a risk-based cleanup level of less than 1 mg/kg was inaccurate.

Based upon the recommendations from the Second Five Year Review, the EPA issued an ESD in 2008 documenting the application of a sand cover over floodplain areas that had been previously identified in the ROD as ecologically sensitive. Placement of the sand cover in these areas of the floodplain was determined to be suitable for the Site as it minimized negative impacts to the habitat. (Figure 3)

The Third Five Year Review (September 2011) stated that although the original remedy and 2008 ESD remedy were "protective in the short term because they had been implemented according to site decision documents," an O&M Plan needed to be finalized and institutional controls were required to protect the sand cover before a long-term protectiveness determination could be made.

The Fourth Five Year Review (September 2016) determined that the current soil/sediment cleanup level for DDTR in OU3 must be revised to ensure the remedy is protective of human health and the environment. In order to evaluate the protectiveness of the OU3 remedy, the Fourth Five Year Review suggested that additional site characterization may be required to determine the full extent of contamination.

IV. Selected Remedy and Previous EPA Actions

The 1995 ROD presented Remedial Goal Options (RGOs) for soil and sediment ranging from 0.04 mg/kg to 3.76 mg/kg for DDTR to be protective of different ecological receptors. The 1995 ROD stated that in order to achieve a hazard quotient (HQ) of 1 or less, the concentration of DDTR in the floodplain must be no greater than 1 mg/kg [one (1) milligram per kilogram (mg/kg)]. However, in the 1995 ROD, the EPA concluded that remediating to 1 mg/kg was not practical because it would require extensive excavation and destruction of the bottomland hardwood forest and the cypress-tupelo swamp. The 1995 ROD selected 15 mg/kg total DDTR as a risk

management-based cleanup goal for OU3 to provide the best balance of overall protection among cleanup goals considered for remediation of the floodplain soil and sediment. However, as previously stated, two subsequent site inspections conducted in support of the Second Five Year Review found that the OU3 overstory is co-dominated, if not dominated, by sugarberry (*Celtis laevigata*), not cypress-tupelo.

The 1995 ROD for OU3 stated that adjustments and modifications to the cleanup goal based on area-specific factors and additional sampling results would be considered by the EPA during the Remedial Design Study, and any adjustments to the cleanup level would be published in an ESD or ROD Amendment.

The 1995 ROD resulted in the excavation of 23,000 cubic yards of contaminated sediment from the OU3 wetland and floodplain areas.

Though a performance standard for fish tissue was not established in the 1995 ROD, a performance goal range of 0.3 to 1.5 mg/kg in whole body mosquitofish (*Gambusia affinis*) tissue was used to assess post-remedy effectiveness. The OU3 remedy resulted in average concentrations of DDTR across OU3 soil/sediment of less than 15 mg/kg; however, large continuous areas greater than 15 mg/kg still existed within OU3, and *Gambusia* tissue concentrations continued to exceed the upper end of the performance goal range. The 2008 ESD for OU3 specified placement of a sand cover over areas of the floodplain with soil/sediment DDTR concentrations above 15 mg/kg and continued monitoring of *Gambusia* to assess remedy performance. The 2008 ESD also restated the 1.5 mg/kg performance goal for *Gambusia*. It should be noted that in 1998, when the OU3 remedy was being implemented, the cover application technology was not available (or certainly not widely used by the EPA) to apply soil/sediment as a cover in the ecologically sensitive areas without destroying the habitat. Following the implementation of the cover remedy, *Gambusia* concentrations declined by 99% in Cypress Swamp (the waterbody in the area that was covered) and are currently meeting the 1.5 mg/kg goal in all OU3 waterbodies.

V. Description of Significant Differences and Basis for the ESD

The 1995 ROD's use of risk-management based cleanup levels for DDTR in soils/sediments in order to minimize destruction of sensitive habitats is no longer warranted. The Second Five Year Review documented that the majority of the forested wetlands were probably clear-cut at one time; and the sand cap placed as a result of the 2008 ESD demonstrated that active remediation could be accomplished in the floodplain with minimal destruction of cypress-tupelo forest. Potential impacts to small areas of cypress-tupelo and bottomland forest in Ciba OU3 from remedial activities are insignificant compared to potential risks from DDTR to ecological receptors in OU3 and potential transport of DDTR to downstream areas of the Mobile-Tensaw Delta. Additionally, the habitat in the Ciba floodplain is not unique in the 260,000-acre delta.

