# Third Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System, in Wheeler Reservoir, Alabama. Volume 2. Appendices

Published by
U.S. Environmental Protection Agency
Washington, D.C.
September, 2000

# Third Report on the Remedial Action to Isolate DDT from People and the Environment in the Huntsville Spring Branch-Indian Creek System in Wheeler Reservoir, Alabama

## Volume 2. Appendices

Review Panel Activities to Administer the
United States v. Olin Corporation Consent Decree
July 1, 1990-April 23, 1999

Volume 2 of two volumes

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Chairman's Letter

This third report of Review Panel Activities, United States v. Olin Corporation Consent Decree, July 1, 1990 - April 23, 1999 reflects significant progress in reducing DDTR levels in fish, water, and sediments. Although the performance standard has not yet been achieved for all fish, there are numerous indicators that the Remedial Action continues to reduce DDT exposure to people and the environment.

This report and appendices (in separate volumes) mark the transition from planning and constructing a remedy to monitoring changes. In order to fairly evaluate that change, this report has included all of the post-construction monitoring (1988-1997) and summaries of earlier decisions by the Review Panel. The report summarizes RP activities which assure that: data are valid and accurate for use in evaluating the remedy, sampling is representative of environmental conditions, and the remedy is operating as anticipated.

This report also marks another important transition. On November 2, 1996, Ms. Anne Asbell, second chair of the Review Panel, lost her battle with cancer. Ms. Asbell was more than a thoughtful and tireless leader. She was a teacher and colleague, who challenged everyone associated with this project to apply their best talents, collaboratively, to achieve solutions to tough problems. She also reached out with empathy to the communities affected by this and other environmental problems in order to understand their needs and concerns.

Again in this phase of the project, the RP has demonstrated the power of collaboration among federal, local, and state governments and industry to achieve environmental benefits.

As the new chair, I am heartened by our progress and the continuing commitment of the Review Panel and Olin to achieve a successful resolution of the DDT contamination of the Huntsville Spring Branch-Indian Creek system. I am confident that we will succeed.

Sincerely,

Edward S. Bender, Ph.D.
Chair, Review Panel
(202) 564-6483

# Introduction to Volume 2

On May 31, 1983, U.S. District Court Judge Robert B. Propst entered, as part of an order settling litigation against Olin Corporation, a Consent Decree (CD) governing remedial action for DDTR contamination in the Huntsville Spring Branch-Indian Creek (HSB-IC) system. The CD requires Olin to develop and implement a plan consistent with the goals and objectives of the CD to meet a performance standard of 5 parts per million (ppm) DDTR in filets of channel catfish, largemouth bass, and smallmouth buffalo in specified reaches of the HSB-IC system.

The CD established a Review Panel (RP) with voting members from the U.S. Environmental Protection Agency (EPA), Tennessee Valley Authority (TVA), U.S. Fish and Wildlife Service (FWS), Department of the Army (DOA), and Alabama Department of Environmental Management (ADEM), and non-voting participants from Triana, Alabama (Triana) and Olin Corporation (Olin). This volume contains documents that are pertinent to the Review Panel activities during the period July 1990 - April 23, 1999.

# Appendices (Volume 2)

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Appendix A. Project Chronology

For period May 31, 1983 through April 23, 1999

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| May 31, 1983 | Court approved Consent Decree for US vs Olin Corp |
| June 14, 1983 | Review Panel established. |
| January 26, 1984 | Review Panel adopted operating procedures. |
| June 1, 1984 | Olin submitted remedial action plan to RP. |
| July 14, 1984 | Public Meeting, Triana, AL, to receive comments on Olin's Proposed Remedial Action Plan. |
| August 31, 1984 | RP issued first decision document approving Olin's Proposed Remedial Action Plan with modifications. |
| January 2, 1985 | USACE Nashville District initiated Environmental Impact Statement Public Scoping Process. |
| February 5, 1985 | Olin submitted draft permit applications to RP and permitting agencies (USACE, USFWS, TVA, Alabama, and EPA). |
| July 1, 1985 | Olin submitted: 1) final engineering drawings and specifications and environmental analysis report; 2) permit applications to USACE Nashville District, TVA, and US FWS; and 3) report on field and laboratory investigations of the Huntsville Spring Branch-Indian Creek (HSB-IC) system to the RP. |
| July 17, 1985 | USACE Nashville District issued notice of availability of draft EIS for permitting activities. |

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| August 1, 1985 | Olin submitted to the RP: 1) remedial action alternatives report for Lower Reach A (LRA) and 2) interim goals report. |
| December 2, 1985 | Department of Army (DA) issued license to Olin for remedial action construction activities on Redstone Arsenal. |
| January 11, 1986 | Olin submitted revised permit applications and detailed engineering plans to RP, USACE Nashville District, TVA, and USFWS. |
| January 28, 1986 | USFWS issued limited authorization to begin site preparation and mobilization within the boundaries of Wheeler National Wildlife Refuge (WNWR). |
| February 21, 1986 | Final EIS issued by the USACE Nashville District. |
| March 1, 1986 | Olin submitted special reports: baseline conditions for water and fish; substitute fish species; long-term data acquisition program (revised); and interim goals. |
| March 24, 1986 | Close of public comment period on final EIS. |
| March 25, 1986 | Alabama Department of Environmental Management (ADEM) issued 401(a) certification. |
| March 31, 1986 | Applicable permits issued to Olin. |
| April 1, 1986 | USFWS issued permit and construction began on Upper Reach A (URA). |
| April 23, 1986 | Groundbreaking Ceremony for URA. |

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| July 2-8, 1986 | RP approved and regulatory agencies modified permits for relocation of the northern diversion ditch in URA. |
| July 16, 1986 | HSB diverted to new channel in URA (salient cut opened June 11 and oxbow cut opened July 16). |
| September 15, 1986 | Olin submitted preliminary applications for permits on Lower Reach A (LRA). |
| October 1, 1986 | USACE issued public notice of remedial action proposal for LRA. |
| October 2, 1986 | Olin, with RP concurrence, committed to start construction in LRA by December 1, 1986. |
| October 21, 1986 | Olin issued proposed engineering drawings for the remedial action in LRA, highlighting areas where construction activities were proposed prior to December 1. |
| October 28, 1986 | RP held public meeting at Triana concerning the remedial action for LRA and RP issued Decision Document 2, baseline data, substitute species, and interim goals for fish and water. |
| November 18, 1986 | ADEM issued 401(a) certification for remedial action in LRA. |
| November 21, 1986 | USFWS issued permit for remedial action in LRA. |
| November 28, 1986 | TVA and USACE issued permits for remedial action in LRA. |
| December 1, 1986 | Construction mobilization began for remedial action in LRA. |

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| December 9, 1986 | RP issued Decision Document 3, remedial action plan to isolate DDTR in LRA and full construction began in LRA. |
| January 18, 1987 | Construction of diversion structure No. 4 in LRA completed to elevation 558. |
| February 16, 1987 | Mechanical excavation of bottom sediments between HSBM 3.4 and 4.0 in LRA completed. |
| March 18, 1987 | HSB diverted to new channel in LRA. |
| April 16, 1987 | RP issued Decision Document 4, report on DDTR in Reaches B and C of the HSB-IC system. |
| May 20, 1987 | Revised plan submitted to RP for demobilization following completion of construction in URA and LRA. |
| May 20, 1987 | Eight-foot alligator captured in LRA and relocated with USFWS assistance. |
| July 22, 1987 | Major construction activities completed; ceremony held at remedial action site. |
| July 22, 1987 | RP issued Decision Document 5, substitute species for largemouth bass. |
| August 19, 1987 | USACE Nashville District, issued report of interagency regulatory committee inspection conducted August 3, 1987; no major deficiencies of permit conditions identified. |
| September 14, 1987 | RP inspection committee (including representatives of all agencies) issued report of August 27 inspection to RP Chair certifying the "as built" remedial action for URA and LRA meets or exceeds requirements of the decision documents 1 and 3, plans and specifications approved by the RP. |

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| October 14, 1987 | RP Chair transmitted to Olin his concurrence with the interagency regulatory inspection committee and the RP inspection committee certification; requested Olin to submit for a approval a proposed date for completion of construction and start of the long-term monitoring program. |
| October 15, 1987 | Olin transmitted letter to RP Chair proposing January 1, 1988 as the date for the "designated event" signifying completion of construction and implementation of the remedy as required by Decision Document 3 and CD, paragraph 52(j). |
| December 3, 1987 | RP approved January 1, 1988 as completion of construction and start of long-term monitoring period; issued Decision Document 6, long-term monitoring program for the remedial action in the HSB-IC system. |
| December 3, 1987 | Howard Zeller announced his resignation as Chair of the RP, effective December 31, 1987; Anne Asbell appointed RP Chair effective January 1, 1988; Anne Asbell requested continuation of the technical committee and inspection committee. RP adopted a semiannual meeting schedule in lieu of the quarterly meeting schedule held through December 3, 1987. |
| January 1, 1988 | Anne Asbell became RP Chair. Official completion of construction and beginning of the initial remedy as required by the Decision Document 3 and CD, paragraph 52 (j). |
| February 9, 1989 | Olin requested change in the due date for the long-term monitoring reports from March 1 to April 15 of each report year. |

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| February 22, 1989 | RP informally concurred with requested change in due date for the long-term monitoring report. |
| April 14, 1989 | Olin submitted long-term monitoring report 1. |
| June 13, 1989 | Technical Committee, Inspection Committee, and RP jointly inspected remedial action project. |
| June 14, 1989 | RP requested Olin and EPA jointly propose data validation procedures for the long-term monitoring program. |
| November 21, 1989 | Olin and EPA proposed long-term monitoring program data validation; Olin proposed optimum number of fish to be collected. |
| December 7, 1989 | RP modified Decision Document 6 to change the due date of long-term monitoring program reports to April 15. |
| April 15, 1990 | Olin submitted long-term monitoring program report 2. |
| June 11, 1990 | Inspection Committee reported on June 13, 1989 inspection of remedial action. |
| June 13, 1990 | Inspection Committee, Technical Committee and RP jointly inspected project. |
| June 14, 1990 | RP issued Decision Document 7, quality assurance and fish sample size. RP approved termination of the "far-field" groundwater monitoring program and reduced frequency of the "near-field" groundwater monitoring program. |
| June 25, 1990 | Inspection Committee reported on June 13, 1990 inspection of the remedial action project site. |

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| December 6, 1990 | Decision Document No. 8 to terminate Technical Proposal Groundwater Monitoring until Year 10 (1997). |
| January 23, 1992 | Decision Document No. 9, Process for Review of Monitoring Data and Olin Notification of Compliance by the Technical Committee . |
| July 15, 1993 | Huntsville DDT Project Public Meeting to inform the Public of the progress toward meeting the performance standards. |
| January 19, 1995 | Review Panel Decision Document No. 10, Process for Review of Continued Attainment defined. Appendix A to Document Number 10 found that Continued Attainment had occurred for Largemouth Bass in Reach C. |
| July 20, 1995 | Finding of Continued Attainment Largemouth Bass, Reach A and Reach B (Appendices B and C to Decision Document Number 10). |
| May 17, 1996 | Report on Interlaboratory Quality Assurance and Quality Control |
| July 24-25, 1996 | Detailed Review of long term monitoring program results with the Review Panel and Technical Committee |
| March 17, 1997 | Post Remediation Sediment Investigation – Reach A and Reach B |
| May 15, 1998 | Olin proposes a time extension for meeting the performance standard for channel catfish and smallmouth buffalo. |
| July 23, 1998 | Review Panel reviews Olin's proposal for a time extension. |

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| September 15, 1998 | Public meeting on Olin's proposal to extend time to meet the performance standard for channel catfish and smallmouth buffalo. |
| October 2, 1998 | Letter of Inspection Committee on vegetation and stability of Remedial Action Site through monitoring period. |
| December 21, 1998 | RP Decision Document Number 11, to Extend Time for Meeting the Performance Standard for Channel Catfish and Smallmouth Buffalo. |
| February 3, 1999 | Olin submitted interim goals and contingency plans for Extension Period. |
| February 25, 1999 | U.S. Department of Justice and Olin jointly petitioned the court to modify the schedule to attain the performance standard. |
| April 23, 1999 | Court Order modified schedule to meet performance standards. |

Appendix B. Consent Decree and Joint Technical Proposal

IN THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF ALABAMA
NORTHEASTERN DIVISION

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| UNITED STATES OF AMERICA,<br><br>Plaintiff,<br><br>v.<br><br>OLIN CORPORATION, A Virginia Corporation<br><br>Defendant,<br><br>TOWN OF TRIANA<br><br>Intervenor. | CIVIL ACTION<br><br>NO. CV80-PT-5300-NE |
| STATE OF ALABAMA, ex rel. CHARLES A. GRADDICK, Attorney General, et al.,<br><br>Plaintiffs,<br><br>v.<br><br>OLIN MATHIESON CHEMICAL CORPORATION, a Virginia Corporation,<br><br>Defendant. | CIVIL ACTION<br><br>NO. CV79-PT-5174-NE |



CONSENT DECREE

The undersigned have agreed and stipulated that a judgment can be entered in these actions incorporating a settlement agreement containing terms and conditions which include those set

forth in this Consent Decree. The parties to this Consent Decree have agreed to its terms conditional upon the filing and approval by the Court of the overall settlement of this case and related cases. The Court has reviewed such terms and conditions and has determined that they are reasonable and adequate to resolve the issues raised in these actions and constitute appropriate relief, including: development and implementation of remedial action to achieve the performance standard and to isolate DDT from people and the environment in the area of the Huntsville Spring Branch ("HSB") - Indian Creek ("IC") tributary system of the Tennessee River ("TR") ("HSB-IC System"); provision of health care and monitoring to Claimants; and mitigation of adverse environmental effects. The Court, having subject matter jurisdiction in these actions,

NOW, THEREFORE, ORDERS, ADJUDGES, AND DECREES AS FOLLOWS:

INTRODUCTION

1. The parties to this Consent Decree are:

(a) United States of America, on behalf of all federal agencies, departments and other entities thereof (all collectively referred to as the "United States");

(b) Olin Corporation, a corporation organized and existing under the laws of the Commonwealth of Virginia with its principal place of business in Stamford, Connecticut ("Olin"); and

(c) State of Alabama, on behalf of all branches agencies, departments, establishments, instrumentalities, bureaus,

subsidiaries, boards or commissions and any other entity of the Government of the State of Alabama (all collectively referred to as the "State").

The terms of this Consent Decree shall bind the parties hereto and their successors and assigns.

2. The HSB enters Redstone Arsenal ("RSA") from the City of Huntsville, Alabama. It flows through RSA and the Wheeler National Wildlife Refuge and converges with IC at HSB Mile ("M") 0.0. IC flows into the TR near Triana at TRM 321 (ICM 0.0). For purposes of this Consent Decree, the HSB-IC System is defined as that portion of HSB beginning at HSBM 5.4 to HSBM 0.0, and that portion of IC from ICM 5.6 to ICM 0.0. The HSB-IC System is depicted on the Figure attached hereto as Exhibit"A." In the "Engineering and Environmental Study of DDT Contamination of Huntsville Spring Branch, Indian Creek and Adjacent Lands and Waters, Wheeler Reservoir, Alabama" Vols. 1-3, November, 1980, by Water and Air Research, Inc. ("W.A.R. Report"), the HSB-IC System is divided into three reaches: Reach A, Reach B, and Reach C. Reaches A, B, and C are defined in the W.A.R. Report as follows:

Reach A - Begins at HSBM 5.4 and extends to HSBM 2.4;

Reach B - Begins at HSBM 2.4 and extends to HSBM 0.0; and

Reach C - Begins at ICM 5.6 and extends to ICM 0.0.

For the purposes of this Consent Decree, Reaches A, B and C are defined as they are in the W.A.R. Report.

3. DDT is defined for purposes of this Consent Decree as: 1,1,1-trichloro-2,2-bis-(p-chlorophenyl) ethane, including its isomers, and the degradation products and metabolites DDD or TDE (1,1-dichloro-2,2-bis (p-chlorophenyl) ethane), and DDE (1,1-dichloro-2,2-bis (p-chlorophenyl) ethylene), and the isomers thereof.

4. The United States filed a Complaint on December 4, 1980 and an Amended Complaint on February 5, 1982. The United States' complaint as amended alleges an imminent and substantial endangerment to human health and the environment as a result of Olin's alleged discharge of DDT into the waters of the United States, the Wheeler National Wildlife Refuge, and the environment from a former manufacturing plant located at RSA in northern Alabama, and seeks appropriate relief under federal statutory law and under common law. The State filed a complaint and amended complaint alleging these same facts and seeks relief similar to that requested by the United States. Olin filed answers and motions to dismiss and denied liability in these actions.

5. To resolve this matter constructively, to avoid prolonged litigation, to permit efficient implementation of the remedies to be performed pursuant to this Consent Decree, to provide health care and monitoring to Claimants, and to further the public interest, the United States, Olin, and the State, have agreed to forego their respective claims, allegations, responses and defenses to these

actions and to enter into this Consent Decree. This Consent Decree is part of an overall settlement of the following claims and actions:

a. James Cloud, et al. v. Olin Corporation, In the United States District Court for the Northern District of Alabama, Northeastern Division, Civil Action File No. CV79-PT-5128-NE;

b. Marvelene T. Freeman, et al. v. Olin Corporation, In the United States District Court for the Northern District of Alabama, Northeastern Division, Civil Action File No. CV80-PT-5057-NE;

c. Erskine Parcus, et al. v. Olin Corporation, In the United States District Court for the Northern District of Alabama, Northeastern Division, Civil Action File No. CV80-PT-5098-NE;

d. State of Alabama ex rel Charles A. Graddick, Attorney General, Charles A. Graddick, Attorney General v. Olin Corporation, a Virginia Corporation, In the United States District Court for the Northern District of Alabama, Northeastern Division, Civil Action File No. CV79-PT-5174-NE;

e. United States of America v. Olin Corporation, a Virginia Corporation, In the United States District Court for the Northern District of Alabama, Northeastern Division, Civil Action File No. CV80-PT-5300-NE;

f. Annie Mae Charest, et al. v. Olin Corporation, a Virginia Corporation, et al., In the United States District Court for the Northern District of Alabama, Northeastern Division, Civil Action File No. CV81-PT-5367-NE; and

g. Administrative tort claims filed against the United States relating to, among other

things, DDT, allegedly discharged into the waters of the United States, the Wheeler National Wildlife Refuge, and the environment in the vicinity of RSA in northern Alabama.

6. The parties to this Consent Decree have agreed to its terms conditional on the filing with and approval by the Court of the overall settlement, including this Consent Decree. The public notice requirements of 28 C.F.R.§50.7 will be complied with, and this Consent Decree is to be entered only after the provisions of that regulation have been met.

PURPOSE OF THE CONSENT DECREE

7. The purpose of the remedy(ies), monitoring and other actions which Olin is required to perform under this Consent Decree is to isolate DDT in the HSB-IC System from people and the environment and to minimize transport of DDT out of the HSB-IC System to protect human health and the environment.

REMEDIAL ACTIONS

8. Olin shall implement remedial actions required by this Consent Decree and consistent with the "Joint Technical Proposal to Implement Remedial Activities Pursuant to Consent Decree" (the "Proposal", Exhibit "B" hereto).

9. Olin shall develop remedy(ies) pursuant to the requirements of this Consent Decree to achieve and continue to achieve the performance standard under the terms of this Consent Decree.

10. Olin shall conduct monitoring studies of fish, water, sediment, and sediment transport, as set forth in the Proposal and pursuant to this Consent Decree, to obtain baseline data and to evaluate the effectiveness of the remedy(ies). Olin shall also conduct studies of groundwater as set forth in the Proposal. Selected monitoring activities will continue beyond the time for attainment of the performance standard.

11. The baseline monitoring program is to begin no later than the date of entry of this Consent Decree.

PERFORMANCE STANDARD

12. The performance standard is a DDT level of 5 parts per million ("ppm") in the fillets of channel catfish, largemouth bass and smallmouth buffalo, in Reaches A, B, and C. Methods for measuring DDT levels in fish are set forth in the Proposal. In the event that one of the three fish species identified above cannot be obtained in any one of the Reaches, Olin and the RP shall agree upon one or more substitute fish species for that Reach. In the event of a disagreement, the RP shall designate such substitute fish species.

GOALS AND OBJECTIVES

13. The performance standard shall be achieved consistent with the following Goals and Objectives:

a. Isolate DDT from people and the environment in order to prevent further exposure;

b. Minimize further transport of DDT out of the HSB-IC System;

c. Minimize adverse environmental impact of remedial actions;

d. Mitigate effect of DDT on wildlife habitats in the Wheeler National Wildlife Refuge;

e. Minimize adverse effects on operations at RSA, Wheeler Reservoir, and Wheeler National Wildlife Refuge;

f. No increase in flooding, particularly at City of Huntsville and RSA, except those increases in water levels which can be reasonably expected in connection with the implementation of remedial action, provided Olin takes all reasonable steps to minimize or prevent such increase; and

g. Minimize effect on loss of storage capacity for power generation, in accordance with the Tennessee Valley Authority Act ("TVA Act").

REVIEW PANEL

14. A Review Panel ("RP") is to be established promptly consisting of members designated by each of: United States Fish and Wildlife Service, TVA, EPA, the United States Army, and the State. The Town of Triana, Alabama and Olin shall serve as non-voting participants on the RP. An EPA representative shall be the chairperson of the RP. The RP shall meet semiannually and may hold special meetings as appropriate. The decisions of the RP shall be by majority vote of the members, and the RP shall establish its own operating procedures. The members of the RP shall have the right to deliberate in sessions restricted to members only. Each entity appointing a member to the RP shall be responsible for its own expenses in connection with its respective member's service on the RP.

15. The RP shall review the data collected pursuant to the Proposal and this Consent Decree and Olin's proposed remedy(ies). In proposing and reviewing the initial remedy pursuant to the Consent Decree, Olin and the RP shall act in good faith, shall fully cooperate, and shall use their best efforts to agree upon an initial remedy consistent with this Consent Decree. Pursuant to the schedule in this Consent Decree, the RP shall either approve Olin's proposed initial remedy, monitoring plan, and construction and implementation schedule, subject to compliance with applicable law; disapprove the proposed initial remedy and monitoring plan, and, pursuant to a designated schedule, require submission of a modified remedy and monitoring plan with a schedule for construction and implementation; or designate a substitute remedy and monitoring plan with a schedule for construction and implementation.

16. If the RP determines, pursuant to paragraph 20 below, that a modification to the remedy implemented by Olin is necessary, it shall specify a schedule for Olin's submission of such modification. Olin shall submit such modifications in accordance with the schedule, and thereafter the RP shall follow the procedure specified in paragraph 15.

17. Olin must implement the remedy(ies) approved or designated by the RP pursuant to the schedule for construction and implementation of the remedy(ies) or seek relief from the Court pursuant to paragraph 22 below.

18. Olin shall submit quarterly reports of its monitoring data to the RP and reports relating to the development of significant information in a format to be agreed upon by the RP and Olin. The quarterly reports shall include, at a minimum, a summary of the data collected and the raw data. Olin shall also submit a quarterly report of its progress in meeting the schedule for construction and implementation of the remedy(ies) undertaken pursuant to this Consent Decree.

19. Interim goals to indicate progress toward attainment of the performance standard will be set pursuant to paragraph 29 below, after selection of the initial remedy.

20. The RP shall, semiannually, review the monitoring data gathered pursuant to the Proposal and this Consent Decree and the remedy(ies) implemented, shall compare the data to the interim goals, and shall determine whether Olin is making appropriate progress in meeting the performance standard. The RP shall determine whether a remedy(ies) or remedy implementation is inadequate and if it determines that a modification of the remedy is necessary, it shall act in accordance with paragraph 16 above.

21. In determining whether remedial actions are appropriate, the RP shall consider the following factors:

(a) The nature of the endangerment to human health and the environment which the remedial action is designed to address;

(b) The extent to which implementation of the remedial action would reduce or increase endangerment to human health or the environment, or would otherwise affect human health or the environment;

(c) Whether implementation of such remedies is unnecessary to satisfy or is inconsistent with the Goals and Objectives set forth in paragraph 13 herein, and the performance standard; and

(d) Whether the remedy chosen is the most cost-effective means of accomplishing the performance standard.

JUDICIAL REVIEW

22. Olin shall be required to implement the remedial actions required by the RP unless, upon petition by Olin, the Court determines, upon the evidence:

(a) That implementation of such remedy(ies) is unnecessary to satisfy or is inconsistent with the Goals and Objectives set forth in paragraph 13 herein, and the performance standard; or

(b) that considering:

(i) The nature of the endangerment to human health or the environment which the remedial action is designed to address;

(ii) The extent to which implementation of the remedial action would reduce or increase endangerment to human health or the environment, or would otherwise affect human health or the environment; and

(iii) Whether the remedy(ies) chosen is the most cost-effective means of accomplishing the performance standard,

it would be arbitrary or capricious to require Olin to implement the remedy(ies).

SCHEDULE FOR REMEDIAL ACTION DEVELOPMENT

23. By June 1, 1984, Olin shall complete the necessary monitoring studies outlined in the Proposal, shall submit the data gathered pursuant thereto, and shall specify an initial remedy to the RP. Olin's proposal for an initial remedy shall include a schedule for implementation, a monitoring plan, and the other information required in paragraph 52 below.

24. By September 1, 1984, the RP shall take action in accordance with paragraph 15.

25. Olin shall complete construction and implementation of the initial remedy and any subsequent remedies required under this Consent Decree pursuant to the schedule established under paragraph 15.

26. Within 10 years from the date of "completion" of the construction and implementation of the initial remedy (as that event is determined pursuant to paragraphs 15 and 52(j)), Olin shall attain the performance standard in Reaches A, B, and C. The definition of "attain the performance standard" is set forth in the Proposal in Section 7.0.

27. After attainment of the performance standard, Olin shall demonstrate "continued attainment of the performance standard". The definition of "continued attainment of the performance standard" is set forth in the Proposal in Section 7.0.

28. Once Olin attains the performance standard, it shall operate or maintain, as necessary, any remedy(ies) (including bird repelling devices) implemented pursuant to this Consent Decree until termination of the Consent Decree pursuant to paragraph 54 below.

29. To evaluate Olin's progress toward attaining the performance standard within the schedule set forth in paragraph 26, interim performance goals shall be established. Interim performance goals will be agreed upon by Olin and the RP; in the unlikely event that Olin and the RP cannot agree on interim performance goals, the RP shall set such goals after selection and approval of the initial remedy. The interim performance goals shall be expressed in terms of reductions of DDT levels or particular ranges of DDT levels in fish fillets, as specified in paragraph 12 above, for certain time periods.

## FINANCIAL SECURITY

30. If at any time prior to the completion of construction and implementation of the initial remedy and any subsequent remedy(ies) required under this Consent Decree, (i) the consolidated net worth of Olin declines by fifteen percent (15%) or more in any one fiscal quarter, or (ii) over a period of three consecutive fiscal quarters the consolidated net worth of Olin declines by a total of fifteen percent (15%) or more as compared with the consolidated net worth of Olin as of the beginning of the first of such quarters, or (iii) if the consolidated net worth of Olin declines by fifteen percent (15%) or more in any one fiscal year, or (iv) if the consolidated net worth of Olin declines at any time to five hundred million dollars ($500,000,000) or below, Olin shall immediately notify the United States and shall promptly provide security in an amount equal to one hundred and twenty-five percent (125%) of the estimated cost to complete such construction and implementation. If such event occurs prior to the identification and estimation of the cost of the initial remedy(ies), the amount of such security shall be twenty million dollars ($20,000,000). Such security shall take the form of a first lien on valuable assets, a performance bond, a surety bond, a letter of credit or a cash bond. The parties may hereafter agree upon other forms of similar security. If at any time the United States believes the foregoing "net worth" test is insufficient security for Olin's performance under the Consent Decree, it may

petition the Court to order Olin to produce the security set forth above.

INSURANCE

31. Olin agrees to be responsible for the liability arising from its acts and omissions occuring during the term of this Consent Decree. Olin agrees that it, and independent contractors employed by it to perform any work pursuant to this Consent Decree, shall maintain for the duration of this Consent Decree general liability and automobile insurance with limits of ten million dollars ($10,000,000) combined single limit, with no sudden and accidental pollution exclusion clause, and Alabama Statutory Workmans Compensation Insurance. Olin and independent contractors employed by it further agree to perform all work pursuant to this Consent Decree in a workmanlike manner.

DELAY OR PREVENTION OF PERFORMANCE

32. Olin shall take all reasonable measures to minimize or avoid any delay or prevention of the performance of its obligations pursuant to this Consent Decree. If any event occurs, or if Olin anticipates that an event will occur, which would delay or prevent the performance of Olin's obligations pursuant to this Consent Decree ("Delaying Event"), Olin shall notify the United States Program Coordinator in writing as soon thereafter as possible, but in no event later than 20 days after becoming aware of such Delaying Event. The written notice shall fully describe the actual or

anticipated length and cause of such Delaying Event, the actions Olin has taken, and proposes to take, to prevent and to minimize the impact of the Delaying Event, and the schedules for taking such actions.

33. To the extent that Delaying Events have been or will be caused by force majeure, i.e., acts of God, strikes, fires, war, or other causes beyond Olin's control, the time for performance hereunder shall be extended as appropriate. Increased costs or expenses associated with the implementation of actions required by this Consent Decree shall not alone be considered a force majeure event.

34. If the United States and Olin agree on the occurrence and length of a Delaying Event, they shall file with this Court a stipulation and proposed order extending the time for Olin to perform the activity(ies) affected by the Delaying Event. If, however, Olin and the United States do not so stipulate or the United States advises Olin in writing that it does not agree that a Delaying Event occurred or to the extension of time sought by Olin, either Olin or the United States may submit the matter to the Court for resolution. Olin shall have the burden of proof, based upon a preponderance of the evidence, (i) that the Delaying Event excused or extended the time for Olin's performance under the terms of this paragraph and (ii) that the time extension sought is appropriate. Any extension of the schedule for performance of an intermediate

requirement agreed or ordered pursuant to this paragraph shall not result in the automatic extension of a subsequent requirement.

35. If a Delaying Event is not excusable under the terms of this Consent Decree or if after an excusable Delaying Event occurs, the time extension sought by Olin is unjustified, Olin shall be subject only to the following stipulated penalties for such unexcused failure to comply with the following paragraphs of this Consent Decree:

A. Paragraphs 16 and 18

(i) Fifty dollars ($50) per day for the first fifteen days; and

(ii) Two hundred fifty dollars ($250) per day thereafter.

B. Paragraphs 23, 25, 27, 28, and 41

(i) Five hundred dollars ($500) per day for the first fifteen days;

(ii) Seven hundred fifty dollars ($750) per day for the sixteenth to ninetieth days; and

(iii) Up to twenty five hundred dollars ($2500) per day thereafter.

C. Paragraph 26

(i) One thousand dollars ($1000) per day for the first sixty days; and

(ii) Up to five thousand dollars ($5000) per day thereafter.

36. In determining the amount of any penalty which the United States seeks to assess under subparagraphs 35.B.(iii) and C.(ii),

the United States shall consider the economic savings, if any, to Olin for its delay or failure to comply with such paragraphs, the degree or seriousness of the delay or non-compliance, the duration of the delay or non-compliance, the degree of endangerment to human health or the environment, if any, resulting from the delay or non-compliance, and other relevant factors. Provided, however, that no payment shall be assessed for each day that compliance is delayed or excused pursuant to this Consent Decree, or by order of the Court.

37. If the United States seeks to assess penalties pursuant to paragraph 35 of this Consent Decree, it shall give written notice to Olin of the requirement with which Olin has not timely complied or has failed to comply, the amount of the proposed penalty and, in the case of penalties to be assessed pursuant to subparagraphs 35.B.(iii) and C.(ii), the basis for such amount, taking into account the factors set forth in paragraph 36. Such notice from the United States shall be a condition precedent to the United States' right to seek enforcement of such penalty assessment under paragraph 38 of this Consent Decree. Within ten (10) days of its receipt of such notice, Olin shall notify the United States whether it agrees to pay such proposed penalty. If Olin agrees to pay such penalty, it shall do so within twenty (20) days from receipt of such notice by check payable to the Treasurer of the United States and sent to the Assistant Attorney General at the address specified in paragraph 51.

38. If the United States and Olin do not agree to the amount of the penalty which the United States seeks to assess against Olin, the United States may petition the Court to enter judgment against Olin for the amount of the penalties it seeks hereunder. The foregoing petition by the United States shall set forth the requirement with which Olin has failed to comply, shall propose amounts to be paid and, in the case of penalties sought pursuant to subparagraphs 35.B.(iii) and C.(ii), the basis for such proposed amounts, taking account of the factors set forth in paragraph 36 of this Consent Decree. The United States shall have the burden of proof, by a preponderance of the evidence, that the amounts of money it seeks under subparagraphs 35.B.(iii) and C.(ii) are justified; the United States shall have no burden of proof with respect to the stipulated penalties set forth in subparagraphs 35.A., 35.B.(i), (ii), and 35.C.(i).

39. Any penalty payments made or collected pursuant to paragraphs 35 through 38 shall be payable only to the United States and shall be in full satisfaction of all civil claims by any party or the Town of Triana, Alabama for fines, penalties, or other monetary assessments arising out of Olin's failure to comply with this Consent Decree, except those specific monetary obligations imposed pursuant to paragraphs 41, 42 and 43. Olin shall be subject to civil fines, penalties, or other monetary assessments arising out of its failure to comply with this Consent Decree only as provided in

paragraph 35. Notwithstanding anything in this Consent Decree to the contrary, the provisions of paragraphs 35 through 39 shall not be construed to limit any equitable or other non-monetary relief which may be available to the United States for violations of this Consent Decree or bar the United States from seeking any appropriate relief, equitable, monetary or otherwise, which may be available to the United States for violations of law arising during and in connection with Olin's performance under this Consent Decree.

40. If Olin and the United States agree that Olin has acted in good faith consistent with the schedule set forth in this Consent Decree but has failed to meet the performance standard within the time set forth herein, Olin and the United States shall agree to an extension of time for meeting the performance standard, shall jointly petition the Court for a modification of the schedule and Olin shall not be liable for penalties set forth in paragraph 35 based solely on its failure to meet the performance standard within the time required during such extended period. In the event of a disagreement concerning whether Olin has acted in good faith, Olin shall have the burden of proof, by a preponderance of the evidence, that it has acted in good faith.

REMEDIAL ACTION MITIGATION MEASURES

41. Olin agrees to install and maintain bird repelling measures or bird repelling devices as required by remedial actions undertaken pursuant to this Consent Decree. Olin further agrees

upon entry of this Consent Decree to pay into a trust fund the sum of $375,000 for the purpose of funding mitigation measures (such as studies or structures) to be selected by the United States in furtherance of the goals of the statutes cited in the first amended complaint of the United States in the above-styled action.

EXPENSES

42. Olin shall bear the reasonable expenses incurred by the United States for contracts to monitor Olin's activities, including data collection and analysis, in connection with this Consent Decree. From and after the date of entry of this Consent Decree, Olin shall bear, without its prior approval, such expenses in an amount not to exceed $10,000 per year until it demonstrates continued attainment of the performance standard as provided for herein with prior notice of such expenditures to be given to Olin. Upon request of Olin, the United States shall provide a brief description of the work to be performed under contracts entered into pursuant to this paragraph and substantiation for the expenses thereof. In any event, if the Government does not expend the sum of $10,000 in any one year, the Government may not carry over such unused sums in any subsequent year, it being expressly understood that Olin's obligations under this paragraph are limited to a total of $10,000 per year. Olin shall reimburse such expenses in excess of $10,000 per calendar year only if it has given prior approval to such expenditures.

43. In addition, Olin agrees to pay for the cost of developing any environmental impact statements or environmental assessments which may be required pursuant to NEPA in order to implement any remedies under this Consent Decree.

EMPLOYMENT PREFERENCE

44. Olin agrees to give employment preference (consistent with applicable law) for all work related to development and implementation of this settlement including, but not limited to, construction work, to "Claimants," as the term is defined in the "Comprehensive Agreement Regarding Compromise of Claims" and to anyone else who resides in the immediate area of Triana, Alabama who agrees to sign a release and waiver of any liability against the United States and Olin, arising from the presence of DDT in the HSB-IC System. The parties hereto do not intend this paragraph to create and the provisions of this paragraph shall not create any enforceable rights of action or any remedies on behalf of either the parties to this Consent Decree or individuals or entities who are not parties to this Consent Decree.

INSPECTION

45. The United States, the State, and their agencies and authorized representatives, including contractors and consultants, shall, upon notice, be provided reasonable access at all times to the site of any actions taken within the HSB-IC System pursuant to this Consent Decree to observe and monitor the work performed by

Olin, to collect samples, to inspect records and for any other lawful purpose relating to assuring compliance by Olin with the terms of this Consent Decree. Nothing in this paragraph is intended to limit any other lawful rights of access or inspection which the United States or the State of Alabama may have with respect to the site or to affect the right of the United States Army to restrict access as necessary.

EFFECT OF CONSENT DECREE

46. Nothing contained in this Consent Decree shall constitute an admission of law or fact or may be introduced into evidence as proof of same, or constitute proof of the violation of any law or regulation. The parties hereto may rely upon this Consent Decree only in this action or in any of the other actions listed in paragraph 5, above. The parties hereto may not rely upon this Consent Decree in any other action or proceeding, and neither this Consent Decree nor any part hereof may be introduced into evidence in any other action or proceeding. Except for the right of the Town of Triana, Alabama to enforce this Consent Decree, as provided in an order entered contemporaneously herewith, it is intended that this Consent Decree shall neither create nor have any effect upon rights of persons or entities not parties to this Consent Decree.

PROGRAM COORDINATOR

47. The United States and Olin shall each designate a program coordinator and an alternate within 15 days following the date of

entry of this Consent Decree. At any time, Olin and the United States may appoint new coordinators, alternates or both, and notice thereof shall be given in writing.

48. Olin and the United States intend that communications between them to carry out the terms and conditions of this Consent Decree shall be by and between the program coordinators or alternates. The coordinators designated by the parties shall be deemed agents for purposes of receiving proposals, reports and notifications from other parties, except that the coordinators shall not constitute agents for the purpose of receiving service of process, subpoenas, or other judicial or administrative process, and each coordinator shall be responsible for assuring that all communications from the other are appropriately disseminated and processed.

COMPLIANCE WITH ALL LAWS

49. All work undertaken pursuant to this Consent Decree is to be performed in accordance with all applicable federal, state and local statutes, regulations, ordinances and permits, including, but not limited to the following statutes which may be applicable to the work undertaken pursuant to this Consent Decree: the National Environmental Policy Act, 42 U.S.C. §§4371, et seq., the Fish and Wildlife Coordination Act, 16 U.S.C. §§661-666c, the Endangered Species Act, Pub. L. No. 93-205, 87 Stat. 884 (codified as amended in scattered sections of 7 and 16 U.S.C.), the National Wildlife Refuge

System Administration Act, 16 U.S.C. §§668dd-668ee, the Tennessee Valley Authority Act, 16 U.S.C. §831 as amended by Pub. L. No. 96-97, 93 Stat. 730, the Clean Water Act, 33 U.S.C. §§1251 et seq., the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq., the Comprehensive Environmental Response, Compensation and Liability Act, ("CERCLA"), 42 U.S.C. §§9601 et seq., the Occupational Safety and Health Act, 29 U.S.C. §§651 et seq., the Hazardous Waste Management Act of 1978, Code of Ala. 1975, §§22-30-1 et seq. (1982 cum. supp), the Alabama Water Pollution Control Act, Code of Ala. 1975 §§22.22-1 et seq. (1982 cum. supp.), and all applicable regulations promulgated thereunder, including without limitation, the revised National Contingency Plan, 40 C.F.R. Part 300 et seq., as published in 47 Fed. Reg. 31180 (July 16, 1982). Olin shall apply for and use its best efforts to obtain any permits or authorizations required by applicable federal, state or local law in carrying out the work required of Olin under this Consent Decree.

EXPENSES UNDER CERCLA

50. In consideration of the entry of this Consent Decree, Olin agrees not to make any claims pursuant to Section 112 of CERCLA, 42 U.S.C. §9612, against the Fund established by that Act for expenses related to this case and this Consent Decree.

NOTICES

51. All notices and documents required to be provided to the United States, Olin and the State pursuant to this Consent Decree, unless otherwise stated, shall be addressed as follows:

Assistant Attorney General
Land and Natural Resources Division
Department of Justice
9th & Pennsylvania Avenue, N.W.
Washington, D.C. 20530

United States Environmental Protection Agency
Regional Administrator
Region 4
Atlanta, GA 30309

State of Alabama
Attorney General
250 Administrative Building
Montgomery, Alabama 36130

Olin Corporation
120 Long Ridge Road
Stamford, CT 06904

DOCUMENTS

52. In submitting its initial proposed remedy and any subsequent or modified remedies to the RP, Olin shall submit, in addition to the other information required by this Consent Decree, at a minimum the following information:

(a) References to all scientific and/or technical literature used in preparation of the remedy;

(b) Engineering diagrams, chemical analyses, and all other technical data used in proposing the remedy;

(c) Names, titles and disciplines of all professionals engaged in preparation of the remedy;

(d) A description of all analytical techniques and protocols used in preparing the remedy;

(e) Anticipated effects on people and the environment of any actions to be implemented under the remedy, including, as applicable, the information described in section 8 of the Proposal;

(f) Cost and time to implement the proposed remedy(ies);

(g) A discussion of all alternative remedies examined but rejected including, where developed, cost, time to implement, and other data and the reasons for concluding that each alternative remedy is not necessary or appropriate to attain the performance standard;

(h) A specific monitoring plan for determining the efficacy of the remedial action implemented, including monitoring activities continuing beyond the time for attainment of the performance standard;

(i) Any health and safety plans required by law to implement the remedy(ies);

(j) Construction and implementation schedules, including a schedule for the development and submission of detailed engineering specifications and a designation of the event which signifies "completion" of construction and implementation of the initial remedy; and

(k) The assumptions on which the remedy(ies) are based.

RETENTION OF JURISDICTION

53. This Court retains jurisdiction over the parties to this Consent Decree to enforce compliance with its terms, to construe the

Consent Decree, and to resolve disputes in accordance with its provisions.

## TERMINATION OF CONSENT DECREE

54. After Olin (1) demonstrates to the RP continued attainment of the performance standard and (2) demonstrates to the reasonable satisfaction of the RP that the remedy(ies) implemented pursuant to this Consent Decree has provided, is providing and will continue to provide achievement of the performance standard once this Consent Decree terminates, Olin shall operate or maintain such remedy(ies), as set forth in paragraph 28, for a period of seven additional years. At the conclusion of this seven year period, if Olin is in compliance with the provisions of this Consent Decree and the performance standard, Olin shall be deemed to have completely fulfilled all of its obligations hereunder, and this Consent Decree shall terminate.