The EPA issued a letter to the PRP dated April 1, 2015 stating that current soil/sediment cleanup levels and performance standards for ecological receptors must be revised to ensure remedial actions are protective of human health and the environment.

The *Gambusia* performance standard range contained in the OU3 Post-Remediation Monitoring Plan was originally established to protect piscivorous birds from the No Observed Adverse Effects Level (NOAEL) of 0.28 mg/kg to the Lowest Observed Adverse Effects Level (LOAEL) of 1.5 mg/kg. However, this range does not take into account protection of other ecological receptors and the effects of bioaccumulation and biomagnification in fish.

The 1995 ROD calculated Remedial Goal Options (RGOs) for multiple ecological receptors and exposure based on the EPA's ecological risk evaluation of the Site, and derived risk-based RGOs for soil/sediment ranging from 0.04 mg/kg to 3.76 mg/kg for DDTR. This range of RGOs is consistent with those developed for DDTR in the floodplain and basin of the adjacent Olin Superfund Site (Olin OU2), where sediment RGOs for DDTR for protection of fish and wildlife ranged from 0.21 to 1.2 mg/kg, floodplain soil RGOs for wildlife ranged from 0.14 to 1.4 mg/kg, and fish tissue RGOs ranged from 0.23 to 0.64 mg/kg.

Remedial Action Objective Summary

Per the EPA's guidance, Remedial Action Objectives (RAOs) are medium-specific goals that define the objectives when conducting remedial actions to protect human health and the environment. RAOs specify the contaminants of concern (COCs), potential exposure routes and receptors, and acceptable concentrations (i.e., cleanup levels) for a site and provide a general description of what the cleanup will accomplish.

The 1995 ROD contained the following general cleanup objective:

- Remediate the source of the contamination, minimize the migration of the contamination from the soil/sediment to the groundwater/surface water, and prevent current or future exposure to contaminated groundwater or other environmental receptors.

In this ESD, the following RAOs are developed for OU3 to clarify the cleanup objective stated in the 1995 ROD. The associated cleanup levels for soils and sediments, the surface water protection standard, and performance standards for ecological receptors are provided in Table 1. The Ciba OU3 RAOs are specified as follows:

- ***Reduce, or mitigate, risk to piscivorous birds from ingestion of fish exposed to DDTR contaminated sediments.***
- ***Reduce, or mitigate, risk to fish from food-chain exposure to DDTR contaminated sediments.***
- ***Reduce fish tissue concentrations of DDTR to levels protective of predatory fish and piscivorous birds.***
- ***Reduce, or mitigate, risk to ecological receptors exposed to DDTR in contaminated floodplain soils.***
- ***Protect surface water quality from migration of DDTR contaminated media into surface water.***

The EPA anticipates these RAOs can be met without changing the remedial alternatives previously implemented in the 1995 ROD and 2008 ESD.

The protective levels to be achieved by the modified RAOs require replacing the non-protective cleanup levels for DDTR selected in the 1995 ROD and 2008 ESD with the protective cleanup levels, performance standards, and ARARs presented in Table 1. ~~The specific soil/sediment cleanup levels and~~The fish performance standards in Table 1 are risk-based thresholds based on protection of fish and wildlife and were calculated for ecological receptors representative of the Site using the geometric mean of the NOAEL and the LOAEL toxicity information, and thus are protective of the environment at OU3. The interim soil/sediment cleanup levels were derived from the performance standards through modeling, but are subject to uncertainty. The cleanup level for DDTR in surface water is a promulgated standard, i.e., chemical-specific ARAR, in the state ambient water quality criteria and will be used to monitor potential migration of DDTR from OU3 soil and sediment.