## MISCELLANEOUS PROVISIONS

55. All information and documents submitted by Olin to the United States, State or RP pursuant to this Consent Decree shall be subject to public inspection.

56. The terms and conditions of this Consent Decree shall include the terms and conditions contained in the Proposal attached hereto, which are incorporated herein by reference.

57. In the event of changed material circumstances of law or environmental or health standards, arising after the entry of this

57. In the event of changed material circumstances of law or environmental or health standards, arising after the entry of this Consent Decree, the United States or Olin may petition the Court for a modification of the Consent Decree.

58. Each party shall bear its own costs, disbursements and attorneys' fees of this action.

59. The parties represent to the Court that their respective undersigned counsel and the other signatories have full authority to approve the terms and conditions of this Consent Decree and to execute and legally bind the respective parties to this Consent Decree.

UNITED STATES OF AMERICA

By: _____
ANTHONY C. LIOTTA
Deputy Assistant Attorney General
Land and Natural Resources Division
United States Department of Justice DATED: 4/13/83

_____
FRANK DONALDSON
United States Attorney
Northern District of Alabama DATED: 4/15/83

HENRY FROSHIN
First Assistant United States Attorney

DATED: 4/15/83

ELIZABETH TODD CAMPBELL
Assistant United States Attorney

DATED: 4/15/83

KENNETH A. REICH
Attorney
United States Department of Justice

DATED: 4/13/83

LOIS J. SCHIFFER
Attorney
United States Department of Justice

DATED: 4/13/83

DAVID BATSON
Attorney
United States Environmental Protection Agency

DATED: 4/12/83

ARTHUR RAY
Attorney
United States Environmental Protection Agency

DATED: 4/12/83

ELIZABETH TODD CAMPBELL
Assistant United States Attorney DATED: _____

KENNETH A. REICH
Attorney
United States Department of Justice DATED: _____

LOIS J. SCHIFFER
Attorney
United States Department of Justice DATED: _____

DAVID BATSON
Attorney
United States Environmental
Protection Agency DATED: _____

ARTHUR RAY
Attorney
United States Environmental
Protection Agency DATED: _____

ANNE L. ASBELL
Assistant Regional Counsel
United States Environmental
Protection Agency
Region IV DATED: April 14 1983

ANNE L. ASBELL
Assistant Regional Counsel
United States Environmental
Protection Agency
Region IV

DATED: _____

STATE OF ALABAMA

By: Charles A. Graddick
CHARLES A. GRADDICK
Attorney General of the
State of Alabama

DATED: 4/14/83

R. Craig Kneisel
R. CRAIG KNEISEL
Assistant Attorney General
State of Alabama

DATED: 4/14/83

OLIN CORPORATION

By: _____
E. MCINTOSH COVER
Group Counsel
Olin Chemicals Group

DATED: _____

_____
MYRON B. SOKOLOWSKI
Counsel
Olin Chemicals Group

STATE OF ALABAMA

By: _____
CHARLES A. GRADDICK
Attorney General of the
State of Alabama DATED: _____

_____
R. CRAIG KNEISEL
Interim General Counsel
Department of Environmental
Management DATED: _____

OLIN CORPORATION

By: _____
E. MCINTOSH COVER
Group Counsel
Olin Chemicals Group DATED: 4/22/83

_____
MYRON S. SOKOLOWSKI
Counsel
Olin Chemicals Group

_____
STUART N. ROTH
Associate Counsel
Olin Chemicals Group DATED: 4/21/83

G. LEE GARRETT, JR.
Hansell & Post
Attorneys for Olin Corporation

DATED: 4/15/83

Entered in accordance with the foregoing Consent Decree.

UNITED STATES DISTRICT JUDGE

DATED: May 31, 1983

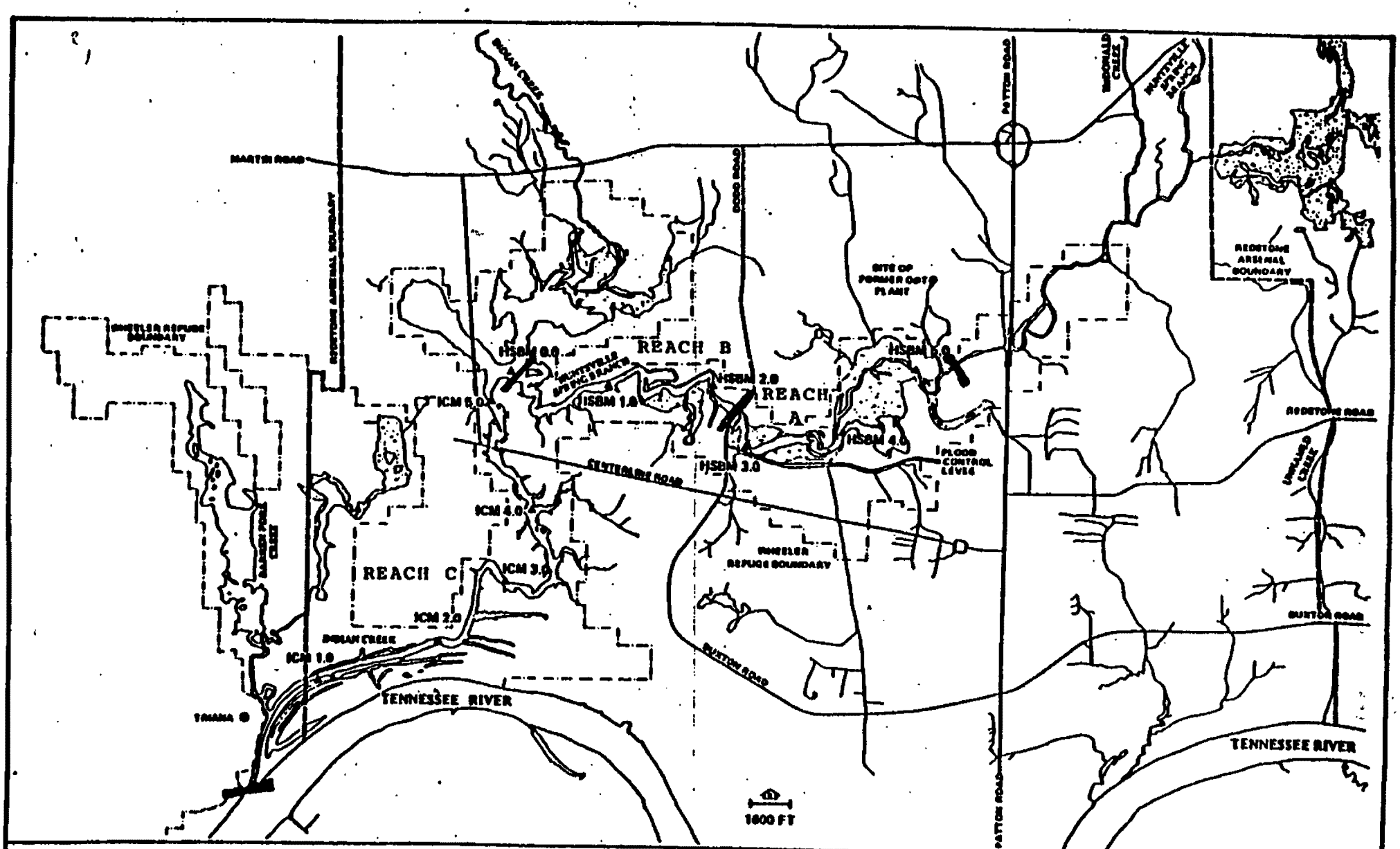


FIGURE 4. General Site Map - Huntsville Spring Branch, Indian Creek, and Vicinity

SOURCE: WATER AND AIR RESEARCH, INC., 1980

U.S. ARMY CORPS OF ENGINEERS, MOBILE DISTRICT
Engineering and Environmental Study of DDT Contamination of Huntsville Spring Branch, Indian Creek, and Adjacent Lands and Waters, Wheeler Reservoir, Alabama

# JOINT TECHNICAL
# PROPOSAL TO IMPLEMENT
# REMEDIAL ACTIVITIES
# PURSUANT TO
# CONSENT DECREE

TABLE OF CONTENTS

# 1.0 SUMMARY

## 1.1 Background

Since 1977, the United States Army, The Tennessee Valley Authority (TVA), the Environmental Protection Agency (EPA), and other federal agencies have reported DDT residues* in the Huntsville Spring Branch-Indian Creek (HSB-IC) tributary system of the Tennessee River (TR). Reports have described the existence of DDT within the boundaries of the Wheeler National Wildlife Refuge (WNWR) and the Redstone Arsenal (RSA) near Huntsville, Alabama.

In 1980, Water and Air Research, Inc. (W.A.R.) completed a report entitled "Engineering and Environmental Study of DDT Contamination of Huntsville Spring Branch, Indian Creek and Adjacent Lands and Waters, Wheeler Reservoir, Alabama" (W.A.R.

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* DDT is defined as 1,1,1-trichloro-2,2-bis-(p-chlorophenyl) ethane including its isomers, and the degradation products and metabolites DDD or TDE (1,1-dichloro-2,2-bis (p-chlorophenyl) ethane), and DDE (1,1-dichloro-2, 2-bis (p-chlorophenyl) ethylene), and the isomers thereof.

Report).* W.A.R. links the DDT to the discharge of effluent from the manufacture of DDT by the Olin Corporation (Olin). The DDT manufacturing plant operated from 1947 to 1970 on RSA facilities leased from the United States. W.A.R. states that DDT, discharged into the drainage ditch, entered the HSB-IC system. W.A.R. now estimates that 475 tons of DDT presently exist within that system and estimates that 97.8 percent of the resulting in situ DDT is contained within HSB miles (HSBM) 5.4-2.4 (Reach A), 1.4 percent within HSBM 2.4 and its confluence with IC (Reach B) and the remaining 0.8 percent within IC (Reach C).

W.A.R. also states that fish within the HSB-IC-TR system have exhibited levels of DDT greater than the Food and Drug Administration action level of 5 parts per million in the fillet. DDT in channel catfish, a food source for local residents, has prompted particular concern.

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* That report consists of three volumes, viz., an Executive Summary, Appendices I-III, and IV-VI. References herein to pages in the Executive Summary will appear as "S-____"; references to pages in the appendices will give the appendix number followed by the page, e.g., "II-77" means page 77 in Appendix II.

## 1.2 Objectives of This Proposal

The primary objective of the remedy (ies), monitoring and other actions which Olin is required to perform under this Consent Decree is to isolate DDT in the HSB-IC System from people and the environment and to minimize transport of DDT out of the HSB-IC System to protect human health and the environment. This objective is met under the terms of the Consent Decree when DDT levels in the fillets of channel catfish, largemouth bass, and smallmouth buffalo in Reaches A, B, and C are reduced to 5 ppm, i.e., the performance standard of the Consent Decree, and the other terms of the Consent Decree are fulfilled. The overall goals and objectives set forth in the Consent Decree are as follows:

1. Isolate DDT from people and the environment in order to prevent further exposure.

2. Minimize further transport of DDT out of the HSB-IC system.

3. Minimize adverse environmental impact of remedial actions.

4. Mitigate effect of DDT on wildlife habitats in the Wheeler National Wildlife Refuge.

5. Minimize adverse effects on operations at Redstone Arsenal, Wheeler Reservoir, and Wheeler National Wildlife Refuge.

6. No increase in flooding, particularly at City of Huntsville and Redstone Arsenal, except those increases in water levels which can be reasonably expected in connection with the implementation of remedial action, provided Olin takes all reasonable steps to minimize or prevent such increase.

7. Minimize effect on loss of storage capacity for power generation, in accordance with the Tennessee Valley Authority Act ("TVA Act").

The Proposal contemplates use, to the extent possible, of data collected by W.A.R. Although the W.A.R. Report contains extensive regional data and can be used to determine certain background environmental conditions, the environmental characteristics of the various segments of the HSB-IC system must be defined more specifically before any remedial action alternative can be developed. Likewise, the evaluation of the short and long-term environmental impacts associated with proposed remedial actions requires a more extensive data base. These studies, combined with data from the W.A.R. Report, will provide that data base.

### 1.3 Proposal Approach

This Proposal will investigate the pathways that DDT takes to enter the water and biota in HSB-IC. The findings of this study will identify the critical point(s) in the pathways which can be blocked via specific remedial actions applied to the HSB-IC system. In addition, the study will provide the basic design information for remedial actions (i.e. flow rates, particle size/DDT relationships, etc.).

The Proposal has four primary areas of investigation: suspended sediment transport, in situ sediment sampling, fish sampling and fish uptake studies. The purpose of each study is to answer several basic questions concerning the movement of DDT into the water and the biota. The main questions to be answered are as follows:

- What is the source of DDT that is available to contaminate fish or other biota? Is it in the channel and/or overbank areas? Is it from Reach A, B, and/or C? Under what conditions is

this DDT available (i.e., high or low water elevations, flow rates, etc.)?

- What is the source of DDT to the water column? What are the contributions of each reach (A, B, and C) of the HSB-IC system? Under what conditions does DDT enter the water column? Are storms more significant than normal day-to-day transport?

- Why and how are fish becoming contaminated? Is it caused by suspended, dissolved or deposited DDT? What is the effect of siltation and covering on these sources?

The in situ sediment sampling and suspended sediment transport (water sampling) studies are designed to address the first two sets of questions. The fish sampling and fish uptake studies are designed to answer the third set of questions.

The data evaluation phase of the project is just as critical as the data collection phase. The data evaluation phase will utilize two main tools in addition to normal engineering analysis to aid in the decision process for selecting and development remedial actions. The two tools are (1) computer modeling of the system and (2) the display of significant field data on a topographical map or aerial photograph.

The computer model will simulate the transport of sediment through the HSB-IC system. The first step in the modeling process will be the selection of a computer model which best simulates the sediment transport process that is occurring in HSB-IC. Data collected during the in situ sediment and water sampling programs will be utilized in the computer model and used to verify the model. Once a computer model has been developed which simulates the HSB-IC

system, the model can be modified to include one or more potential remedial actions. Thus, the effects of potential remedial actions on sediment and DDT transport can be estimated. Various combinations of remedial actions can be evaluated by computer modeling in order to determine the optimum set of remedial actions. The computer modeling is discussed further in Section 6.0.

The topographical map or aerial photograph will be used to provide a visual overview of the HSB-IC system. Areas of DDT which are available for transport or biological uptake will be highlighted. Significant findings of the field data collections will be illustrated. The locations of potential remedial actions will also be shown. This map will be a valuable tool in the development of the remedial actions.

### 1.4 Organization of Proposal

This Proposal will discuss the technically-feasible and environmentally-sound approaches towards resolution of the following:

- identifying the pathways of DDT contamination in the given environmental setting,
- evaluating timely, cost-effective remedial solution(s),
- predicting the environmental effects resulting from those remedial solutions, and
- proposing a long-term environmental monitoring program to monitor the effectiveness of future remedial actions.

Each section will describe the specific objectives of each task relative to and associated with the proposal objectives and the

methodology utilized to achieve the proposal objectives. Changes (with proper approval) may be necessary as the project progresses.

The proposed fish studies are described in Section 4.0. Proposed sampling locations, scheduling, equipment to be utilized, fish species to be collected, sample protocol and analytical procedures are outlined.

The in situ sediment sampling study is set forth in Section 5.0 of the Proposal. This study will provide the more complete and precise data on the areal and vertical distribution of DDT necessary to determine types and locations of appropriate remedial actions.

The suspended sediment transport and water sampling study parameters are set forth in Section 6.0. The results of this study will provide data on, and permit the prediction of the effectiveness of, in situ burial/isolation of DDT sediments, as well as quantify the transport of DDT through and out of the system.

An extensive quality assurance program has been developed for both analytical laboratory facilities and field sampling programs. The major aspects of the laboratory quality assurance program will be the use of a primary laboratory, two secondary laboratories for split sampling, and a referee laboratory. Approved testing methodologies, blinding of samples and standard chain-of-custody procedures will be employed at all times. These procedures are described in Section 3.0 of the Proposal.

In summary, the Proposal provides for the attainment of the following:

(a) Development of data to define more precisely the environmental characteristics of the HSB-IC system;

(b) Determination of the biological and geotechnical characteristics of the HSB-IC system with respect to DDT (DDT pathways) to design remedial alternatives;

(c) Development of a data base to predict the environmental and related impacts of the selected remedial alternatives;

(d) Development of baseline data from which to assess the effectiveness of the remedial actions selected;

(e) Development and proposal by Olin of specific remedial actions for all three reaches (A, B, and C); and

(f) Development of a long-term environmental monitoring program to ascertain the effectiveness of remedial actions.

## 2.0 NEED FOR REMEDIAL ACTION ALTERNATIVES

### 2.1 The W.A.R. Alternatives

W.A.R. presented seven alternatives (including F*) for addressing DDT in the HSB-IC system. The no-action alternative involves natural restoration processes. This alternative requires no remedial operations but includes an extensive monitoring program to evaluate the progress of the natural restoration processes. All remaining alternatives would involve removal or isolation of essentially 100 percent of the DDT in the HSB-IC system. These alternatives, B through F*, include:

- Dredging the entire area and disposing of the dredged material off-site; or
- Variations of dredging a substantial portion of the area and diversion of the HSB from its present basin to the TR (out-of-basin diversion); or
- Variations of dredging a substantial portion of the area and diversion of the HSB around much of Reach A (within-basin diversion).

For both the out-of-basin and within-basin diversion alternatives, W.A.R. considered removing the DDT sediments or providing in-place containment of these sediments. The major features of these various alternatives are outlined in Table 2.1 (taken from the Executive Summary of the W.A.R. Report). Detailed discussions of these alternatives are presented in the Summary and Appendix III of the W.A.R. Report.

Table 2.1 Alternatives for Mitigation of DDT Contamination

| Alternative | Major Actions Implemented |
|---|---|
| A. Natural Restoration | o let natural processes mitigate contamination<br>o extensive monitoring to determine whether system is improving, remaining stable, or deteriorating |
| B. Dredging and Disposal | o construct dredged material disposal area<br>o dredge channel sediments from HSB Mile 5.6 to IC Mile 0.0 and 260 acres of overbank sediments between Dodd and Patton Roads to a depth of 3 feet |
| C. Out-of-Basin Diversion and Removal of Contaminated Sediments | o divert HSB upstream from contaminated area directly to the TR<br>o implement all actions listed for Alternative B under reduced flow conditions |
| D. Out-of-Basin Diversion and Containment of Contaminated Sediments | o divert HSB upstream from contaminated area directly to the TR<br>o construct dikes to isolate contaminated sediments upstream of Dodd Road from surface water flow<br>o construct dredged material disposal area<br>o dredge channel sediments from Dodd Road to IC Mile 0.0 to a depth of 3 feet<br>o cover and stabilize channel sediments and 260 acres of overbank sediments upstream of Dodd Road |
| E. Within-Basin Diversion and Removal of Contaminated Sediments | o divert HSB around the highly contaminated area between HSB Miles 3.9 and 5.6<br>o construct dike around the highly contaminated area<br>o implement all actions listed under Alternative B. Highly contaminated sediments would be removed under zero flow or dry conditions. |
| F. Within-Basin Diversion and Containment of Contaminated Sediments | o divert HSB around the highly contaminated area between HSB Miles 3.9 and 5.6<br>o construct dike around the highly contaminated area<br>o construct dredged material disposal area<br>o dredge channel sediments from HSB Mile 3.9 to IC Mile 0.0 to a depth of 3 feet<br>o cover and stabilize channel sediments and 185 acres of overbank sediments within diked area |
| Alternate: Use Containment Area for Disposal of Dredged Material | o Same as above except dredged material would be disposed of within the diked highly contaminated area. |

The remedial action alternative originally recommended by a Government/Citizen Advisory Committee was F*. Like Alternative F, F* involves a within-basin diversion of the HSB between HSBM 5.6 and 3.9 and the containment of DDT sediments located therein. In F*, the containment area will be used for the disposal of material dredged from the area between HSBM 3.9 and ICM 0.0.

Table 2.2 (taken from the Executive Summary of the W.A.R. Report) provides an overview of the predicted effectiveness of the various alternatives and estimated costs of implementation. Although W.A.R. predicts that F* would be 99.7 percent effective in "mitigation" of the DDT, W.A.R. notes there are numerous problems associated with alternatives which include removing and disposing of DDT-containing sediments. These problems include (S-51):

> Some DDT will remain after dredging,
>
> An undetermined amount of DDT transport will occur for an unknown distance during dredging, and
>
> The potential exists for DDT-containing materials to be spilled or leaked during removal.

W.A.R. concludes by stating, "dredging and removal can be assumed somewhat less effective than in-place containment" (S-53). Another problem with F* and similar alternatives is that the time required for implementation is long. W.A.R. estimates that 2.5 years would be required for the engineering and design phase of F* (or similar alternatives) prior to the initiation of field construction

activities. An additional six to nine years would be required for completion of the work. The implementation timeline for Alternative F is provided in Figure 2.1 (excerpted from III-124) as a typical example.

The remedial alternatives proposed by W.A.R. are expensive. W.A.R. estimates the cost for F* (one of the less expensive alternatives examined by W.A.R.) to be $88.9 million. This estimate may be low considering the implementation timeframe and the extent of work required.

## 2.2 Environmental Impacts of F*

Implementation of any of the action alternatives presented by W.A.R. would have significant adverse environmental impacts. Table 2.2 provides a W.A.R. overview of predicted adverse environmental impacts posed by the alternatives it examined.

Table 2.2 Estimated Level of Mitigation, Predicted Impacts, and Estimated Costs Associated With Proposed Alternatives.

| Alternative | Estimated % DDTR | | | Predicted Adverse Environmental Impacts | Est. Cost millions |
|---|---|---|---|---|---|
| | Remove | Cover | Total | | |
| A | 0 | 0 | 0 | (1) DDTR continues to move down HSB to IC and the TR<br>(2) Fish and other biota continue to have elevated DDTR levels | 0.6/yr |
| B | 99.3 | 0 | 99.3 | (1) Significantly alter 313 acres wetland, 228 acres aquatic habitat<br>(2) Lose "edge" habitat along dredged stream<br>(3) Lose Aufwuch communities and snag habitats in dredged stream<br>(4) Some short-term water quality loss | 86.8 |
| C | 99.3 | 0 | 99.3 | (1) Significantly alter 684 acres wetland, 495 acres upland, and 313 acres aquatic habitat<br>(2) Dredging impacts (2)-(4) listed under Alternative B<br>(3) Increase in suspended solids and nutrients loading to the TR via the diversion channel | 137 |
| D | 4.4 | 94.9 | 99.3 | (1) Significantly alter 701 acres wetland, 521 acres upland, and 313 acres aquatic habitat<br>(2) Dredging impacts (2)-(4) listed under Alternative B for dredging downstream from Dodd Road<br>(3) Increase in suspended solids and nutrient loading to the TR via the diversion channel<br>(4) Drier habitat in HSB between Patton and Dodd Roads | 130 |

Table 2.2 Estimated Level of Mitigation, Predicted Impacts, and Estimated Costs Associated With Proposed Alternatives, (Continued)

| Alternative | Estimated % DDTR | | | Predicted Adverse Environmental Impacts | Est. Cost millions |
|---|---|---|---|---|---|
| | Remove | Cover | Total | | |
| E | 99.3 | 0 | 99.3 | (1) Significantly alter 619 acres wetland, 348 acres upland, and 338 acres aquatic habitat<br>(2) Dredging impacts (2)-(4) listed under Alternative B for dredging downstream from HSB Mile 3.9<br>(3) Increase in suspended solids and nutrient loading to IC via the diversion channel | 106 |
| F | 8.3 | 91.0 | 99.3 | (1) Significantly alter 612 acres wetland, 348 acres upland, and 338 acres aquatic habitat<br>(2) Dredging impacts (2)-(4) listed under Alternative B for dredging downstream from HSB Mile 3.9<br>(3) Increase in suspended solids, nutrient loading to IC via the diversion channel<br>(4) Drier habitat in HSB between Miles 3.9 and 5.6 | 93.0 |
| F* | 8.3 | 91.4 | 99.7 | (1) Significantly alter 612 acres wetland, 161 acres upland, and 338 acres aquatic habitat<br>(2) Dredging impacts (2)-(4) listed under Alternative B for dredging downstream from HSB Mile 3.9<br>(3) Increase in suspended solids and nutrient loading to IC via the diversion channel<br>(4) Drier habitat in HSB between Miles 3.9 and 5.6 | 88.9 |

* Alternative F with option to use diked contaminated area for disposal of dredged material.

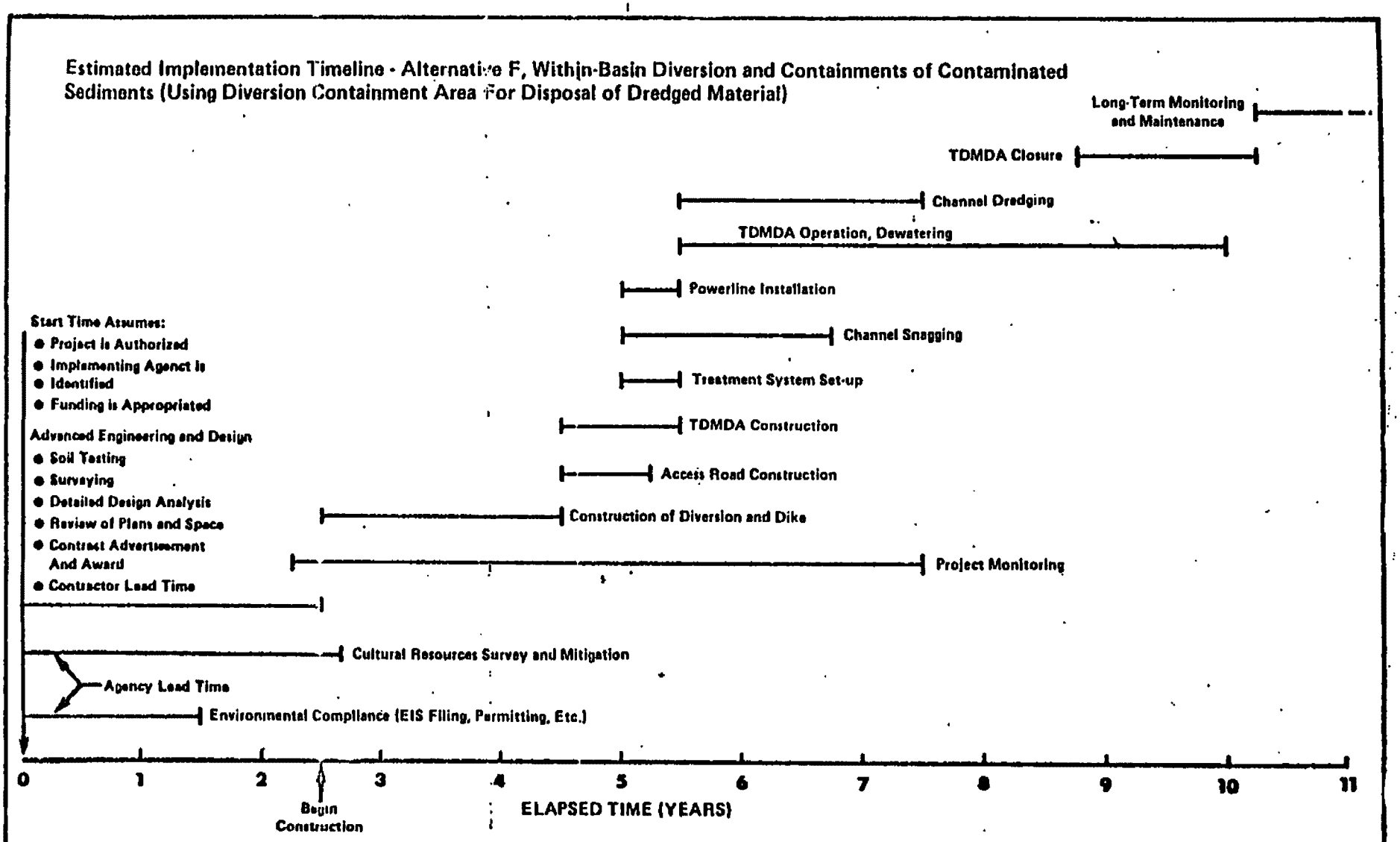


FIGURE 2.1 Estimated Implementation Timeline, Alternative F

SOURCE: WATER AND AIR RESEARCH, INC., 1980

U.S. ARMY CORPS OF ENGINEERS,
MOBILE DISTRICT
Engineering and Environmental Study of DDT Contamination of Huntsville Spring Branch, Indian Creek, and Adjacent Lands and Waters Wheeler Reservoir, Alabama

The W.A.R. alternatives would necessitate significant amounts of appurtenant construction and destroy the major portion of the existing natural habitat of HSB and much of IC. Aquatic habitats and wetlands, which cover hundreds of acres, would be destroyed or drastically altered. Depending upon the alternative chosen, almost 72 acres of stream bank (S-29) would be converted to access roads, over 12 miles of pipelines with 11 booster pumps (S-27) would be installed for transporting dredged material, 187 acres of upland habitat (S-30) would be converted into disposal areas, and a two to three million gallon per day (MGD) water treatment plant and/or a four MGD pumping station would have to be constructed. In all, 1000 acres or more of upland and water habitat would be destroyed or significantly degraded.

## 2.3 Other Remedial Actions

This Proposal is intended to develop remedial measures that will achieve the performance standard and the goals and objectives of the Consent Decree. The studies set forth in this Proposal are necessary for the adequate development and assessment of new alternatives.

# 3.0 QUALITY ASSURANCE PROGRAM

## 3.1 Introduction

The primary and secondary laboratories described below will provide quantitative data (analytical test results) for use in decision making processes relative to any final remedial action to be implemented for the HSB-IC system. To be valuable, sampling protocols and laboratory analytical methods must be appropriate to assure (i) the samples are representative, and (ii) the laboratory data accurately describe the characteristics and constituents of samples submitted. To this end, the following quality assurance program will be followed.

### 3.1.1 Program

The quality assurance program will include the use of primary, secondary and referee laboratories; specific parameters for analysis; standardization of analytical methods, instrumentation, and laboratory operations and techniques; and the blinding of analytical samples prior to analysis. Additionally, there will be a defined intra- and interlaboratory control program.*

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* Whenever a determination of equivalency of methods, procedures or equipment is required, Olin and EPA shall agree upon such determination.

## 3.2 Participating Laboratories

### 3.2.1 Primary Laboratory

The primary analytical facility will be provided by Recra Environmental Laboratories. This laboratory is based in Tonawanda, New York and is a New York State certified environmental laboratory for various analyses performed on drinking water. It will be the responsibility of the Recra laboratory to maintain its own laboratory controls and to coordinate interlaboratory activities with secondary laboratories and the referee laboratory. All samples will be analyzed by the staff of the primary laboratory.

### 3.2.2 Secondary Laboratory

The role of a secondary laboratory is to provide verification of the results generated by the primary laboratory. Split samples prepared by the primary laboratory and blinded by an independent organization will be shipped under appropriate custody to the secondary laboratories. Additionally, reference samples provided by the referee laboratory via the primary laboratory will also require analysis.

Two secondary laboratories are planned for this project. The first is the laboratory of the Olin Corporation in Charleston, Tennessee. The second is the Olin laboratory at its research center in Connecticut.

### 3.2.3 Referee Laboratory

The referee laboratory for this program is the Region IV, Athens, Georgia laboratory of the EPA. The referee laboratory will provide evaluation samples for the primary and secondary laboratories, review split reference samples, evaluate each laboratory's performance, and assist in the identification and solution of any analytical discrepancies and/or problems that arise over the course of the analytical phase of the project. The referee laboratory will also be involved in selecting and using each analytical procedure (especially those concerning DDT) to insure the validity of the analytical data.

The referee laboratory will analyze 5% of all DDT samples. The primary laboratory will provide these samples in duplicate after blinding by an outside firm. For those samples sent to the referee laboratory (EPA), a total of five (5) blinded aliquots will be prepared with 2 subsamples sent to EPA and one (1) subsample sent to each of the secondary and primary laboratories. The analytical results of these samples will be compared to determine laboratory equivalency.

## 3.3 Analytical Parameters

### 3.3.1 Biological Samples

The only biological samples to be collected, at least during the initial phase of this project, are fish from the HSB-IC system. Other fauna, including waterfowl, have been collected and analyzed

as a part of past projects. Other aquatic biota samples such as algae, benthic macroinvertebrates and zooplankton also have been collected in previous studies. It is not this Proposal's intent to duplicate these efforts but rather to use, wherever possible, the results available from the W.A.R. Report.

Both fish fillet and the offal will be analyzed as a part of this program. The offal analysis is included to determine the whole body concentration and to address the concern of biomagnification. Both fillet and offal results may also be compared to the analyses performed during other studies by previous investigators. Offal represents the remainder of the carcass after the fillets have been removed and skinned. The skin is included as part of the offal. Analysis of both fillets and offal will permit construction of whole body residue concentrations.

Analysis will include qualification and quantification of DDT and lipid (% fat) content in both the fillet and offal samples.

### 3.3.2 Sediment Samples

The collected sediment samples, as further described in Section 5 of this proposed scope of work, will be analyzed for the following:

- wet weight, dry weight and moisture content
- grain size distribution
- total organic content (total volatile solids)
- DDT

### 3.3.3 Water Samples

Water samples collected as a part of this project will be analyzed to determine DDT content in both the dissolved and suspended phases. Whole (total) water samples will be analyzed for total suspended solids and DDT content. Suspended particulates (after separation by filtration) will also be analyzed for DDT. Additionally, at the time of water sample collection, the following measurements will also be made and provided to the secondary and/or referee laboratories:

- pH
- specific conductance
- temperature
- dissolved oxygen
- alkalinity

## 3.4 Analytical Methodologies

One of the major factors in a successful interlaboratory quality control program is standardization of analytical methodologies. Although numerous methodologies from various sources are available for the above parameters of interest, the following methods will be used in this project. All of the following methods are consistent with "accepted" state-of-the-art analytical techniques, have been used in past studies, and are available to the primary, secondary, and referee laboratories.

### 3.4.1 Biological Samples

Both the fish fillet and the offal will be analyzed as a part of this program. Filets will be skinned and the skin will be included as part of the offal during sample preparation and subsequent analysis.

Fish samples (both fillet and offal) will be analyzed for lipid (% fat) content and DDT according to the "Interim Method for the Sampling and Analysis of Priority Pollutants in Sediment and Fish Tissue" as presented by EPA in August 1977 (revised October 1980). This document presents two procedures for the analysis of chlorinated pesticides in fish. For consistency with past studies, Method A (the blender method) will be employed, except that an ultra sonic probe (or Brinkman Polytron) will be used during the extraction procedure in lieu of a blender to reduce the possibility of cross contamination. Past work has shown that the homogeneity of the sample is critical to the reliability of the analytical data. Therefore, the fish fillets and offals will be put through the meat grinder three times to assure homogeneity of the sample.

### 3.4.2 Sediment Samples

After removal of twigs, rocks and/or other debris and thorough homogenization, DDT content of collected sediment samples will be determined by EPA methods. Specifically, the procedure outlined in "Organochlorine and Organophosphorus Insecticide in Bottom Sediment" (Section 11B) from the Manual of Analytical Methods for the Analysis of Pesticides in Human and Environmental Samples (EPA-

600/8-80-038, June 1980) will be used with the exception that the Soxhlet extraction procedure will be substituted for the column extraction procedure. The determination of moisture content of the sediment is also addressed in the above referenced procedure.

Grain size analysis of collected sediment will be completed using methods consistent with or equivalent to those procedures employed by TVA and reported by W.A.R. Specifically, an electronic particle size procedure (Welch et al., and Micrometric Instrument Corp.) utilizing a Sedigraph Model 5000D particle size analyzer (or equivalent) will be used.

The association between DDT and particle size will be ascertained by direct analysis of the sand and silt plus clay size fractions and by regression/correlation analysis for the specific silt and clay fractions as identified by the Sedigraph 5000D (or equivalent).

3.4.3 Water Samples

At the time of sample collection, field measurements of pH, temperature, specific conductance and dissolved oxygen will be made. The methods to be used for determining these parameters are contained in EPA manual of Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020, March 1979). Actual procedures are as follows:

- pH — Method 150.1
- specific conductance — Method 120.1
- temperature — Method 170.1
- dissolved oxygen — Method 360.1

Laboratory analysis of water samples for total suspended solids (non-filterable residue) will be done according to Method 160.2, set forth in the above reference. Alkalinity of water samples will be determined according to Method 310.1.

The DDT of the whole (total) water sample (usually 1 liter) will be determined via EPA Method 617 (EPA, July 1982). This method, although not specifically referenced in past studies, is equivalent to the previously used methods. This equivalency will be demonstrated.

Suspended solids/particulate DDT determinations will employ the Soxhlet extraction procedures (Section 11A from the Manual of Analytical Methods for the Analysis of Pesticides in Human and Environmental Samples). Suspended particulates will be separated from the whole (total) water sample via large volume water filtration through pre-extracted glass fiber filters [U.S. EPA, Test Methods for Evaluating Solids: Physical and Chemical Methods SW-846, Method 7.2 (1980)]. Due to the low concentration (5 to 50 mg/ℓ) of suspended solids in the water samples, five to eight liters of water must be filtered to provide sufficient quantity of sediment for DDT analysis. The glass fiber filters and filtered materials,

after being dessicant-dried to a control weight, will be extracted directly and subjected to DDT quantification. The filtrate (water phase) will be analyzed for DDT using the procedure specified above for whole water.

In the past, difficulty has arisen during the analysis for total and suspended DDT of water samples. The sum of the quantity of DDT in the water phase and the DDT in the sediment phase did not equal the DDT found in the total sample. This error generally arises because very large volumes of water with very small concentrations of sediment have to be analyzed.

Present plans call for the analysis of total water and both the dissolved and the suspended fractions as previously defined. After completion of the analysis the sum of the fractions(dissolved and suspended) will be compared to the separately determined total water sample DDT content. It is anticipated that differences will exist between these two values. On a case-by-case basis, the extent of the relative error will be assessed. Based upon the techniques employed and as long as the total suspended solids remain relatively low, the total water sample analytical result will be considered to be most reliable. All three DDT analyses will be reported.

## 3.5 Intralaboratory Quality Control Plans

### 3.5.1 Facilities

All participating laboratories will be of sufficient size and capability to assure the necessary amount of work-space,

ventilation, separation of analytical activities, heating or cooling, solvent storage, sample storage, etc., to assure the successful completion of the analytical programs.

3.5.2 Chain-of-Custody and Sample Handling and Storage

Water and sediment samples will be placed in pre-cleaned glass bottles with TEFLON-lined lids. Fish samples will be wrapped in aluminum foil. All samples will be preserved in accordance with EPA recommendations. All samples will be handled under chain-of-custody procedures which will apply to all laboratories used in this study. An example custody form is attached as Figure 3.1.

Upon receipt of samples and after appropriate inventory activities (logging, labelling, etc.) are completed, water and sediment samples will be stored in Recra's secured 800 ft³ walk-in cooler which is maintained at 4°C. Special cooling system modifications have been implemented to guarantee against loss of samples due to freezing. Storage time prior to analyses will not exceed recommendations in the above-referenced procedures, i.e., water samples must be extracted within seven days and completely analyzed within 30 days of collection. Holding time criteria will apply to all participating laboratories. Fish samples, after inventory, will be maintained in a locked freezer until analysis. Custody of samples will be maintained during analysis using permanently bound separation-laboratory and analysis-laboratory notebooks. All chromatographs, preparation sheets and forms,

FIGURE 3.1

RECRA RESEARCH, INC.
CHAIN OF CUSTODY RECORD

PROJECT#: _____ PROJECT NAME: _____

STUDY AREA: _____ SAMPLERS SIGNATURE: _____

| STATION# | | DATE | TIME | SUBSAMPLE CODES | TOTAL #OF SAMPLES | REMARKS |
|---|---|---|---|---|---|---|
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| Relinquished By: | Date/Time: | Received By: | Comments: |
|---|---|---|---|
| Relinquished By: | Date/Time | Received By: | Comments: |
| *Method of Shipment* | Shipped By: | Received By: | Comments: |

Recieved for Laboratory: _____ Authorization for Disposal: _____

Job #: _____ Type of Disposal: _____

Date/Time: _____ Date of Disposal: _____

etc., will be maintained and available for inspection and review by interested parties. All written information will be retained for five years after completion and approval of the project report. After analysis, samples will be retained until the final report is accepted by the United States.

3.5.3 Laboratory Personnel and Equipment

Laboratory personnel will be experienced residue or water quality analysts or under the close supervision of such qualified persons.

All laboratory equipment, including the $^{63}Ni$ electron capture gas liquid chromatographs, shall be covered by manufacturers' service contracts, unless other arrangements for maintenance of such equipment are provided. Instrument maintenance quality control includes at least the following:

- determination of chromatographic column efficiency (theoretical plates) - after initial packing
- daily monitoring of absolute retention and relative (to aldrin) retention times - all samples; aldrin may also be used as a surrogate, in the absence of other chromatographic interferences
- daily evaluation of GC columns to ensure no breakdown of DDT is occurring on column
- daily monitoring of response factors for DDT and metabolite standards
- daily linearity of standard curves
- daily determination of column resolution capabilities

Personnel at all participating laboratories will maintain this information in bound logs which will be available for review or inspection.

### 3.5.4 Data Quality Assurance

The overall data quality assurance activities of the participating laboratories will include a minimum of approximately 30 percent of the total work load. Quality control limits will be established during the method equivalency period (at the initiation of the proposed scope of work) and will be continually verified by each laboratory throughout the life of the project. During the method equivalency program, replicate samples will be analyzed by each participating laboratory. Evaluation of these results will allow for the establishment of warning and control limits. As the project progresses, a number of additional control measures will be completed in order to further refine these limits as necessary. These control techniques include:

- analysis of replicate samples and spike samples
- analysis of standard reference materials
- analysis of independently blinded samples which are analyzed by the Region IV EPA (referee) laboratory and the primary and secondary laboratories.

#### 3.5.4.1 Precision

The precision (reproducibility) of analytical results will be based upon a minimum of ten percent of the samples being analyzed in duplicate. The results of these duplicate analyses will allow for

the establishment of $\bar{x}$ charts specifically related to the project. These charts, commonly called Shewhart Control Charts, will contain both upper and lower warning and control limits, based upon the standard deviation of the replicate analysis. Generally, or at least initially, these limits are set at plus and minus one and two standard deviations, respectively, of the relative standard deviation values.