Determination of attainment of ~~cleanup levels,~~ performance standards~~,~~ and surface water ARARs will be based on measurements of DDTR in ~~sediment, floodplain soil,~~ whole body forage fish (e.g. *Gambusia*) tissue, whole body predatory fish (e.g. largemouth bass) tissue, and surface water. Specific decision rules for determining remedy success, compliance with ARARs, and attainment of cleanup levels and performance standards within specified limits of uncertainty will be defined in a performance monitoring plan to be developed by the PRP with approval from the EPA. The performance monitoring plan will be the basis for a structured adaptive management program that will guarantee achievement of the performance standards and result in the determination of the appropriate soil and sediment cleanup levels. Once performance standards for body burden in specified biota receptors have been achieved, final soil /sediment cleanup levels will be set to reflect the actual soil and sediment cleanup levels that were necessary to achieve protection of ecological receptors.

The time frame for attainment of the revised cleanup levels, performance standards, and ARARs may be dependent on ~~1)~~ further investigation in Ciba OU3 (as recommended in the Fourth Five Year Review~~); and 2) implementation of the Olin OU2 ROD.~~). The need for any additional remedial action, or adjustment of soil/sediment cleanup levels to reflect concentrations that resulted in protection of forage and predatory fish will be documented in an ESD or ROD Amendment, as appropriate.

VI. Support Agency Comments

The EPA consulted with ADEM and provided it the opportunity to comment on this ESD in accordance with NCP § 300.435 (c)(2) and § 300.435 (c)(2)(i) and CERCLA § 121(f).

VII. Statutory Determinations

The EPA has determined that the significant change to the cleanup value for DDT and its metabolites in soil and sediment complies with the statutory requirements of CERCLA § 121, 42 U.S.C. § 9621, are protective of human health and the environment, comply with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, are cost

effective, and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

VIII. Public Participation

A public notice of availability will be published in the Mobile Press-Register in mid-October 2018. This proposed ESD has been distributed to the site mailing list, placed in the Administrative Record Files at the EPA Region 4 Record Center in Atlanta Georgia, and copies are available at the McIntosh Town Hall on Highway 43 in McIntosh, Alabama for review.

The dates for the public comment period are October 20, 2018 through November 20, 2018. If you prefer to submit written comments, please mail them postmarked no later than midnight November 13, 2018.

Please direct written comments on this proposed ESD to:

Beth Walden
Remedial Project Manager
Superfund Remedial Branch
U.S. Environmental Protection Agency Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303-3104
EMAIL: walden.beth@epa.gov
TELEPHONE: (404) 562-8814

After EPA has received comments during the comment period, EPA will summarize the comments and provide responses in a Responsiveness Summary made part of the Administrative Record for the Site.

Table 1. Comparison of Cleanup Levels and Performance Standards for Ciba OU3

Summary of Ciba OU3 Cleanup Levels and Remedy Performance Standards for DDTR		
1995 ROD	2008 ESD	2018 ESD
Cleanup Level Soil/Sediment: 15 mg/kg	Cleanup Level Soil/Sediment: 15 mg/kg Performance Standard *Gambusia*: 1.5 mg/kg (established 0.3 - 1.5 ppm post 1995 ROD)	Interim Cleanup Levels[1] Sediment: 0.21 mg/kg Floodplain Soil: 0.63 mg/kg Performance Standards [2] *Gambusia*: 0.23 mg/kg Predatory Fish: 0.64 mg/kg ARARs Surface Water: 0.00~~0~~1 ug/L[3]
Summary of Ciba OU3 Cleanup Levels and Remedy Performance Standards for DDTR Isomers		
		Surface Water ARARs 4,4'-DDD: 0.0002 ug/L[4] 4,4'-DDE: 0.0001 ug/L[4] 4,4'-DDT: 0.0001 ug/L[4]

[1] The DDTR cleanup levels are consistent with those selected in the Olin OU2 ROD, but are subject to adjustment once the performance standards for Gambusia and predatory fish have been met.

[2] The Olin OU2 ROD uses the term cleanup level for fish tissue.

[3] ~~As calculated by Eq. 19 specified in ADEM Admin. Code r. 335-6-10-.07(1)(d)(2)(ii), relating to calculation of human health criteria for consumption of fish only for those toxic pollutants classified by EPA as carcinogens, applicable to all waters of the State of Alabama. *See* ADEM Admin. Code r. 335-6-10-.07(1)(e).~~ The chronic freshwater criteria for protection of aquatic life, 0.001 ug/L, for 4,4'-DDT applies to DDT and its metabolites (DDTR). *See* ADEM Admin. Code r. 335-6-10-.07(1), Table 1 Toxic Pollutant Criteria~~.~~.