Analytical results falling outside the control limits will require re-analysis. If the re-analysis falls outside the control limits, the reason will be identified (operator error, equipment malfunction, etc.). After the problem has been corrected, the entire lot of samples will be re-analyzed along with the appropriate standards and blanks.

3.5.4.2 Accuracy

Accuracy limits will be determined for both "absolute" and "relative" recovery. Absolute recovery is based upon the addition of spikes to blanks and relative recovery is based upon the addition of spikes to samples. Experience shows that absolute recovery is almost always within warning limits unless the problems associated with the analysis are instrument related. Generally, absolute recoveries are most indicative of method/control verification; relative recovery, on the other hand, of analytical/analyst control and/or matrix effects.

The accuracy of analysis will be monitored by performing percent recovery of known constituent additions on a minimum of ten percent of the samples. The percent recovery less 100 percent (percent bias) will be plotted on R charts. From the individual values of percent bias, the mean and standard deviation are calculated. The warning limits (UWL and LWL) and control limits (UCL and LCL) are initially set at the mean ±10% bias, and at the mean ±20% bias, respectively. In the event that accuracy measurements are above or below warning limits, the analyst will examine the system/protocol to retard loss of control. If bias values indicate greater than the mean ±20% bias, samples will be re-analyzed. In the event that samples are not available for re-analysis, out-of-control data will be so identifed and not used in further evaluations for purposes of developing remedial action alternatives.

3.5.4.3 Sample Blinding

One of the main quality control measures, which will be employed in this project, is sample blinding. All samples collected for analysis (fish, water and sediment) will be blinded. The samples which are split and sent to all participating laboratories for analysis will be blinded by an outside party which is not connected with this project in any manner. The samples will be blinded by replacing existing labels with randomly distributed laboratory numbers. Only the blinding party will have the key which

identifies the samples. The identity of the individual samples will remain unknown to all analytical laboratories (Recra, Olin (2) and EPA) until all analyses have been completed and results submitted to the blinding agent.

The samples which are to be analyzed by only the Recra laboratory will be blinded by Recra upon arrival at Recra. During analysis, the sample will be identified by only a laboratory job/control number. The identity of the sample will not be revealed to the laboratory analysts. Blinding in this manner will minimize the time required for the generation of analytical data and will permit expeditious processing of samples and data while assuring a high degree of quality assurance.

3.5.4.4 Additional Control Measures

In addition to the above precision and accuracy determinations, other control measures will also be employed to insure intralaboratory quality control. The most important of these is the use of standard reference materials (SRM's). SRM's for water analysis, including DDT and metabolites, are currently available from EPA or commercial concerns such as Environmental Resource Associates (ERA). SRM's for pesticides (including DDT and metabolites) in fish are also available. The SRM for sediment DDT is being developed by Recra. The source of the sediment for this SRM is the overbank area near the old waste ditch.

As an integral part of the quality control program, SRM's will be analyzed with each lot or analytical batch of water, sediment, or fish samples. The results of these analyses will be plotted and reviewed relative to established control limits on a frequency of no less than ten percent of the work-load or with each set of analysis (if less than 10 samples). The method equivalency program which will use the above SRM's also allows for establishment of warning and control limits for the SRM charts.

Other quality control means to be employed include, but are not necessarily limited to, the following:

- establishment of five point calibration curves on a daily basis;
- analysis of a mid-range standard every tenth sample to verify maintenance of linearity and consistency of standard curve;
- analysis of method blanks on a frequency of one every ten samples or one blank on each set of analysis if less than ten samples in a set/batch;
- re-injection and gas chromatograph interpretation of samples analyzed after any sample which exceeded 50 percent of the analytical range in order to guard against "ghosting";
- verification of the absence of contaminants and/or interference in extraction (or cleaning) solvents; and
- use of field blanks to verify that samples were not contaminated during field handling and transportation.

## 3.6 Interlaboratory Quality Control Plan

### 3.6.1 General Requirements

The proposed program as outlined above will be practiced by both the primary and secondary laboratories. It is also anticipated that, dependent upon the degree of involvement of the referee laboratory (Region IV, EPA, Athens, Georgia), the above quality control plan will be utilized by the referee laboratory. The interlaboratory control plan will be primarily used to control overall laboratory bias and to resolve analytical discrepancies that may arise.

The splitting of samples will be the responsibility of the primary laboratory. Blinding of samples will be the responsibility of an independent concern. In addition to reviewing the analysis of the split sample results, it will also be the responsibility of the primary laboratory to design and implement the interlaboratory equivalency program.

The role of the referee laboratory will be to analyze blind samples and provide other quality control samples, as deemed necessary, to both the primary and secondary laboratories. The referee laboratory will be asked to play a major role if discrepancies in the analytical results are identified.

### 3.6.2 Method Equivalency

Despite the standardization of procedures as addressed in the above subsection, differences (bias) will undoubtedly exist between

participating laboratories. If differences become significant, the reasons for the bias will have to be determined. To make this determination, the primary laboratory will implement a method equivalency program. This program will be implemented prior to the actual analysis of any collected soil/sediment or fish samples.

This program consists of a step-by-step assessment to establish where the bias(es) of each participating laboratory exist. The initial sample splitting and subsequent data review will indicate the total bias between the participating laboratories. Areas in which differences can originate include homogenization, splitting, extraction, clean-up, and instrumentation or data interpretation. The method/laboratory equivalency program is based upon the use of fish and water SRM's and is illustrated in Figure 3.2.

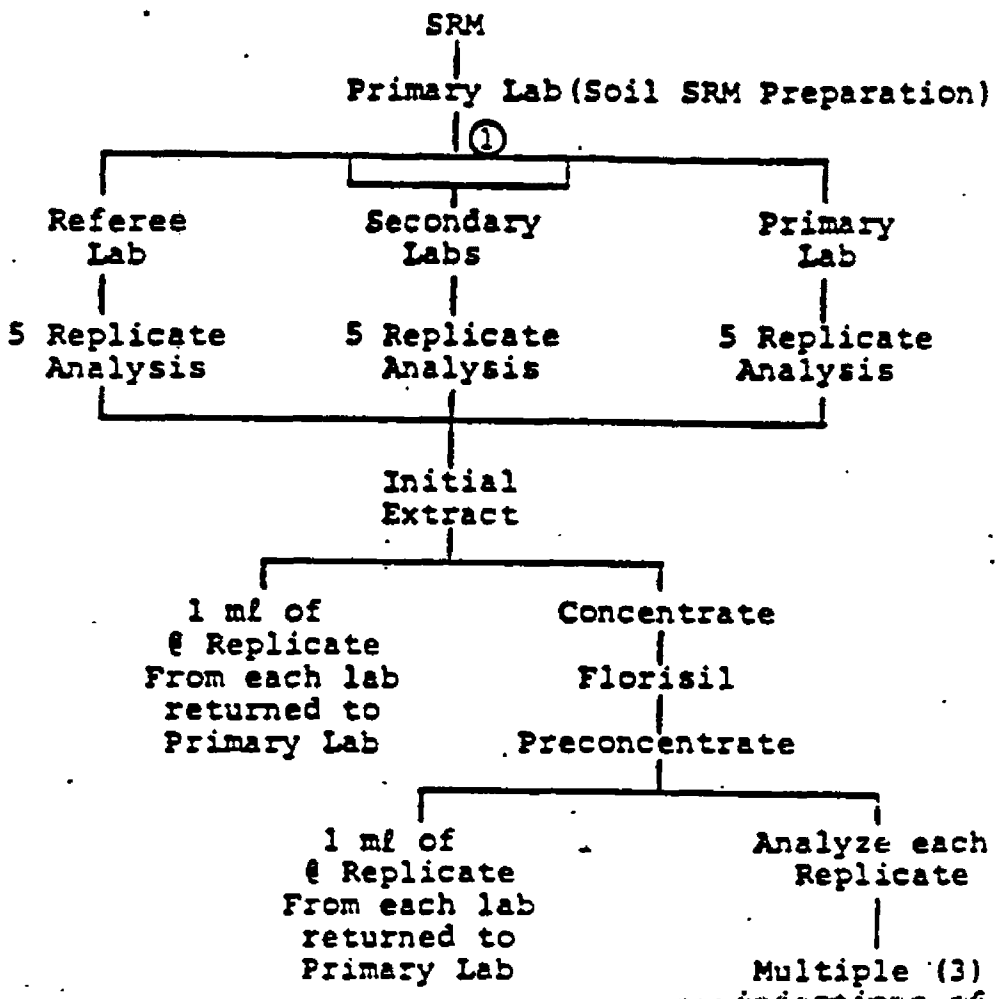
To directly or indirectly evaluate these various aspects of bias, the following procedure will be followed:

- extracts or composite extracts will be subdivided and sent by Recra to participating laboratories; and
- a set of extracts will be prepared by the secondary and referee laboratories and sent to the primary laboratory.

Based upon the results of the analysis of the split extracts, the instrumental or interpretive bias of the laboratories can be assessed. With multiple injection of each extract and the submission of copies of chromatographs and standard curves,

FIGURE 3-2

METHOD/LABORATORY EQUIVALENCY PROGRAM




① Distribution of SRM materials to Referee Secondary Laboratories

the primary laboratory will also be able to indirectly address bias due to injection techniques and interpretation and calculation procedures.

Additionally, if extract cleanup is generally required, the secondary and referee laboratories will analyze the extracts after, as well as before, cleanup to address differences that may be caused by the use of Florisil column chromatography and subsequent re-concentration.

Extraction procedures bias can be determined from the analytical data of the split extract samples sent by the secondary and referee laboratories to the primary laboratory.

Finally, but of great importance, is the review of the above incremental differences in comparison to the total sample bias between laboratories. This comparison will reflect the homogeneity of the sample splitting procedures which past experiences have shown to be a significant consideration in overall data quality assurance.

This method equivalency program will be implemented after the initial split sample results are received and reviewed. The majority of this program will be concentrated within a single relatively short (approximately two months) time frame but will continue less intensely over the duration of the Consent Decree.

# 4.0 FISH STUDIES

## 4.1 Introduction

The majority of the fish studies reported by W.A.R. focused on the Tennessee River. A few included the IC but the HSB itself was rarely sampled. For example, in the 1970 Alabama Department of Conservation and the 1971 Alabama Department of Agriculture and Industry surveys (II-21, 23), no HSB-IC stations were sampled. No fish were collected from HSB-IC stations in the W.A.R.-TVA fish survey of June-July 1980 (II-172). In the 1977-1979 Food and Drug Administration (FDA) surveys, the HSB and IC were not sampled (II-27). In the 1975-1977 FDA analyses of fish taken from area markets, the origins of the fish were not established (S-7). In the April-May and June-October 1979 TVA project, no fish were collected from HSB. However, channel catfish, white crappie, gizzard shad, smallmouth buffalo, white bass, and largemouth bass from IC were analyzed (II-167-169). Similarly, the November 1977 and June and September 1978 TVA surveys (II-29) included fish from IC but not the HSB. The same was true for the Fall 1979 analysis (II-171).

Samples were collected from HSB stations in only three previous fish monitoring projects. In 1977, TVA analyzed whole body samples of shortnose gar, gizzard shad, white bass, black crappie, freshwater drum and bluegills collected from HSB (II-25). The same year, the Army Environmental Hygiene Agency analyzed HSB goldfish and gar (II-22). In 1979, the TVA collected gizzard shad and

bluegills from the mouth of HSB (V-Task 2). At HSBM 4.0, TVA did not collect largemouth and smallmouth bass, smallmouth buffalo, bluegill, white crappie, white bass, and gizzard shad for analysis (V-Task 1), perhaps because there were no fish there at that time.

As indicated above, the information on HSB fish is very limited. No data exist concerning three fish in the HSB, i.e., channel catfish, largemouth bass, and smallmouth buffalo. Accordingly, the levels of DDT in these fish in HSB is unknown. W.A.R. did provide a limited amount of data on fish (catfish, smallmouth buffalo and gizzard shad) from Indian Creek. Additional data is needed for both IC and HSB in order to define the existing environmental concentrations of DDT in the species of fish present in IC and HSB. The effect of remedial actions on the nektonic community cannot be assessed without this baseline information.

Without additional data specific to HSB, one cannot reach valid conclusions concerning the significance of fish migration in the area (one of W.A.R.'s cited potential mechanisms of contamination, S-17). There is insufficient information to determine if fish migration is occurring from HSB or IC to the TR or vice-versa. Given the lack of data on fish migration and DDT levels, the need for remedial action designed to prevent fish movement into or out of the HSB-IC system (or segments thereof) to reduce DDT levels in fish cannot be assessed. The conclusions of the W.A.R. Report with respect to fish are based primarily on data on TR fish. Information

specifically obtained from IC and HSB samples is required to supplement the W.A.R. conclusions and to develop suitable remedial actions. To these ends, monitoring programs for fish in IC and HSB have been developed.

## 4.2 Program Objectives

The fish monitoring program will provide data on concentrations of DDT in fish in the HSB-IC study area to complement the more regionally-oriented data of the W.A.R. Report.

The purpose is to:

- Provide estimates of DDT in fish and relative abundance of fish at specific locations for use in choosing and assessing possible remedial actions;
- Develop a sufficient data base to predict the short- and long-term impacts of proposed remedial actions; and
- Establish baseline data to monitor the effectiveness of any remedial action measures over time.

## 4.3 Utilization of W.A.R. Data

W.A.R. data will be utilized to the extent possible. A large amount of data was generated for fish in the TR. This information is believed to provide an adequate data base for fish in the Wheeler, Wilson, and Guntersville Reservoirs. However, additional sampling of the TR will be conducted near (both upstream and downstream) the confluence of Indian Creek. This data can be used to assess natural changes occurring in the system and will ensure that future

comparisons are based on a full and complete data base. Based upon the extent of W.A.R. and TVA data, no sampling locations on the TR beyond five miles of the IC-TR confluence are planned at this time. The W.A.R. data appears sufficient for the goals of this project and further sampling of the TR would not add significantly to the existing data base.

The existing data base, and the two planned sampling locations in TR, will be used to help develop the long-term monitoring program and to help identify any necessary additional appropriate sampling locations.

This Proposal will concentrate primarily on fish in and near the HSB-IC system. The data to be generated will be used in conjunction with all available W.A.R. information on HSB-IC fish, as discussed below. The W.A.R. HSB-IC fish data have been utilized to identify the types of fish which might be encountered in the various sections of the study area and, in combination with a consideration of the site characteristics, have also helped define the most appropriate sampling techniques and sample locations.

4.4 Program Design

The specific design of the fish monitoring program is detailed in the following subsections. These subsections set forth the sampling locations and schedule, the kinds of equipment to be used, the types of fish to be collected, and the sample handling and analytical procedures. In addition, some of the concerns considered

during the development of this program or expressed by concerned parties are also discussed.

4.4.1 Sampling Locations

Eight locations on the HSB and IC will be sampled in the fish monitoring program. These locations, shown on Figure 4-1, are:

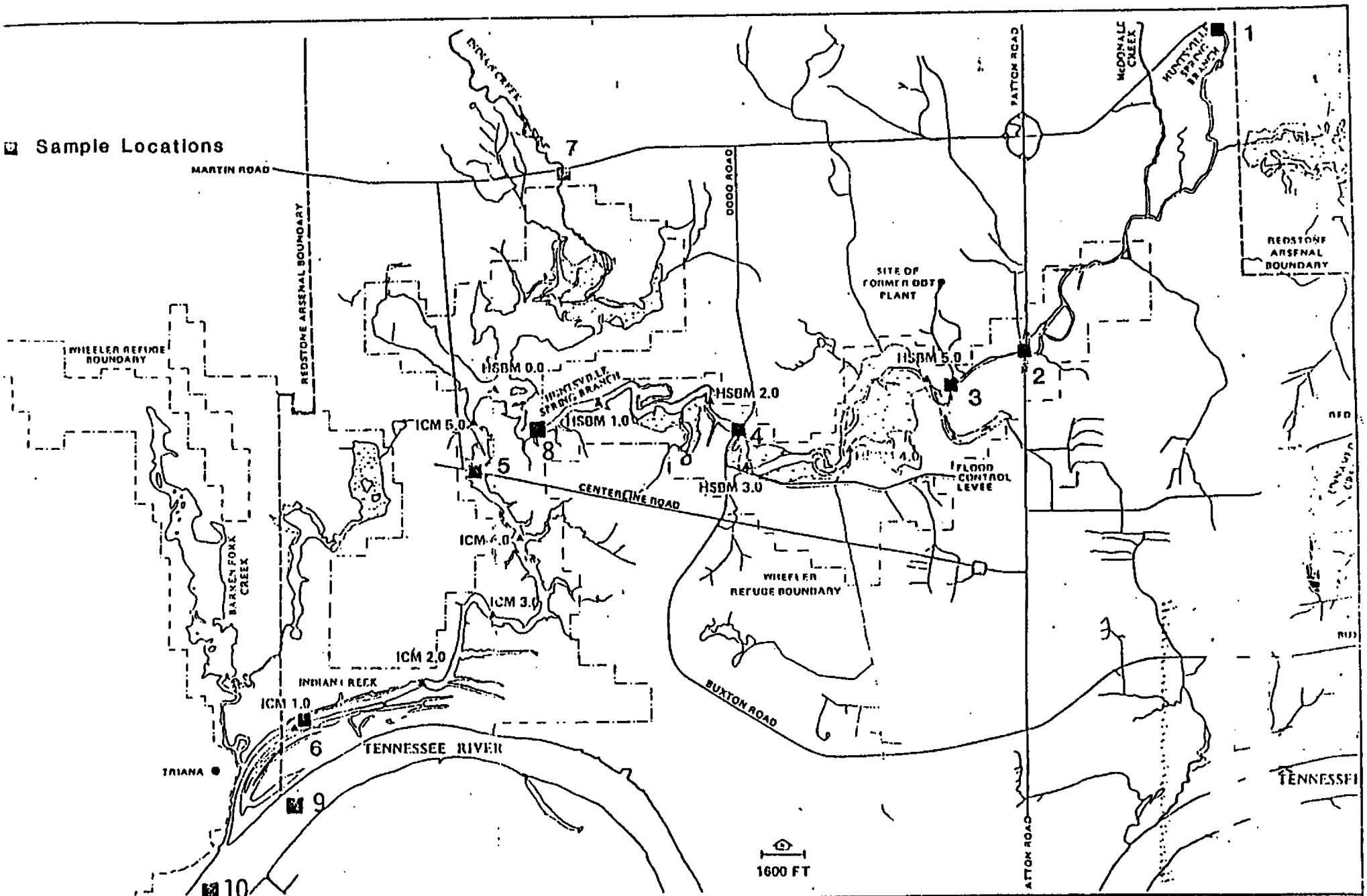
1. HSB near Martin Road bridge and Gate 1 of RSA,
2. HSB near Patton Road bridge,
3. HSB in the vicinity of the former DDT plant,
4. HSB upstream of Dodd Road bridge,
5. IC near Centerline Road bridge,
6. IC near the RSA boundary (ICM 1.0),
7. IC near Martin Road bridge, and
8. HSB between HSBM 1.0 and HSBM 2.0.

These sampling locations were selected for a number of reasons. Sites 1 and 2 are located at the HSB upstream of Reach A. No information has been generated to date on the types and sizes of fish inhabiting the upstream area or the levels of DDT in these fish. These sites were selected to help determine if fish upstream of Reach A contain elevated levels of DDT and to determine if measures should be taken to isolate fish in these areas from the section of the HSB downstream of Patton Road.

Site 4 is roughly at the downstream boundary of Reach A. Site 3 is located in HSB near HSBM 5.0. Site 3 will provide data on fish within Reach A.

Sites 5 and 6 are within Reach C. In conjunction with the W.A.R. data, samples collected from these sites will be used to establish the levels of DDT in fish in the various portions of Reach C. These sites are important because they represent the transition zone between the HSB and TR and must be traversed by fish moving between HSB and TR. In addition, Site 6, at ICM 1.0, is the point of the RSA closest to Triana. Site 7 is located on IC upstream of the confluence of the HSB. Like Site 1, Site 7 was selected to help determine if fish containing DDT are present in other portions of the HSB-IC system. Observations of fish at this site also may provide information nelpful in understanding the patterns of movement of fish in this system.

Site 8 is located within Reach B and will provide a point for comparison with Reaches A and C. Site 8 was not sampled during 1982 by Olin (Recra). Site 8 was added to the list of sample locations in order to provide a more complete picture of the fish species and their DDT concentrations within HSB and IC. Sampling at Site 8 will begin in February 1983.




General Site Map - Huntsville Spring Branch, Indian Creek, and Vicinity

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Engineering and Environmental Study of DDT Contamination of Huntsville Spring Branch, Indian Creek, and Adjacent Lands and Waters, Wheeler Reservoir, Alabama

SOURCE: WATER AND AIR RESEARCH, INC., 1980

In addition to the eight sampling points within HSB and IC, two locations on the Tennessee River will also be sampled. One point will be upstream of the IC-TR confluence in the vicinity of TRM 323. The other sampling point will be in the vicinity of TRM 319 which is downstream of the IC-TR confluence (TRM 320.9).

4.4.2 Sampling Frequency

Under the monitoring program, fish will be collected monthly for a year. Each monthly collection will require four to five days to complete during which time each site will be sampled one to two times. Fish distribution patterns are influenced by a number of factors including seasonal fluctuations in water temperature, depth and area extent of the water pool, food supply availability, and other habitat conditions. The effect of the pool elevations and seasonal changes in the chemical and physical characteristics of the water on the fish must be investigated.