[4] As calculated by Eq. 19 specified in ADEM Admin. Code r. 335-6-10-.07(1)(d)(2)(ii), relating to calculation of human health criteria for consumption of fish only for those toxic pollutants classified by EPA as carcinogens, applicable to all waters of the State of Alabama. *See* ADEM Admin. Code r. 335-6-10-.07(1)(e).

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ATTACHMENT 7

Statutory Warranty Deed, #464, page 237, Entry 64527, public records of Washington County, Alabama.

STATE OF: ALABAMA

§

COUNTY OF WASHINGTON

This Instrument Prepared By:
T. Bruce McGowin, Esq.
Hand Arendall, L.L.C.
Post Office Box 123
Mobile, Alabama 36601
(251) 432-5511

STATUTORY WARRANTY DEED

Effective as of 12:01 AM Central Time on September 29th, 2006, **Ciba Specialty Chemicals Corporation**, a Delaware corporation ("**Grantor**"), whose address is Post Office Box 113, McIntosh, AL 36553, does hereby EXCHANGE, GRANT, BARGAIN, SELL, and CONVEY to **Olin Corporation**, a Virginia corporation ("**Grantee**") whose address is Post Office Box 28, McIntosh, AL 36553, its successors and assigns, subject to the exceptions and other matters specifically mentioned below, that parcel of land located in Washington County, State of Alabama described as follows and all improvements thereon (collectively the "**Property**"):

A Portion Of Section 40, Township 4 North, Range 1 East, Washington County, Alabama and being more particularly described as follows:

Commencing at the Southwest Corner of Fractional Section 38, Township 4 North, Range 1 East, Washington County, Alabama; Thence N 62°18'58" E 7890.06 feet to a 6" X 6" Concrete Monument (Ciba Monument No. 9) at the Point Of Beginning of the Parcel of Land Herein Described; Thence S 50°26'13" E 161.07 feet to a ½" Rebar (Cap Ca 0537-Ls); Thence S 00°10'49" E 1887.06 feet to a ½" Rebar (Cap Ca 0537-Ls); Thence S 00°25'37" W 689.56 feet to the Northwestern Margin of the Tombigbee River; Thence along the Meandering Shoreline of the Tombigbee River a Bearing and Distance of S 48°37'11" W 191.01 feet; Thence leaving said Shoreline N 00°25'37" E 2319.62 feet to a 6" X 6" Concrete Monument (Ciba Monument No. 10); Thence N 00°07'30" E 485.89 feet to the Point Of Beginning. Said Parcel Containing 8.35 Acres More Or Less.

LESS AND EXCEPT all oil, gas and other minerals and mineral rights owned by the Grantor, the same being reserved to the Grantor, provided that notwithstanding the reservation of all oil, gas and minerals situate on, in and under said Property, the Grantor and its successors and assigns does, by these presents, acknowledge that Grantor shall have no right to ingress or egress in or on the surface, and no right whatsoever to use the surface of the Property for the purpose of exploration, drilling, development, production, storage, marketing or other purposes connected with said minerals or mineral rights retained, and agrees that Grantor will take no action which might cause subsidence of the surface or otherwise interfere with the free use and enjoyment of the surface of said Property, in any way; and does hereby release all right, title and interest in and to such oil, gas and minerals as may be situate within 500 feet of the surface of the Property.

TO HAVE AND TO HOLD the Property, together with all and singular the rights and appurtenances thereunto and in anywise belonging, unto Grantee, its successors and assigns, forever.