A long-term fish sampling program comparing relative fish species abundance is included as a feasible method of collecting evidence of fish migration. Although exact fish migration patterns in the HSB-IC system cannot be established by this method, variations in the composition of the nektonic community could allow one to infer if migration (or movement) is occurring. Portions of the original sampling schedule have been completed (see Table 4.1). The new program entails collecting monthly samples at the proposed sites from August 1982 through May 1983 (thereby providing data for

a complete year from June 1982 through May 1983). Sampling at sites 6, 8, 9 and 10 will continue on a monthly basis through August 1983.

4.4.3 Sampling Protocol

To the extent possible, the fish sampling program will be directed towards channel catfish, largemouth bass, and smallmouth buffalo. These fish were selected because they can be food for humans and because of the existing data base for these fish in the Wheeler Reservoir. Channel catfish is the primary species showing DDT levels greater than 5 ppm. Also, due to their feeding habits, monitoring these three species of fish may provide information on DDT in the food chain in this section of the Wheeler Reservoir. For example, the preferred food of young largemouth bass includes crustaceans, insects, zooplankton, and other invertebrates. Adult largemouth bass prefer small fish such as yellow bass, channel catfish, perch, gizzard shad, and trout. Adult channel catfish feed on crustaceans, mollusks, plants, and small fish such as minnows. Smallmouth buffalo tend to feed on plants such as duckweed, algae, protozoans, insects, and crustaceans such as copepods(summarized from II-156).

TABLE 4.1

SUMMARY OF OLIN/RECRA FISH COLLECTIONS IN THE HSB/IC SYSTEM

June, 1982 through February, 1983[1]

| | SAMPLING SITE NUMBER | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | TOTAL |
| Number of Samplings | 9 | 10 | 11 | 11 | 11 | 3 | 9 | 1 | |
| Fish Species Caught | | | | | | | | | |
| Catfish (Channel, Flathead) | 0 | 0 | 0 | 12 | 13 | 7 | 0 | 1 | 33 |
| Bullhead (Black, Brown, Yellow) | 1 | 7 | 2 | 4 | 20 | 14 | 28[2] | 0 | 76 |
| Carp | 20 | 18 | 45 | 38 | 17 | 40 | 1 | 1 | 180 |
| Goldfish | 0 | 4 | 20 | 10 | 1 | 1 | 0 | 0 | 36 |
| Bass (Smallmouth, Largemouth, White) | 1 | 1 | 5 | 20 | 24 | 30 | 13 | 13 | 107 |
| Bluegill | 2 | 0 | 27 | 1 | 1 | 0 | 14 | 0 | 45 |
| Buffalo (Bigmouth, Smallmouth) | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 14 |
| Sunfish | 6 | 0 | 8 | 0 | 0 | 0 | 13 | 0 | 27 |
| Bowfin | 12 | 16 | 0 | 1 | 1 | 0 | 0 | 0 | 30 |
| Gar (Spotted, Shortnose) | 5 | 28 | 4 | 3 | 17 | 1 | 0 | 25 | 83 |
| Crappie | 1 | 3 | 5 | 1 | 2 | 0 | 0 | 0 | 12 |
| Sucker (White, Spotted, Redhorse) | 16 | 16 | 7 | 5 | 4 | 1 | 10 | 0 | 59 |
| Gizzard Shad | 1 | 23 | 24 | 9 | 28 | 13 | 26 | 2 | 126 |
| Other species[3] | 0 | 0 | 0 | 1 | 31 | 8 | 5 | 4 | 49 |
| TOTAL | 65 | 116 | 147 | 105 | 159 | 129 | 110 | 46 | 877 |

[1] Eleven collection trips

[2] Includes 20 young-of-year fish

[3] Includes Skipjack Herring, Chain Pickerel, Freshwater Drum



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W.A.R. data indicated that largemouth bass, smallmouth buffalo, and channel catfish may be rare, or absent, at several of the sampling locations. Other fish including gar, bluegills, sunfish, bullheads, white bass, goldfish and gizzard shad are more frequently encountered. Therefore, all species of fish taken at each station will be retained for analysis (up to a maximum of 6 fish per species). The criteria for selection of fish for analysis is to retain fish of each species collected at a given site and to save for analysis, when possible, a sufficient number of fish (generally six) to provide an adequate mass of fillet and offal for complete analysis including the previously outlined quality assurance procedures. Additionally, efforts will be made to collect similar fish at all stations in order to generate a representative picture of the types of fish present and the levels of DDT in these species. This is important because residues in one species of fish at one site cannot be compared with residues in another species of fish at another site.

The fact that channel catfish, largemouth bass and smallmouth buffalo may not be present or collected at several of the stations should not be construed as a criticism of the sampling program viability. To develop a meaningful long-term monitoring program, one needs to know what types of fish are present and the relative ease with which they can be caught. The knowledge of the fish present is critical to the development of the monitoring program.

Parallel to the fish collection, Olin will perform a literature study of the life cycle, habits, etc., of the species in the HSB-IC system to help explain the presence or absence of specific species at specific locations.

Due to the variety of fish which may be present, several different collection methods will be employed. The relative effectiveness of various sampling equipment for different types of fish are compared in Table 4.2. Four methods will be employed in this project. These are seining, trotlines, gill nets and shocking (either from a boat or by wading using a portable, backpack electrofishing outfit - Model BP-2 manufactured by Coffelt Electronics Company, Englewood, Colorado). All four methods may be employed at eacn site since the relative effectiveness of each will vary with site characteristics and the types of fish present. Each collection will be carefully documented with respect to species of fish caught, methods used, size of area fished, time required to collect, etc.

TABLE 4.2

RELATIVE EFFICIENCY OF SEVERAL FISH - SAMPLING METHODS (AFTER BENNETT, 1971)

METHOD OF SAMPLING

| Kind of Fish | Trammel Nets | Wing and Trap Nets | Seines | Spot Poisoning | (Boat) Electroshocking | Angling |
|---|---|---|---|---|---|---|
| Largemouth Bass | poor | poor | fair | good | fair | good |
| Smallmouth Bass | poor | fair | fair | good | fair | good |
| Sunfish, etc. | good | good | good | good | good | good |
| Crappies | good | excellent | good | good | fair | poor |
| Carp | good | good | good | good | fair | poor |
| Gizzard Shad | fair | good | good | good | good | -- |
| Gar | good | fair | good | good | poor | poor |
| Bullheads | fair | good | poor | fair | poor | good |
| Channel Catfish | poor | good | good | good | poor | poor |

The value of using Rotenone at each station on a semiannual basis will be evaluated during this project. Utilization of Rotenone shall be subject to approval by the RP. This collection method would give a good estimate of species composition and relative abundance. This is similar to Task 2 in the W.A.R. Report. The monthly sampling program will provide guidance on the critical times of the year as to when the fish population may be high or low. The fish collected by Rotenone can also be used for DDT analysis since Rotenone does not interfere with the DDT analysis.

At each station, up to six individuals of all species of fish found, will be collected, if possible. The weight and length of each fish will be recorded. The fish will then be wrapped in aluminum foil, frozen, and shipped by air freight to Recra's Tonawanda, New York laboratory for analysis (and/or subsequent shipment to secondary and referee quality control laboratories). Each collected fish will be field identified with the following information: project number, specimen identification number, species of fish, date of catch and sampling location. Chain of custody forms will be initiated at the time of collection. Fish captured but not saved for analysis will be noted and released. As indicated previously, changes in the types, composition and abundance of fish at the various stations will be used as an indication of possible fisn migration.

The following guides will be used to identify the fish collected for analysis:

- Etnier, David, Personal notes on Fishes of Tennessee, University of Tennessee, Knoxville, TN, 1976 (rev. 1982).
- Eddy, Samuel, How to Know Freshwater Fishes, William C. Brown, Co. 1957.
- Whitaker, John O., Jr., Keys to the Vertebrates of the Eastern United States Excluding Birds, Burgess Publishing Co., Minneapolis, MN, 1968, p1-127.
- Kuhn, E.R., A Guide to the Fishes of Tennessee and the Mid-South. Tennessee Department of Conservation, Division of Game and Fish, 1929, 124p.
- Smith-Vaniz, W. F., Freshwater Fishes of Alabama. Auburn University, Agricultural Exp. Station, 1968, 211 p.

4.4.4 Analytical Parameters

The analytical procedures to be employed for the fish are set forth in Section 3.4.1 of this Proposal. The fillet and offal of each fish will be analyzed individually if sufficient mass is available (approximately 250 grams each). Small fish will be combined by site and species until the combined weight of 250 grams is obtained and whole body analysis performed. Percent lipids (total fat) will also be determined for all samples.

4.5 Mechanism of Fish Contamination

Evidence collected to date has not provided a clear picture of the mechanisms responsible for elevated DDT concentrations in fish.

DDT in fish may occur from numerous pathways but quantifying the DDT contribution of each pathway to the total DDT measured in the fish is a difficult undertaking. For example, do fish accumulate more DDT from the passing of water through the gills or from consuming benthic macroinvertebrates which have ingested DDT from the water? Several combinations of these factors are possible. W.A.R. presented several parameters (II-152) which are graphically illustrated in Figure 4.2.

Identifying all the parameters and variables that contributed to elevated DDT levels in fish and wildlife is a complex, involved issue and is not completely addressed in this Proposal. Data provided by W.A.R. and by the Proposal will assist in resolving some of the variables involved. Additionally, Olin will perform a fish DDT uptake study, if determined to be appropriate, to address the following important questions:

- Will sediments in the range of 10 to 30 ppm (similar to Reach C) result in DDT concentrations of 5 ppm in fish?
- What portion of the DDT in fish can be attributed to the uptake of DDT from their food?
- What portion of the DDT in fish can be attributed to the uptake of DDT from the water column?

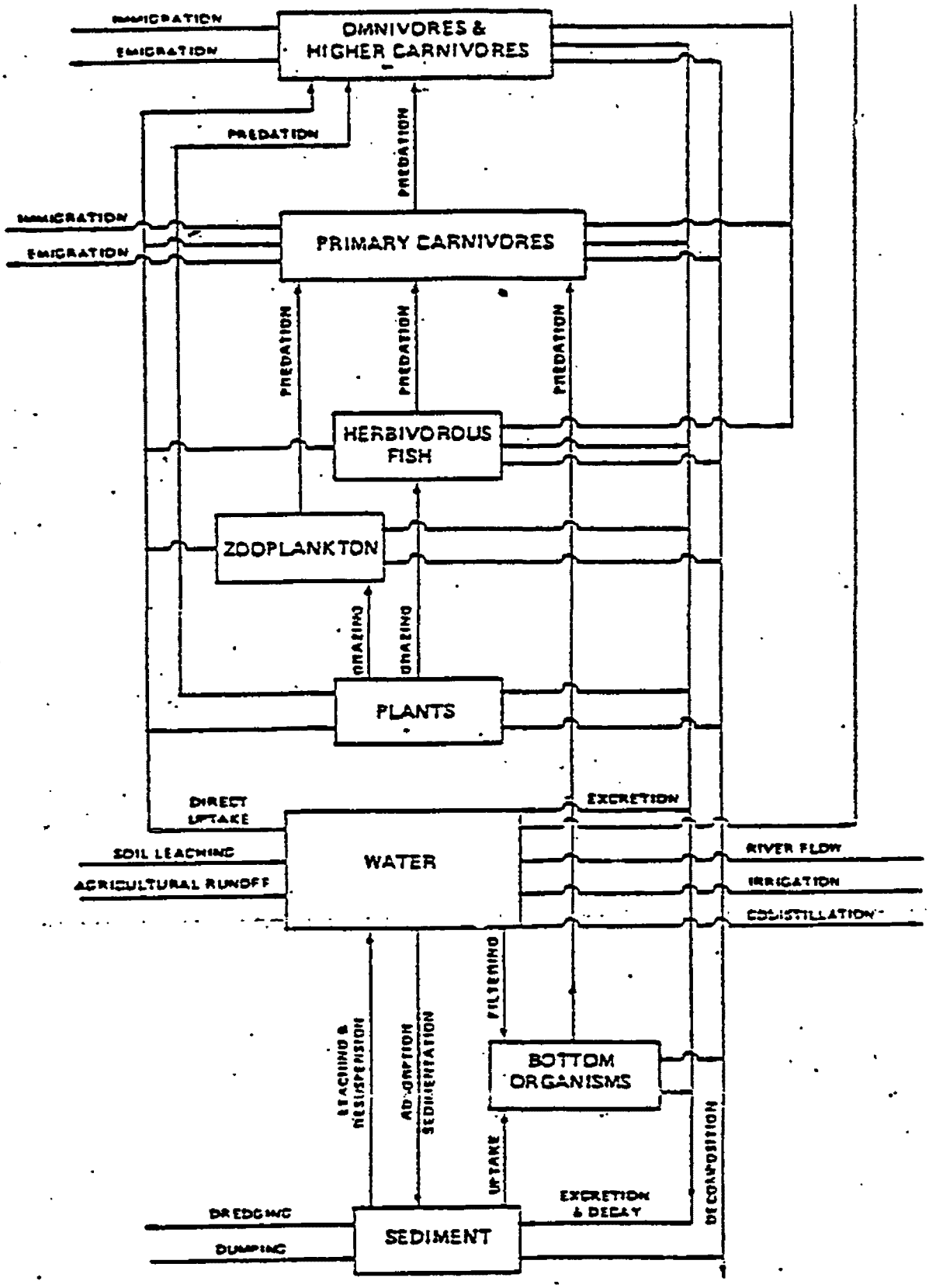


FIGURE 4.2 Transport of DDT in an Ecosystem - Adapted from AEHA, 1977

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The following discusses the conceptual aspects of such a study rather than a definitive program. The design of the study can proceed after further pre-study work, including detailed discussions with government experts, is completed. These studies may be especially pertinent to Reaches B and C.

Numerous laboratory studies have been undertaken to determine the fate of DDT and other contaminants in both terrestrial and aquatic environments. Metcalf et al., (1971) discuss the use of the model ecosystem approach, where an attempt is made to reproduce (to the extent possible) in situ conditions. Others (Branson, 1978) have stated that an environmental rates approach using a material balance equation will more accurately predict the environmental concentration of contaminants. In either case, the validity of the data generated is subject to question due to the inability of laboratory conditions to accurately model the in situ environment.

In an uptake study, known concentrations of radio-labeled DDT could be introduced into a closed system, and the species would be tested over time to determine DDT uptake rates. Another type of test involves determining the rate of bioconcentration from bottom sediment. DDT could be introduced into sediments similar to those in the HSB-IC system. Actual DDT contaminated sediments from HSB-IC could also be used. Concentrations of DDT within the sediments could be varied in various aquariums to determine the effect of sediment concentrations on bioconcentrations. Of special interest may be a

test which covers DDT containing sediments with clay, plastic or other material and establishes the rate of bioconcentration. Finally, it could be possible, as Macek et al., (1979) have done, to compare the rates of bioconcentration to bioaccumulation in aquatic organisms. The results of this investigation showed that, unlike other chemicals, DDT accumulated in higher trophic levels through the food chain, as well as through bioconcentration.

A field study could be performed to study the uptake of DDT by fish in HSB-IC. The study would entail obtaining channel catfish from a hatchery and dividing them into two groups - fed and unfed. The fish should be placed in cages and one set of fish from each group suspended in the water and another set placed on the bottom sediment. Another experiment would repeat the above except the bottom sediment upstream from the cages would be disturbed on a regular basis over a period of several weeks.

The combination of field and laboratory studies could provide an insight into the relationships between uptake (or DDT concentrations in fish) and (1) DDT in the in situ sediment versus suspended sediment, (2) the effects of various concentrations of DDT in sediment, and, (3) the effects of sediment isolation (covering). Prior to the initiation of an uptake study, detailed literature searches and discussions with experts in this field of study must be undertaken to thoroughly define the objectives and parameters of study.

## 4.6 Utilization of Data Base

The primary uses of the data to be collected in this project are to help identify appropriate remedial measures and to develop a long-term monitoring program for the area. Migration of fish into and out of the HSB and IC has been suggested as one of the two mechanisms by which DDT uptake in TR fish may be occurring (II-173). The other is in situ exposure. Data concerning species diversity and abundance collected from sampling of the study area will be used to discuss the mechanism (in situ and/or migration) through which DDT contamination in the fish occurs.

Some data has already been obtained through preliminary sampling (Recra, June and July 1982). First, channel catfish have been observed and collected for analysis at the Dodd Road bridge section of the HSB (Site 4). The capture of channel catfish is the first direct evidence that these fish are present in at least the downstream portions of Reach A during some parts of the year. Second, young-of-the-year largemouth bass and catfish have been found in the vicinity of the old DDT plant on the HSB (Site 3). Future fish collections in the spring may provide additional evidence concerning the life habits of fish in the HSB-IC area. The year-long sampling program in the Proposal may yield the data on which to base conclusions on the significance of fish migration.

More importantly, the data will allow one to assess and monitor the effects of whatever remedial actions are selected. A data base

will have been developed concerning types of fish common to each sampled section of the HSB and IC and levels of DDT in certain fish for use in the long-term monitoring program and also for purposes of evaluating the short- and long-term environmental assessment (see Section 7.0).

# 5.0 IN SITU SEDIMENT SAMPLING PROGRAM

## 5.1 Introduction

As a means of assessing the regional DDT concentration distribution and the potential for significant physical DDT transport, an in situ sediment and water sampling program was conducted as a part of the W.A.R. Report. The areas investigated include TR and tributaries (both upstream and downstream of the IC-TR confluence) in Wheeler Reservoir, the downstream Wilson Reservoir on the TR, and the upstream Guntersville Reservoir on the TR (V-Task 3).

The vertical distribution of DDT (and soil particle gradation) within the in situ channel and overbank area sediments is an important historical indicator of hydraulically related activities. Analysis of in situ sediment can provide evidence on the type and character of the DDT sediment deposition and the consequent potential for sediment erosion. For example, recent depositon of non-DDT containing sediments over DDT-containing sediments could be an indication that significant, active DDT isolation is occurring. It can also indicate where scouring, which may expose sediments containing DDT, is occurring.

The influence of sediment core compositing (vertical and horizontal), a technique sometimes used by W.A.R., masked the relationship between more heavily contaminated core fractions with depth, location, or along significant transect lengths. The

approach to sediment sampling focuses, not on the areal distribution of DDT but, more importantly for evaluating possible remedial actions, on the vertical distribution of the DDT in the upper (usually more erodible) six inches of sediment. It is not the intent of the Proposal to recalculate the quantity of the DDT reported present in the HSB-IC system. However, a more accurate vertical profile of the DDT present must be known to determine the most appropriate types of, and locations for, remedial actions.

The stream flow characteristics will dictate the size and distribution of the in situ sediment that is likely to be placed, and remain, in suspension. By determining the in situ particle sizes (and the associated DDT) susceptible to hydraulic transport, a proposed remedial action measure can be designed to prevent DDT transport. The lack of data defining the relationship between DDT and sediment characteristics is a significant problem in Reach B and Reach C because remedial actions may need to be more selective and specific in these areas.

The sediment sampling program is designed to incorporate the information available from the existing data base, i.e., DDT concentration and areal extent, and to obtain additional in situ sediment data required to design cost effective remedial solutions for the HSB-IC areas.

The method for development of remedial actions in this Proposal dictates a more detailed, site specific understanding of the in situ

and background sediment conditions in the HSB-IC system which is not presently available from the existing data base. This involves the acquisition of information necessary to address several concerns associated with the development of remedial actions. These concerns are as follows:

(1) What is the interaction between the DDT-containing sediment and the overlying water, i.e., is sediment available for resuspension and transport?

(2) Do the sediment character and sedimentation rates above Dodd Road differ from that downstream?

(3) What is the physical and chemical character of the sediment upstream of Patton Road?

(4) Are there sources of DDT-containing sediment upstream of Patton Road? If so, what is the significance?

(5) What is the concentration of DDT in the sediment in the ponded areas and in the reaches of tributaries entering Indian Creek? Are these areas, such as isolated embayment areas, potential sinks for DDT-containing sediment?

(6) What is the past sedimentation history of the HSB-IC system and in what way does this relate to the physical character of the in situ sediment?

(7) What is the effect of sewage treatment plant effluent on DDT-availability and movement?

(8) What effect does stormwater from the HSB-IC basin (including the city of Huntsville) have on the transport of DDT?

## 5.2 Specific Objectives

The preceding discussion identified those concerns that must be considered and investigated further. The expansion of the existing data base will permit development of effective remedial actions for the HSB-IC system. The specific objectives for the in situ sediment sampling program are as follows:

- determine the relationship between the DDT concentration and particle size/soil type, above and below Dodd Road (including IC);
- determine the organic content in the sediment and its relationship to DDT;
- determine the vertical DDT concentration gradient in the sediment within the HSB-IC system (with special emphasis on each one inch layer in the top six (6) inches of sediment);
- determine the physical character of the sediment available for transport within the HSB-IC system, e.g., moisture content, specific gravity, flocculation of clays;
- determine physical and chemical character of channel sediments upstream of Patton Road to Martin Road;
- establish DDT concentration in the ponded areas and in the reaches of tributaries entering Indian Creek;
- obtain knowledge of the past sedimentation history within the system; and
- determine if sedimentation or scouring is occurring in Reaches A, B, and C.