The Property is conveyed subject to all liens for ad valorem taxes hereafter falling due and to the following Permitted Exceptions:

1. The lien for ad valorem taxes not yet due and payable;

2. All rights, easements and servitudes incident to and a part of the mineral estate underlying the Property and all oil and gas well sites and related agreements;

3. All rights of the State of Alabama and the United States, if any, in and to any navigable waterways situated on or about the Property and all navigational servitudes arising from any navigable waterways situated on or about the Property, all existing easements relating to flowage rights, locks, dams, canals or other improvements pertaining to waterways on the Property;

4. Riparian and other rights created by the fact that the Property is bounded by or transversed by any public water body;

5. The right, if any, of neighboring riparian owners and the public or others to use the waters of any public water body;

6. Boundary line disputes, overlaps, encroachments, or any other similar matters not of record and not discovered by Buyer which would be disclosed by an accurate survey and inspection of the Property;

7. Recorded easements and rights-of-way for existing roads (public or private), railroads and public utility lines running through, over or across the Property;

8. Rights, if any, relating to the construction and maintenance in connection with any public utility of wires, poles, pipes, conduits and appurtenances thereto, on, under or across the Property;

9. All rollback taxes, if any, for any year and the current year's taxes, assessments, water rates and other governmental charges of any kind or nature imposed on or levied against or on account of the Property;

10. Restrictions on Grantee's ability to build upon or use the Property imposed by any current or future building or zoning ordinances or any other law or regulation of any Governmental Authority;

11. Any and all restrictions on use of the Property due to environmental protection laws, including, without limitation, wetlands protection laws, rules, regulations and orders;

12. All previous reservations, exceptions and conveyances of oil, gas, associated hydrocarbons, minerals and mineral substances and royalty and other mineral rights;

13. The CERCLA RD/RA Consent Decree, Operable Unit #3, dated October 11, 1996 entered by the United States District Court for the Southern District of Alabama in that certain action captioned United States of America v. Ciba-Geigy Corporation bearing Civil Action Number 96-0571-CB-M which is recorded in Miscellaneous Record Book 0110 at Page 006 in the Office of the Judge of Probate of Washington County, Alabama ("**Consent Decree**");

14. All rights of access, easements, servitudes and covenants incident to and part of the Consent Decree, to the extent they apply to the Property; and

15. That hunting reservation in that certain deed from Tensaw Land & Timber Co., dated January 31, 1953 and filed for record June 2, 1953 in Deed Record Book 96 at Page 471 in the Office of the Judge of Probate of Washington County, Alabama.

IN WITNESS WHEREOF, Grantor has caused this Statutory Warranty Deed to be executed effective on the day first set forth above.

Ciba Specialty Chemicals Corporation, A Delaware Corporation

By: Douglas J. McHerin 9/25/06 [SEAL]

Title: Vice President, EHS

STATE OF New York

COUNTY OF Westchester

I, the undersigned, a Notary Public in and for said County in said State, hereby certify that Douglas McHerin, whose name as Vice President of Ciba Specialty Chemicals Corporation, a Delaware corporation, is signed to the foregoing instrument and who is known to me, acknowledged before me on this day that, being informed of the contents of the instrument, he/she, as such Vice President and with full authority, executed the same voluntarily for and as the act of said corporation.

Given under my hand this 25 day of September, 2006.

Patricia Lorden Wager
NOTARY PUBLIC
My Commission Expires: 5/31/2010

PATRICIA LORDEN WAGER
Notary Public, State of New York
No. 60-4686482
Qualified in Westchester County
Commission Expires May 31, 2010

3

Environmental Remediation Group

3855 North Ocoee Street, Suite 200
Cleveland, TN. 37312
(423) 336-4388
FAX (423) 336-4166
kdroberts@olin.com

SENT VIA EMAIL

December 20, 2018

Ms. Beth Walden
Remedial Project Manager
Superfund Remedial Branch
U.S. Environmental Protection Agency Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303-3104
walden.beth@epa.gov

Re: **Comments on the October 2018 Proposed *Explanation of Significant Differences* for the Ciba-Geigy Corporation Superfund Site.**

Dear Ms. Walden:

Olin Corporation (Olin) herein submits comments on the October 2018 Proposed Explanation of Significant Differences (ESD) for the Ciba-Geigy Corporation Superfund Site. Please let me know if you have any questions. I can be reached at (423) 336-4388 or via e-mail (kdroberts@olin.com).

Sincerely,

OLIN CORPORATION

Keith D. Roberts
Director, Environmental Remediation

cc: A. Pierce – ADEM
C. A. Hunt – Olin
L. D. O'Brien – Olin
C. E. Draper – Wood
H. E. Fogell – Wood
S. K. Havlik – BASF

COMMENTS ON THE USEPA PROPOSED OCTOBER 2018 EXPLANATION OF SIGNIFICANT DIFFERENCES FOR THE CIBA-GEIGY CORPORATION SUPERFUND SITE

GENERAL COMMENTS:

1. The primary and only release mechanism, excluding background, for DDTR (the total of the 2,4'- and 4,4'- isomers of dichlorodiphenyldichloroethane [DDD], dichlorodiphenyldichloroethylene [DDE], and dichlorodiphenyltrichloroethane [DDT]) at Olin McIntosh Site Operable Unit 2 (OU-2) is migration of sediments and soils containing DDTR from the Ciba-Geigy Corporation OU-3 Superfund Site (Ciba-Geigy), which is located immediately north of Olin's OU-2. Sampling around OU-2 indicates that there is the potential for continued DDTR migration to OU-2 at concentrations greater than cleanup goals. Olin is concerned that this DDTR migration would recontaminate Olin's OU-2 after the completion of Olin's remedial action. Migration of DDTR into remediated areas could make it impractical to comply with the remedial goals included in Olin's OU-2 Record of Decision (ROD; USEPA 2014) (Attachment A). This point is discussed further in the specific comments below.

2. The DDTR fish tissue remedial goal proposed by USEPA is based on the lower end of a range of values presented in a literature summary paper (Beckvar et al. 2005). Olin has previously reported that the fish tissue remedial goals proposed by USEPA are not site-specific, use some fish species not present at Olin's OU-2, and are inappropriately low considering site conditions (background concentrations, sediment accumulation factors, etc.). These remedial goals also may not be achievable because of potential migration of DDTR from the Ciba-Geigy Site. Supporting information for this comment is provided in the specific comments below.

SPECIFIC COMMENTS

1. **ESD Page 5, last paragraph of Section V.** The timeframe for attainment of the revised cleanup levels, performance standards, and applicable or relevant and appropriate requirements (ARARs) should not be dependent on the implementation of the April 2014 Olin McIntosh Site OU-2 ROD (USEPA 2014). The presence of DDTR at OU-2 is solely the result of migration of DDTR from Ciba-Geigy. Capping the OU-2 Basin as specified in Olin's OU-2 ROD should follow documented attainment of the proposed revised cleanup levels, performance standards, and ARARS for Ciba-Geigy to eliminate migration of DDTR at concentrations above the proposed goals from the upgradient Ciba-Geigy Site to OU-2. To ensure Olin's OU-2 cap is not recontaminated with DDTR, the proposed cleanup levels at Ciba-Geigy should be attained prior to the cap

installation in OU-2. Recontamination of the OU-2 cap would render achievement of the DDTR cleanup goals at OU-2 impractical.

2. **ESD Page 4, Section V and Remedial Action Objective Summary.** DDTR is a unique constituent of concern at Olin's OU-2 because its source does not originate from within the Olin Property. Manufacturing activities at the Olin Plant did not include DDTR nor was DDTR used in any production operations. The primary and only release mechanism for DDTR, exclusive of background, is migration of sediments and soils containing DDTR from Ciba-Geigy located immediately north of Olin's OU-2. Floodplain soil and sediment collected from the 1990s at OU-2 show a distinct DDTR migration pattern. These data show that DDTR migrated south from the Ciba-Geigy onto OU-2. The RAOs for Ciba-Geigy should include:
    - **Reduce or mitigate risk to adjacent properties by reducing or mitigating the transport of DDTR through sediment, water, or biota that would result in an exceedance of a remediation goal at adjacent properties.**

3. **ESD Page 5, 2nd Full Paragraph.** The paragraph states that "EPA anticipates these RAOs can be met without changing the remedial alternatives implemented in the 1995 ROD and 2008 ESD". It is not clear how the lower RGOs can be met without changes. Further explanation is needed.

4. **ESD Page 5, 4th Full Paragraph.** Olin requests review of the Ciba-Geigy Performance Monitoring Plan and the resulting Ciba-Geigy Performance Monitoring Data, when available. The performance monitoring data must demonstrate that the proposed goals have been met prior to cap placement at Olin's OU-2.