## 5.3 Utilization of W.A.R. Data

As previously noted, the W.A.R. Report has divided the HSB-IC system into three specific areas, viz., ICM 0.0 to HSB-IC confluence, HSBM 0.0 to 2.4, and HSBM 2.4 to 5.4. These areas are referred to as Reach C, Reach B, and Reach A, respectively. In addition, this program will include evaluation of an area upstream of Reach A, i.e.; HSBM 5.4 to 9.7.

As described in the W.A.R. Report (II-77), the surface hydrologic regime can be divided into four major categories:

channel, overbank, ponded, and floodplain. The terminology used, with some modification for special situations, is defined as follows:

" • Channel Areas - areas confined by well-defined banks as determined from the transect profiles and generally occupied by flowing water.

• Overbank Areas - areas outside of well-defined channel banks, with or without a permanent vegetative cover, periodically inundated as a result of reservoir operations on the Tennessee River and upstream streamflow conditions.

• Ponded Areas - areas generally inundated with standing water and hydraulically connected to a stream channel.

• Floodplain Areas - areas below the 100-year flood evaluation as determined by TVA in the course of this study."

These definitions will be used throughout the remainder of this discussion for consistency with the W.A.R. Report.

The data base generated during the W.A.R. Report generally eliminates the need to determine the areal distribution of DDT concentrations. Exceptions to this are selected locations within Reach C and Reach B and upstream of Reach A which were not fully investigated during the W.A.R. study. These areas specifically include the ponded areas and the lower reaches of tributaries in Reaches B and C and the stream channel in the area upstream of Reach A. The sampling program will emphasize the investigation of the DDT concentration gradient in the top six (6) inches of sediment, the associated physical character of the sediment and past sedimentation history.

## 5.4 Program Design

### 5.4.1 Sampling Locations

Data collected at selected sampling locations will supplement the W.A.R. data base. The sampling locations will include areas of hydraulic interest such as channel bends, embayments, and floodplains where sedimentation, erosion and/or fish spawning may occur. The proposed sample locations will be provided to the RP.

Additional in situ sediment core sampling locations may be selected during field activities in the HSB-IC system, after collection and analysis of the respective DDT concentration levels and sediment gradations of the proposed samples, and during development/design of remedial actions.

Within the stream channel of the HSB-IC system, the proposed sampling locations will be spaced between the existing W.A.R. transects. Proposed sampling sites within Reaches B and C will also be located in ponded areas and lower reaches of tributaries to obtain data analogous to that collected within the channel and to determine if these areas are potential sinks ("hot spots") for DDT. The data necessary to make this determination have not previously been obtained. The data must be obtained because these locations may be fish habitats and may require the development of remedial measures in discrete locations. Overbank and floodplain areas in Reaches B and C will also be sampled.

In Reach C, several overbank and floodplain sampling sites will be selected. Although this area has been extensively investigated, sampling at these locations will provide data on the physical nature of the sediment and DDT concentration in the top six inches and will complement the data to be obtained from channel sampling. The core samples obtained at these selected sites will be examined to determine the past sedimentation history of the HSB-IC system.

5.4.2 Sampling Frequency

This program is expected to be conducted in a single sampling period of three or four weeks duration. As the project progresses, additional samplings may be needed and conducted.

5.4.3 Sampling Protocol

Transects will be established across the HSB-IC channel and tributaries at the sites selected. Sonar recordings and manual probing will be conducted to map the sediment deposition. Sampling locations will be marked in the field for identification and recorded in a bound field log book and on a site topographic map. Conventional surveying techniques and/or aerial photographs of the sampled areas will later be performed to verify sampling locations. The water surface profile and elevations will be obtained from the stream stage recording equipment discussed in Section 6.0. Subsequently, the elevations of the extracted sediment cores will be determined by subtracting the water depth at the sample locations from the water surface elevation.

Samples will be obtained in areas of the deepest sediment deposits on each transect. Replicate samples will be taken to insure that sufficient sample volume has been obtained to conduct all analyses. In addition, there will be several sampling points across each transect in order to insure that the transect is fully defined.

A gravity-type sampler will be used to obtain core samples at all locations. Briefly, this type of sampler consists of a top section containing an encapsulated ball valve which creates a partial vacuum necessary for retention of the sample when the unit is retrieved, a coring tube with a plastic liner insert attached to the top section, and a retaining basket and cutting shoe attached to the coring tube.

Depending on the depth of the water at each sample location, the method used to obtain the desired sample depth will vary. Where the water depth is sufficient, a weighted sampler will be allowed to free fall from a boat through the water which penetrates the bottom sediments to the desired sample depth. If free-fall sampling does not achieve sufficient core depth, the sampler will be manually advanced until the desired core depth is achieved. Where the water is shallow, the sampler will be manually advanced to obtain the desired depth of penetration.

Once the sampler and sample column have been retrieved, the plastic liner that encapsulates the sediment sample will be removed

from the core tube and a new liner inserted for the next sample location. While in the field, the entire sample column will then be removed slowly from the plastic liner by the following procedure: extraction from the top to minimize the possibility of smear effects on the core, scraping of the perimeter of the sediment core to minimize the possibility of contamination from the plastic liner, such as phthalate esters, and separation at the desired depth fractions, viz., 0"-1", 1"-2", 2"-3", 3"-4", 4"-5", 5"-6", and 6"-12".

Each sediment sample will be visually characterized and the following information will be noted in the field log book: sample location, sample number, sample depth, and sample description. Each depth fraction of the sample will be placed in a scrupulously cleaned, wide-mouth, screw-capped, glass bottle with a TEFLON-lined lid, which will be labeled, securely packaged and chilled. Sediment samples will be transported, via air freight, to Recra Environmental Laboratories in Tonawanda, New York.

In order to assure that the required sample volume necessary to fulfill both physical and chemical analyses is obtained, multiple core samples (probably five to six) will be obtained in close proximity to each sampling location.

Another objective of the sampling program is to define the past sedimentation history within the basin. This information will be acquired by obtaining core samples through the recent stream

deposits and, if possible, into the underlying material. This core will be obtained by gravity type sampler or other manual core sampling devices. The core will be retrieved, left in the plastic tube, capped, properly labeled, frozen and returned to Recra Environmental Laboratories, Tonawanda, New York for later visual and, if necessary, microscopic identification.

5.4.4 Analytical Parameters

Samples will be thoroughly homogenized and split prior to physical and chemical characterization. One part of the homogenized mixture will be used to determine DDT concentration. The analytical procedure for DDT has been stated previously in Section 3.0. The analytical procedures for volatile solids content, Method 208E, described in Standard Method for the Examination of Water and Wastewater, 14th Edition, APHA, AWWA, WPCF, will also be performed. In addition, the organic content of the sample will be determined by the procedures stated in Section 3.0.

The remaining portion of the mixture will be divided in half. One half will be placed into a clean glass bottle, as described previously, labeled, refrigerated, and kept for possible future analyses. The other half of this subsample will be used for physical characterization. The physical soil properties of concern are grain size, specific gravity and moisture content. Grain size distribution will be obtained via an electronic particle size procedure using a Sedigraph particle size analyzer. Specific

gravity and moisture content will be determined by procedures described in ASTM-D-854 (Test for Specific Gravity of Soils) and ASTM-D-2216 (Laboratory Determination of Moisture Content of Soils), respectively. *

5.5 Utilization of Proposed Data Base

This in situ sediment sampling program has not been designed to duplicate the existing W.A.R. data. The program was developed to expand the present data base to enable the assessment of proposed alternate remedial actions for Reach A, Reach B and Reach C. Information developed from the physical properties of the

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* Reference: American Society of Testing and Materials, Part 19

sediment in the HSB-IC system, knowledge of past sedimentation and the hydraulics of the HSB-IC system are required as inputs to this assessment.

Information obtained concerning grain size versus DDT concentration and the DDT concentration variation with depth will enable the determination of whether the DDT in the top six inches is ubiquitous, whether recent deposition covered DDT sediment, and whether the sediment is available for resuspension, erosion, transport and deposition. In addition, establishing the properties of the surficial in situ sediments is required for long-term monitoring after any necessary remedial actions are implemented. The information developed concerning any "hot spots" that are hydraulically connected to the main stream channel in Reaches B and C will enable the assessment of the need for localized remedial programs.

A map of the areas, i.e., Reach A, Reach B, Reach C, and upstream of Reach A, will be prepared to show DDT available for transport or available to water or unavailable for either. This map will illustrate the significant findings of the field data collection programs (fish and sediment). W.A.R. data will also be included. This will facilitate development of appropriate remedial action plans to address field conditions. The map will be a planning tool for the selection and evaluation of potential remedial actions.

# 6.0 SUSPENDED SEDIMENT TRANSPORT/WATER SAMPLING PROGRAM

## 6.1 Introduction

The W.A.R. investigation contains HSB-IC field measurements at several in-place stream gaging stations which indicate the temporal variations of DDT transport-related parameters (W.A.R. Appendix V, Task 6). These measurements include stream stage elevation and stream velocity (and discharge) for seven (7) storm events and related DDT concentration, total suspended sediment, and volatile solids concentration for the last three (3) of seven (7) storm events. Channel sampling of bedload material, which included solids load and DDT concentration was also conducted in the field for four (4) storm events. However, the bedload contribution to total contaminant transport was determined to be negligible (W.A.R. Appendix II, p. II-122).

W.A.R. statistically analyzed the river hydrology and sediment data for trends and correlations. From this analysis, sediment transport was found to be the major route for DDT movement. This analytical hydraulic modeling of the HSB-IC system provided the input for quantifying contaminated and uncontaminated sediment transport under existing conditions.

Additional data collection and analysis of sediment transport data are required prior to the selection and design of remedial actions. The transport of sediment during non-storm events must be assessed. In addition, additional storm event data is required in

order to provide a complete picture of sediment transport in the HSB-IC system throughout the year.

Advanced numerical computation techniques (computer modeling) will be applied to the modeling of the HSB-IC sediment/hydraulic system. This approach provides the greatest advantage because parametric variations can be more effectively and expeditiously evaluated. Mathematical representations of complex real world conditions are necessary and are accepted in practice. Several theories have been advanced to describe the sediment transport phenomena. They are discussed in ASCE Manual No. 54(1975), Sedimentation Engineering.

The suspended sediment study will determine the rate and quantity of DDT sediment that is hydraulically transported through and from the HSB-IC system. This data, in turn, provides the basis for identifying and relating the principal hydrogeologic parameters and processes contributing to DDT sediment transport. Remedial action measures, as appropriate, can then be formulated to address these effects. The suspended sediment sampling program for non-storm events and storm events in conjunction with fish monitoring (Section 4.0) and in situ sediment sampling (Section 5.0), has been developed to collect the necessary data. This data will be supplemented by the storm event data reported by W.A.R. The field measurements for determining the hydraulic transport of DDT sediment will be conducted monthly over a year's period of time in

order to include a range of seasons, flows and reservoir pool elevations in the study. Olin's storm and nonstorm events data, when combined with the W.A.R. storm event data, should provide a complete picture of sediment and DDT transport throughout the year.

The information developed during the sediment transport study will be used to address several concerns which include the following:

- How do stream flow conditions affect sediment transport?
- Are storm events more significant than normal day-to-day flow with respect to DDT transport?

## 6.2 Specific Objectives

The specific objectives of the suspended sediment transport study are as follows:

- define the rate of transport of DDT and suspended sediment through and out of the HSB-IC system with respect to time of year and flow conditions such as stage elevation, storms, reverse flow, etc.
- determine particle size distribution of suspended sediment.
- quantify the concentration of settleable and non-settleable DDT in the water of HSB-IC.
- determine the relationship between DDT and particle size/soil type.
- develop a computer model of HSB-IC which simulates DDT/sediment transport.
- develop design data for remedial actions which will minimize sediment transport.

The Proposal, as related to the sediment transport program in

the HSB-IC system, entails several components. Most importantly, a sediment transport model must be developed for an accurate prediction of sediment distribution and movement. The determination of sediment deposition rates is necessary to quantify the present situation and monitor subsequent in situ burial/isolation of DDT sediments in any remedial action undertaken. Based upon the stream/basin hydraulic characteristics, determination of the relationship between DDT concentration and particle size/soil type will be used to assess which sediments are settleable, which are susceptible to transport, and which surficial in situ sediments, if containing DDT, possess the potential to be re-entrained for fluvial transport. The flow regimes and areal distributions of sediment characteristics are variables requiring further consideration for a definitive assessment of conditions now existing. The factors will provide the inputs for effective engineering design of proposed remedial actions.

The need for, feasibility of and effectiveness of any remedial alternatives can best be determined by establishing a sound data base with which long-term monitoring data can be compared. The study will provide data which will permit an accurate evaluation of Reaches A, B, and C. W.A.R. Report data will be utilized, to the extent possible, in support of this work.

## 6.3 Program Design

The suspended sediment sampling program consists of four phases which are as follows:

- non-storm event water sampling
- storm event water sampling
- stream elevation and flow velocity measurements
- computer modeling (simulation of the HSB-IC system)

The first three phases will be data development and the fourth phase will be the evaluation of that data.

### 6.3.1 Sampling Locations

The suspended sediment sampling program is designed to provide information on the quantity of sediment and the physical and chemical characteristics of the sediment in transport for non-storm and storm related events. Each sampling site will be located at or near a TVA gauging station which will provide accurate information on stream velocity (discharge) and stage elevation coincidental with each sampling event. TVA will operate and maintain these stations on a reimbursable basis. Within the HSB-IC basin (Wheeler Reservoir), the stream gauging stations which have been selected for reactivation by the TVA are:

- ICM 0.38, near IC-Tennessee River confluence
- ICM 4.6, Centerline Road Bridge
- ICM 8.2, Martin Road Bridge
- HSBM 2.4, Dodd Road Bridge
- HSBM 5.0, Boat launch on HSB at Road No. 5669
- HSBM 5.9, Patton Road Bridge
- HSBM 9.75, Martin Road Bridge

The transects at the above stream locations are distant from any upstream confluences or conditions which would affect the relationship between sediment transport rates and the pertinent hydraulic variables. These are deemed suitable for providing consistent and interpretable suspended sediment data. In addition, these sample locations correspond to the fish sampling locations.

6.3.2 Sampling Frequency

The sampling process employed at each transect is inherently controlled by the variable hydraulic conditions of flow velocity and stage elevation. Stage elevation data will be collected continuously for one year by the TVA stage recorders. Flow velocity data will be collected monthly by TVA personnel at Olin's expense. This data will be collected using the same methods and personnel as in the W.A.R. Report. The time intervals for suspended sediment data collection will occur coincident with the TVA stream velocity measurements. For the latter collection, it is presently estimated that one-month intervals will be utilized for one calendar year. In addition, storm event sampling will be conducted.

A schedule for the collection of recorded hydrological data will be designed and established by TVA as a function of the type of stage recording instrumentation selected. In general, the schedule will be dictated by the servicing of the recorder power source(s), the recording pen reservoir (if so equipped) or sensor or stylus, and replacement of a recording chart and retrieval thereof. At present, this appears to be a weekly function. The same methods and TVA personnel used to gather data for the W.A.R. Report are being used in this study.

6.3.3 Sampling Protocol

The suspended sediment sampling described herein represents standards and methods developed by the Federal Inter-Agency Sedimentation Project (F.I.A.S.P.) of the Inter-Agency Committee on Water Resources (Guy and Norman, 1970). The intended use of these procedures and methods is to provide sediment-water samples for physical and chemical analytical testing to define: DDT and suspended sediment concentrations at a given location and time, and DDT and suspended sediment quantities transported per unit time past a given location.

U.S.-series time-integrating suspended sediment samplers will be utilized in either point or depth-integration methods to obtain flow proportional samples at the locations described in Section 6.3.1. Point sampling methods are preferred for low stream velocity conditions. Consistent with procedures developed for the equal

transit rate (ETR) method of sampling for the U.S.-series samplers, each stream section will be divided by several equally spaced points (verticals). The number and location of the verticals will be determined for existing field conditions and from the sampling protocol.

Samples will be obtained at the verticals by lowering and raising a sampler at an equal transit rate (depth integration). This technique requires a knowledge of the immediate stream channel profile, stage height, and mean flow velocity prior to each sampling event. The suspended sediment program will be developed to coordinate field sampling with the scheduled TVA hydrological data collection (Section 6.3.2).

Existing data on channel form, stage elevation, and mean velocity suggest use of the U.S.-series depth-integrating sampler(s) USDH-59 and/or USDH-48 (National Handbook of Recommended Methods for Water Data Acquisition, 1978). Each is designed for use with a 473 ml glass bottle for sample collection. A separate bottle will be used at each vertical and the total group of transect bottles will be composited to yield a sample proportional to the total stream flow.

The method of depth integration, used in the ETR method, is limited to a stream depth of approximately 15 ft. If conditions arise which exceed this limit, point integration samples (US P-72) will be utilized to depth-integrate in a single direction (up-

transit) or to obtain point-integrated samples at the centroids of equal discharge increments, such as 0.2 and 0.8 or 0.6 of the stream depth from the water surface. This technique is covered in the method and will not result in a decrease in accuracy. Alternatively, point sampling at stations with low stream velocities will be accomplished using a pump-type sampler that has a high intake velocity relative to the stream velocity at 0.6 of the stream depth.

Methods and personnel employed by TVA in collection of hydrological data are expected to be the same as, or at least equivalent to, those methods utilized by W.A.R. (V-Task 6). Discharge measurements were taken using standard procedures as specified in the U.S. Department of the Interior, Geological Survey Water Supply Paper 888, Stream-Gaging Procedures, A Manual Describing Methods and Practices of the Geological Survey, Washington, D.C., 1943. Procedures for calculating depth, mean velocity and discharges are also given in this manual.

All bottles will have a cap lined with TEFLON or aluminum foil and will be cleaned following the procedures suggested by TVA in their 1978 study, "DDT Residues in Sediment and Fish in the Vicinity of Redstone Arsenal, Alabama." Site identification, date, time, station section, bottle number, and initials of field crew members will be noted on each bottle's label. It is estimated that 10 liters of water will be required to provide sufficient volume for the

analysis. Samples will be stored in ice immediately after collection and will remain as such until received at the laboratory. Samples will be refrigerated at 4°C at the laboratory until physical and chemical analyses have been performed.

6.3.4 Analytical Parameters

As indicated in the Quality Assurance Program (Section 3.0), the primary analytical parameters to be determined for composited samples at each transect are DDT concentration and total suspended solids. If a sufficient sample volume of sediment is available, suspended sediment particle size will be determined. The analytical protocols are cited by reference in Section 3.4.3.

6.4 Utilization of Proposed Data Base

Field data supplied by the W.A.R. investigation and this suspended sediment sampling program will provide representative inputs of the HSB-IC average stream hydraulic characteristics and will enable proposed remedial actions to be developed as well as establish the baseline conditions for post-construction-monitoring of remedial actions.

The utilization of the data base to determine the type and predicted effectiveness of any proposed actions is of paramount importance. Hence, descriptions of the fundamental principles, concepts of sediment deposition, and methodology employed in the assessment of the proposed remedial action effectiveness are herein provided.

In general, the in situ sediment that is available for hydraulic transport (in suspension) is a function of the hydrodynamic forces directly acting upon discrete sediment particles. Entrainment of the sediment is primarily dependent upon the sediment properties (such as particle size) - stream velocity relationship; that is, the higher the velocity the greater the maximum particle size to be placed in suspension, while simultaneously increasing the quantity of finer grained sediment. By maintaining stream velocity and turbulence of the water, sediment particles (up to a certain maximum size) will remain in suspension. High stream discharge/velocity conditions normally degrade or erode the channel sediments. Low stream discharge/velocity creates conditions conducive to sediment deposition.

### 6.4.1 Computer Modeling of HSB-IC

The in situ sediment sampling program and the water sampling program will generate a significant quantity of data on the HSB-IC system. In order to utilize this data to the greatest extent, the development of a computer model of the HSB-IC system is planned. The general programming scheme is as follows:

1) Identify a computer model applicable to the HSB-IC system.

2) Modify the program (if necessary) to incorporate the significant characteristics of the HSB-IC system.

3) Verify the model with field data collected during the field sampling program.

4) Modify program to include potential remedial actions.

5) Evaluate effectiveness of potential remedial actions under various flow conditions.

The computer model can assist in evaluating the effectiveness of potential remedial actions (and combinations of remedial actions).

Any computer program which is used to model a system must accurately simulate actual characteristics of the system. The HSB-IC has several unique and important characteristics:

- reverse flow occurs in the system
- fine particles (clays and silts) make up a significant portion of the sediment load
- transport of DDT in absorbed or dissolved forms
- water flow (and sediment transport) in both channel and overbank areas

Several computer models have been reviewed to determine if they are applicable for modeling the HSB-IC system. All available computer models have certain limitations when applied to the HSB-IC system. Any computer model chosen may require programming modifications. However, a computer program developed by the Hydrologic Engineering Center, Corps of Engineers has been identified as possibly applicable for simulating the HSB-IC system and for predicting the effectiveness of the proposed remedial actions. The program is entitled "Scour and Deposition in Rivers and Reservoirs, HEC-6". A descriptive abstract of the program is presented below, along with the theoretical methods that are used to compute the trap efficiencies for silts, clays, and sand for any proposed containment structure, e.g., dam.