5. **ESD Page 5, 4th Full Paragraph.** DDTR analysis in biotic and abiotic media to document the migration path, or lack thereof, of DDTR from the Ciba-Geigy Site to Olin's OU-2 should be including in the Ciba-Geigy Performance Monitoring Plan. The following sampling types/events should be considered as part of the Ciba-Geigy Performance Monitoring Plan, on a one-time or limited basis.
    - DDTR analysis in surface water, sediment, floodplain soil, spiders, flying insects, and mosquitofish in the Ciba-Geigy effluent ditch, to the extent these biota are available.
    - DDTR analysis in biotic and abiotic media along the migration pathway to Olin's OU-2 including the migration pathway from the Tombigbee River to the intake channel to the Basin.

    These analyses should be monitored to assure compliance with the Site cleanup goals for DDTR for sediment, surface water, floodplain soil, whole body mosquitofish, and whole body largemouth bass.

6. **ESD Page 5, 4th Full Paragraph and Section VII.** The DDTR fish tissue performance standard of 0.64 mg/kg for Ciba-Geigy (and Olin's OU-2) is based on a literature summary paper (Beckvar et al. 2005). The PRG proposed by USEPA in Olin's OU-2 ROD and in the Ciba-Geigy ESD is the lower end of the range of values presented in the paper for a variety of fish species, many of which are not native to the southeastern US. Olin has previously reported that the forage fish tissue performance standard proposed by USEPA is inappropriately low, and also may not be achievable because of potential migration of DDTR from the Ciba-Geigy Site. Olin had previously recommended a forage fish tissue DDTR performance standard range of 1.05 to 2.33 mg/kg, which is consistent with the biota-sediment accumulation relationship developed in USEPA-approved Olin documents leading up to Olin's OU-2 ROD.

   Based on a review of the data presented in an *Evaluation of Bioaccumulation Factors for DDTR* prepared by Neptune & Company (Neptune), approximately one-third of *Gambusia* and over half of largemouth bass sampled exceed the remediation goals, established for forage and predatory fish, seven years after remedy implementation (Neptune 2018). It is uncertain that *Gambusia* and largemouth bass concentrations will achieve remediation goal concentrations in a timely manner at the Ciba-Geigy Site. Sediment, soil, and surface water may still exceed goals, and are potentially subject to DDTR migration, even if fish do meet the remediation goals in a portion of the Ciba-Geigy Site.

   A more comprehensive characterization and evaluation is needed before USEPA can demonstrate that remedial goals are met. Only after this has been demonstrated should construction of a cap at Olin's OU-2 commence.

References

Beckvar, N., T.M. Dillon, and L.B. Read, 2005. Approaches for linking whole-body fish tissue residues of mercury or DDT to biological effects thresholds. *Environ. Toxicol. and Chem.*, 24(8): 2094-2105.

Neptune & Company, 2018. *Evaluation of Bioaccumulation Factors for DDTR at Olin Operable Unit 2 and Ciba-Geigy Operable Unit 3 Superfund Sites*. https://semspub.epa.gov/work/04/11112169.pdf.

Olin, 2013. DDTR in Abiotic and Biotic Media. June 19, 2013.

USEPA, 2014. *Record of Decision*. Olin McIntosh Site, Operable Unit 2 (OU-2), McIntosh, Washington County, Alabama. April.

Record of Decision

Olin McIntosh Site

Operable Unit 2 (OU-2)

McIntosh, Washington County, Alabama

April 2014

U.S. Environmental Protection Agency

Region 4

61 Forsyth Street S.W.

Atlanta, Georgia 30303

The Olin OU2 Record of Decision was removed from this letter response, but can be found on the internet at: https://www.epa.gov/superfund/olin-corporation-mcintosh

Also, for copy of the Olin OU2 Record of Decision, please see the Administrative Record for the Olin OU2 Superfund Site, located at:

Local Repository:

McIntosh Town Hall

206 Commerce Street

McIntosh, Alabama 36553

Tel: (251) 944-2428

Atlanta Repository:

U.S. Environmental Protection Agency

61 Forsyth St., SW

Sam Nunn Atlanta Federal Center, 9th Floor

Atlanta, Georgia 30303

Tel: (404) 562-8190
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E-mail: r4-library@epa.gov

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AFFIDAVIT
State of Alabama - Washington County

US ENVIRONMENTAL PROTECTION AGENCY
61 FORSYTH ST. SW
ATLANTA GA, 30303

Before me, a notary public in and for the county and state above listed, personally appeared **JESSIE GRAY** (AFFIANT), who, by me, duly sworn, deposes and says that: My name is **JESSIE GRAY**, I am the Legal Advertising Coordinator of the Washington County News ("Newspaper"). The Newspaper is printed in the English language, has a general circulation and its principal editorial office in the county in which it is published, and has been mailed under a publication class mailing privilege of the United States Post Office Department for the Post Office of Chatom, AL, where it is published at least 51 consecutive weeks a year.

I further certify that the attached notice is a true and correct copy of the notice published in said Newspaper.

Public Notice LEGAL
Ciba-Geigy Corporation Superfund Site (OU3), McIntosh, Washington County, Alabama

The Newspaper published the attached legal notice in the issues of

10/12/2018

The sum charged for these publications was $141.40 per week for 1.00 consecutive weeks, a total cost of $141.40.

The sum charged by the newspaper for said publication does not exceed the lowest classified rate paid by commercial customers for an advertisement of similar size and frequency in the same newspaper(s) in which the public notice appeared.

There are no agreements between the newspaper and the officer or attorney charged with the duty of placing the attached legal advertising notices whereby any advantage, gain or profit accrued to said officer or attorney.

Jessie Gray (AFFIANT)

Sworn to and subscribed before me on this 12th day of October, 2018.

Notary Public Rhonda Gray

My Commission Expires 7/23/2019

Ad ID 42790

RHONDA GRAY NOTARY PUBLIC MY COMMISSION EXPIRES JULY 23, 2019 STATE OF ALABAMA

The United States Environmental Protection Agency Issues an Explanation of Significant Difference (ESD) for the Ciba-Geigy Corporation Superfund Site (OU3), McIntosh, Washington County, Alabama

The U.S. Environmental Protection Agency (EPA) is inviting the public to comment on an Explanation of Significant Difference (ESD) that modifies the Record of Decision (ROD) that was completed in July 1995 for the Ciba-Geigy Corporation Superfund Site (Site), Operable Unit 03 (OU3). The comment period is open from October 20 to November 20, 2018.

The purpose of the ESD is to document a change from the risk-management based soil/sediment cleanup levels established in the 1995 ROD to risk-based cleanup levels and changes to fish tissue performance standards contained in the 2008 ESD for Dichlorodiphenyltrichloroethane (DDT) along with its metabolites (DDD and DDE), collectively referred to as DDTR. The ESD also documents the current cleanup standard for DDTR in surface water and modifies the Remedial Action Objectives (RAOs) for protection of surface water and reduction of ecological risk to fish, fish-eating birds and mammals, and insectivorous birds exposed to DDTR present in Site media.

The initial cleanup was completed in 1998, but there was not enough monitoring data to determine if the cleanup was protective to standards set by EPA and the state of Alabama by the time of the First Five Year Review (September 2001). The Second Five Year Review (September 2006) indicated that while substantial progress had been made toward reaching the standards, additional remediation work was needed and added to protect the Site. The Third Five Year Review (September 2011) added more institutional controls. The Fourth Five Year Review (September 2016) determined that the current soil/sediment cleanup level for DDTR in OU3 must be revised to ensure the remedy is protective of human health and the environment. EPA prepares an ESD when it is determined by the Agency that changes to the original selected remedy are significant, but do not fundamentally alter the remedy selected in the ROD with respect to scope, performance, or cost.

The ESD can be reviewed online at https://www.epa.gov/superfund/ciba-geigy-corporation or in the information repository located at 206 Commerce Street McIntosh, Al 36553. To submit comments on the ESD or for further information on the ongoing cleanup activities at the Site, please contact Beth Walden, EPA Remedial Project Manager at walden.beth@epa.gov or Ron Tolliver, EPA Community Involvement Coordinator, (877) 718-3752 extension 29591 or (404) 562-95911 or at tolliver.ronald@epa.gov.

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