The total sediment load is transported along a stream. Changes in the stream's bed elevation and water surface profile with respect to time are calculated at each cross section considering the following: the inflowing water discharge, inflowing sediment load, gradation of material in the stream's bed, armoring, and destruction of the armor layer. A series of reservoirs in tandem can be utilized. A dredging option is available. Diversions of water can be specified and inflowing water and sediment can be entered at tributary junctions. Clay, silt, sand and gravel sizes are transported and cobble sizes can be included for armor calculations. The program is dimensioned for up to 150 cross sections, 15 grain sizes, 20 tributary inflow points and 20 reservoirs in tandem.

Water surface profiles are calculated by the standard step method. The bed material load is calculated by either Toffaleti's application of the Einstein Bed Load function, Madden's modification of the Laursen Transport Relationship or a transport capacity per foot of width versus the depth-slope product. Based upon an assumption of steady state, the silt and clay sizes are transported until the shear stress on the streambed becomes less than critical. Deposition then begins using fall velocity as a variable in the exponential decay function. Changes in the bed elevation are calculated with the Exner equation for continuity of sediment material.

The preceding computer program may require a slight programming modification in order to incorporate the sediment resuspension aspect. Another drawback of the model is its inability to handle backflow. This must be investigated further.

The applicability of other relevant programs and/or theories are actively being evaluated to determine their applicability to the HSB-IC system.

# 7.0 REMEDIAL ACTION APPROACHES

## 7.1 Introduction

Previous sections of this document have presented a review of information from the W.A.R. Report and the specific investigative activities which will be completed in this project in order to provide site specific data of the required degree of accuracy and precision to evaluate and assess remedial action alternatives for Reaches A, B, and C with the HSB-IC system.

The fundamental methodology for determining an acceptable remedial action is to completely assess the feasibility of alternative remedial approacnes. The objectives of the sampling program are directly relevant to and essential for both engineering design inputs and a full understanding of existing conditions. In this respect, the combination of existing site information as provided by the W.A.R. Report and design data inputs resulting from the fish, in situ sediment and suspended sediment sampling programs, will provide necessary information for development of remedial actions and will permit demonstration of the adequacy and effectiveness of any remedial action options.

## 7.2 Overview of Action Considerations

The study, the selection, and the design of the most appropriate remedial action alternatives for Reaches A, B, and C are by no means simple tasks. In the previous sections, the overall project objectives, the project approach, the hypotheses to be

tested, the data to be collected and the utilization of that data were discussed in detail. All of this was directed toward the development of remedial actions for the HSB-IC system.

Any "suggested" remedial action for Reaches A, B, and C would be premature. They are very much dependent upon the outcome of investigative programs covered in this Proposal. The types of remedial actions that may be warranted and investigated include: isolation of DDT "hot spots" in the stream channel; removal of DDT "hot spots" from the stream channel; isolation of DDT-containing embayment sediments; diversion; enhanced channel and out-of-channel sediment deposition through artificial means; and sedimentation devices. Other remedial actions may also be developed and evaluated as the study progresses.

The evaluation process for selecting remedial actions will also take into consideration future changes in the HSB-IC drainage basin that may significantly affect the characteristics of the HSB-IC system. One of these changes is the potential diversion of the discharge of the Huntsville POTW directly to the Tennessee River. This action would significantly reduce the base flow in HSB although the peak flows would not be materially affected unless there is diversion of Huntsville storm runoff. It would also eliminate a source of organic matter which may have an affinity for DDT. The effect of the diversion on flow and sediment transport and on potential remedial actions will be evaluated using the computer

model. It will also be evaluated conceptually using engineering/physical principles such as flow velocities, direction of flow, etc.

7.3 Long-Term Environmental Monitoring Program

Throughout this Proposal, reference is made to the long-term environmental monitoring of the HSB-IC system. The purpose of the long-term environmental monitoring plan is to determine the effectiveness of the implemented remedial actions, to assess any new or residual environmental impacts or hazards, and to identify the needs for additional remedial actions. The long-term monitoring plan will, if appropriate, measure the rate of change in DDT levels in fish, migration of DDT in sediments and water, or the dynamics and proportions of DDT components in the sediments, water and biota of Huntsville Spring Branch, Indian Creek and Wheeler National Wildlife Refuge, depending upon the remedial action chosen. The long term monitoring program developed will continue until the termination of the Consent Decree.

For the purposes of the long-term environmental monitoring plan, baseline conditions shall be those levels of DDT in fish, water, and sediment determined during the Olin study supplemented with data from the W.A.R. Report. The results of analyses performed under the long-term monitoring program will be compared with baseline data to evaluate the effectiveness of remedial actions.

The types of samples and the sampling and analytical protocols of the long-term monitoring program will be the same as those detailed in Sections 3.0 through 6.0 with the exception of sampling frequency and the groundwater program. The sampling frequency and the groundwater program are discussed below.

Although an accurately defined time frame and completely developed program cannot be established at this time, a long-term monitoring plan which is similar in concept to the fish, in situ sediment, and suspended sediment sampling programs in Sections 4.0, 5.0, and 6.0, respectively, is contemplated. It is presently envisioned that DDT concentrations (both total, filterable and non-filterable) and the suspended sediment concentrations in the surface water will be determined from samples collected at semi-annual intervals at the seven selected locations indicated in Section 6.0. For the fish species, DDT concentration levels will be determined on an annual basis following implementation of any remedial actions. Sampling locations will be as discussed in Section 4.0. In situ sediment sampling may be conducted on an annual basis at selected locations corresponding approximately to those presented in Section 5.0. Quantitatively, the number of sample core locations will be fewer than indicated in Section 5.0 but will include points common to both this Proposal and the W.A.R. investigation. The analytical parameters to be determined will be DDT concentration variation with depth, and soil particle size

distribution with depth. The latter will be indicative of the type, rate, and extent of the suspended sediment deposition. A relative comparison of DDT parameters over time with the baseline conditions established under this Proposal will indicate the rate of effectiveness of the remedial action, e.g., the sediment transport model predictive capabilities, the HSB basin sediment deposition rates, and, most importantly, the rate of reducing the DDT concentration levels in fish in specified areas to 5 ppm.

7.3.1 Groundwater Monitoring

The groundwater in the vicinity of HSB-IC will be monitored to determine if construction and implementation of any remedial actions affect DDT in groundwater. The monitoring program shall consist of water samples taken from existing groundwater wells (RS 20, RS 22, RS 23, RS 27, RS 30) and drinking water wells (X 37, X 44, Q 79, U 67 and U 98) (see W.A.R. Report II-74 and EPA memorandum dated October 9, 1979 entitled "Transmittal of the Public and Private Water Supply Investigation, Redstone Arsenal and Vicinity, Huntsville, Alabama Area"). RS 30 is upgradient of the DDT source area, RS 27 is immediately downgradient of the source, RS 22 and RS 23 are a downgradient shallow/deep pair at Huntsville Spring Branch, into which the groundwater flows, and RS 20 is an additional downgradient shallow well at the Branch. If any of these wells are found to be dry or damaged, alternate wells may be sampled.

All wells will be sampled once in 1983 and once every two years for up to ten years after completion of construction.

The wells will be sampled with a peristaltic (surface) pump using a dedicated, disposable inert sample tube. Each well will be flushed until it is dry or until 2-3 well casing volumes (about 12 gal.) have been evacuated. Sampling will then be done for DDT. Each sample will be filtered at the laboratory through a 63μ filter prior to analysis to remove suspended solids. Sample handling and analysis will be conducted according to the procedures specified for water samples in Section 3.4.3.

7.3.2 Measurement of Performance Standard

The performance standard is a DDT level of 5 ppm in fillets of channel catfish, largemouth bass and smallmouth buffalo in Reaches A, B, and C. Olin shall be deemed to "attain the performance standard" when the average DDT concentration in the fillets of each of the aforementioned fish species is five ppm (or less) in Reaches A, B, and C. "Continued attainment of the performance standard" occurs when the average DDT concentration in the fillets of each of the aforementioned fish species is five ppm (or less) for three (3) consecutive years (including year of attainment) in Reaches A, B, and C.

The average DDT concentration of a species will be determined as an arithmetic mean concentration of DDT in the fillets within a species adjusted for the weight of each individual. Mathematically, this can be represented as follows:

$$\overline{C} = \frac{\Sigma W_i C_i}{\Sigma W_i}$$

where $\overline{C}$ is the average DDT concentration of a species

$W_i$ is the weight of fillet of each individual fish of that species (in grams)

$C_i$ is the concentration of DDT in the fillet of each individual fish of that species (µg/g)

After continued attainment of the performance standard is achieved for each species of fish in each reach (A, B, and C), that species will no longer be monitored. As continued attainment of the performance standard is achieved in each reach (A, B, and C), that reach will be eliminated from the monitoring program.

After individual analysis of the fillets, the average DDT concentration for each species will be determined and compared to the performance standard. The number of samples of each species to be analyzed will be determined solely by the quantity caught during the sample collection. A maximum of six fish by species per site will be analyzed. If less than six fish are caught and analyzed, the computed average DDT concentration will be based on the number of fish caught (one to five).

## 8.0 ENVIRONMENTAL ASSESSMENT OF REMEDIAL ACTIONS

The size of the study area in which the DDT is reported creates a complex situation involving many components of the environment. Remedial action(s) may affect the ecology of the HSB-IC system. In evaluating a proposed remedial action, the RP will assess its environmental impact. Olin will provide information with respect to anticipated effects on people and the environment of any actions to be implemented under the remedy. At a minimum, the information included will be that set forth in paragraph 52 of the Consent Decree. Such information will be patterned after the applicable guidelines under the National Environmental Policy Act, 42 U. S. C. §§4321 et seq., currently set forth in 40 CFR Parts 1500-1508 and 40 CFR Part 6.

## 9.0 PROPOSAL TIME FRAME

To ensure a timely implementation of this Proposal, a generalized project timeline was developed and is illustrated in Figure 9.1. The elements of study, in conjunction with the assigned durations, have been categorized as follows:

A. Fish Studies

B. Suspended Sediment Sampling and Stream Hydraulics

C. In situ Sediment Sampling

D. QA/Interlab Equivalency Program

E. Sediment Transport Model - Development and Application

F. Engineering Development of Remedial Actions

G. Preliminary Design of Remedial Actions

H. Long-term Monitoring Program Development for Remedial Actions

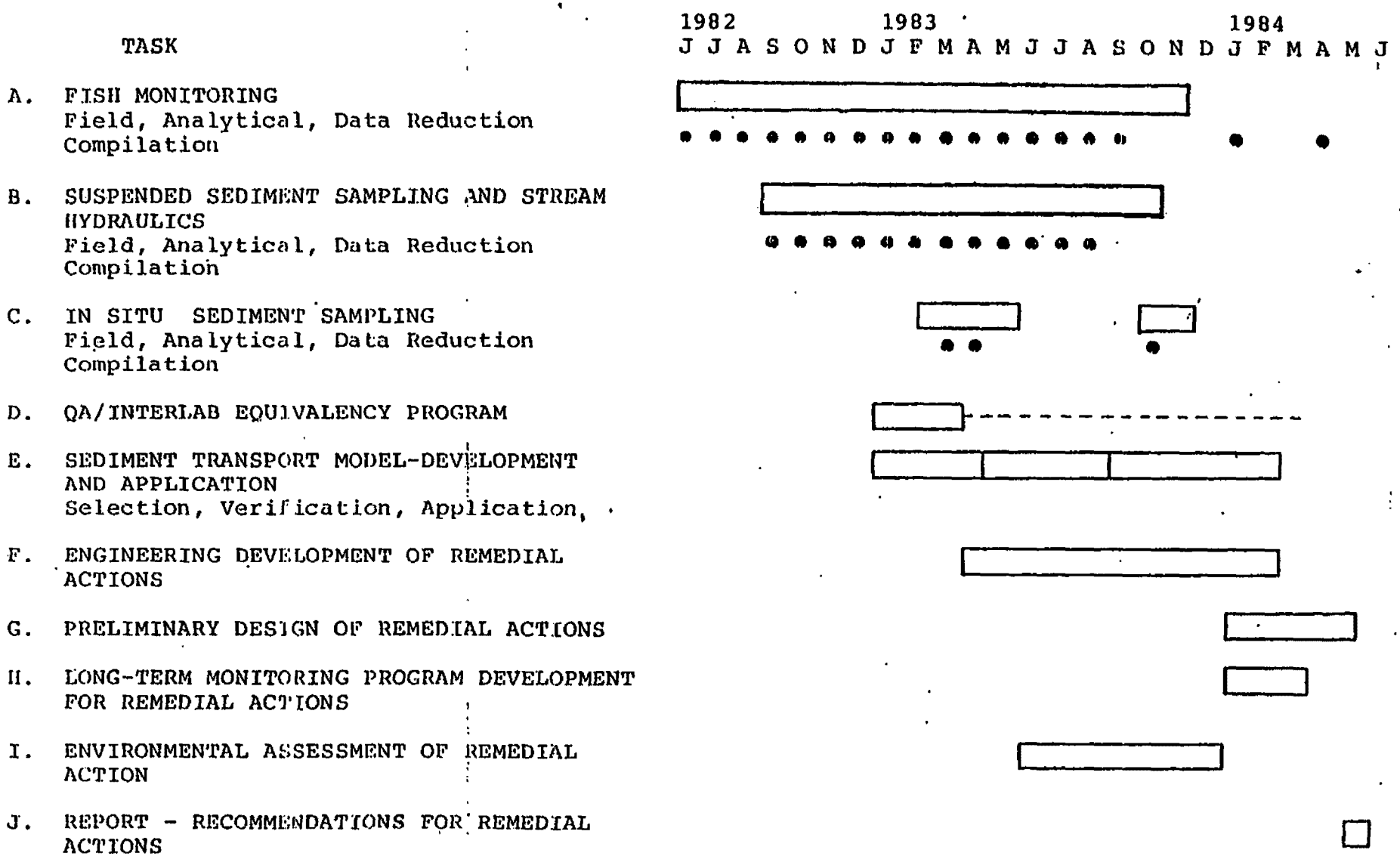
I. Environmental Assessment of Remedial Actions

J. Report - Recommendations for Remedial Actions

Each particular proposal element will encompass the accomplishment of those detailed facets described in the preceding sections, and a final report of recommended remedial actions to be implemented will be made.

FIGURE 9.1

PROPOSED PROJECT TIMELINE




NOTES: Dots indicate field sampling efforts
Quarterly Progress Reports will also be prepared throughout project

## 10.0 REFERENCES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Appendix C

## REVIEW PANEL MEMBERSHIP

Review Panel Chair

Dr. Edward S. Bender
Office of Science Policy (8103R)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

E-mail Address: bender.ed@epamail.epa.gov

Period of Review Panel service–June 14, 1983 to present
(Dr. Bender was appointed Chair of the Review Panel on December 5, 1996 following the death of Anne Asbell)

Dr. Bender is an aquatic biologist with the U.S. Environmental Protection Agency in Washington DC. He chairs the Technical Committee which provides advice and support for Review Panel activities. In 1977, while working for the U.S. Army, Dr. Bender became involved with DDTR sampling at Redstone Arsenal. He joined EPA in 1979 and served as the technical coordinator for the litigation that led to the Consent Decree in U.S. vs Olin Corporation, and the establishment of the Review Panel. Dr. Bender has more than twenty years experience in environmental monitoring, aquatic ecology and toxicology. His dissertation, entitled "Recovery of a Macroinvertebrate Community from Chronic DDTR Contamination," studied the toxic effects of DDTR runoff from an abandoned manufacturing facility on fish and aquatic invertebrates in a south-central Arkansas stream. Dr. Bender has a bachelor of science degree in biology from Westminster College, a master of science degree in zoology from the University of Florida, and a doctorate in biology from the Virginia Polytechnic Institute and State University.

State of Alabama

James W. Warr
Director
Alabama Dept. Environmental Management
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Montgomery, AL 36130-1463

Email "jww@adem.state.al.us"

Period of Review Panel Service: June 14, 1983 to present

Mr. Warr is the Director of the Alabama Department of Environmental Management (ADEM), a position that he has held since April 1996. Prior to April 1996, Mr. Warr was the Deputy Director from August 1982 (when ADEM was created) to November 1993 and from November 1994 to September 1995. He served as the Acting Director from November 1993 to November 1994 and from September 1995 until April 1996 when he became the Director. ADEM is responsible for the implementation and coordination of the State of Alabama's environmental program activities. Mr. Warr was previously the Director of the Alabama Water Improvement Commission (AWIC), which administered the Alabama Water Pollution Control Act. He joined the AWIC in 1968 and has several years of experience and knowledge concerning the environmental conditions in the Wheeler Reservoir, Huntsville Spring Branch – Indian Creek System. Mr. Warr has a Bachelor of Science Degree in Civil Engineering, a Masters Degree in Civil Engineering, and a Master of Business Administration, all from Auburn University. He is a registered professional engineer and is a member of several professional associations. He currently holds the rank of Major General in the U.S. Army Reserve.

Department of Army, RSA

Colonel Steven C. Hamilton
Deputy Post Commander
AMSAM
Redstone Arsenal, AL 35898-5300

Period of Review Panel service—July 1998 to present

Colonel Hamilton was assigned as Deputy Post Commander, Redstone Arsenal, Alabama in July 1998. Previous assignments have been Platoon Leader, 2-34th Infantry, Ft. Stewart, GA; Executive Officer, 24th Ordnance Company, Ft. Stewart, GA; Commander, Surveillance and Accountability Control Team #1 (SAACT #1), 6th Ordnance Battalion, Uijongbu, Korea; Materiel Officer, 80th Ordnance Battalion, Ft. Lewis, WA; Commander, 63rd Ordnance Company, Ft. Lewis, WA; and Operations Officer, Test and Evaluation Division, Army Development and Employment Agency (ADEA), Ft. Lewis, WA. He served as Executive Officer, 80th Ordnance Battalion, Ft. Lewis, WA; Chief, Ammunition Management Branch, 3D COSCOM, Germany; Chief, Supply Management Division, 3D COSCOM, Germany and Commander, 6th Ordnance Battalion, Korea. His most recent assignments have been as Action Officer, J-4, The Joint Staff, Pentagon; Chairman, Joint Munitions Rule Implementation Council (MRIC), Pentagon and Chief, Plans and Operations Division, ODCSLOG, Pentagon. Colonel Hamilton's awards and decorations include the Defense Meritorious Service Medal, the Meritorious Service Medal with 3 Oak Leaf Clusters, the Joint Service Commendation Medal, the Army Commendation Medal with Oak Leaf Cluster, the Joint Chiefs of Staff Identification Badge, the Army Staff Identification Badge, the Parachutist Badge and the Ranger Tab. Colonel Hamilton holds a bachelor of science degree in Medical Technology from the University of Utah, a master of business administration degree from Utah State University and a master of science in National Resource Strategy from the National Defense University. Colonel Hamilton was commissioned a second lieutenant in the Ordnance Corps with a detail in infantry in 1975. He is a graduate of the Infantry Officer Basic Course, the Ordnance Officer Advance Course, the Materiel Acquisition Management Course, the Command and General Staff College, and the Industrial College of the Armed Forces.

US Fish and Wildlife Service

Dr. W. Allen Robison
Environmental Contaminants
Coordinator-Southeast Region
U.S. Fish & Wildlife Service
1875 Century Blvd.
Suite 200
Atlanta, GA 30345

Email "allen_robison@fws.gov"

Period of Service: July 15, 1993 to present.

Dr. Robison holds degrees in wildlife biology, aquatic biology and toxicology. He has worked for the Fish and Wildlife Service (Service) as a Biological Technician, an Environmental Contaminants Biologist, and as an Ecologist. Dr. Robison has also worked in the areas of water quality assessment, fish community analysis, fish contaminant residue evaluation, and the transport/fate of PCBs for the Commonwealth of Kentucky. His involvement with the HSB-IC DDT project began when he came to work in the Service's Tennessee/Kentucky Field Office located in Cookeville, Tennessee. Dr. Robison has continued the monitoring programs at Wheeler National Wildlife Refuge. He is presently employed in the Service's Southeast Regional Office located in Atlanta, Georgia.

Tennessee Valley Authority

Robert Pryor
Business Development
Tennessee Valley Authority
400 Summit Hill Drive (WT-10D)
Knoxville, TN 37902-1499

Email "rjpryor@tva.com"

Period of Review Panel Service: January 1, 1991to present.

Mr. Pryor has over 20 years of accountable management experience in environmental and pollution prevention disciplines. He has a technical background in scientific and environmental engineering professions and broad experience in all TVA businesses. For example, he has managed assessment and protection programs for natural resources, served as Project Engineer for capacity additions to the Power System from siting to sub-system modifications. Advised agency management on effects of operations on natural resources and provided corporate-level oversight of environmental activities at operating sites, has management responsibility for performing National Environmental Policy Act reviews.

He has a master of science in zoology and a bachelor of science in biology and chemistry from the University of Texas at San Angelo, Texas. He also has an engineering certification from Texas A&M.

NON-VOTING MEMBERS

Town of Triana, AL

Honorable Clyde Foster (Town Hall)
480 Zierdt Road
Triana, AL 35756

E-mail "cfoster293@aol.com"

Mr. Foster, formerly the Mayor of the Town of Triana, Alabama, is a prominent community leader. He was instrumental in the restoration of the town charter for Triana, originally chartered in 1819, and was appointed Triana Mayor in 1964, serving in that capacity until 1984. He has been a strong community advocate and instrumental in focusing community concerns. His efforts on behalf of the town of Triana have been successful in improving many areas of community life.

Mayor Foster has been involved with the resolution of the DDTR contamination problem in the Huntsville Spring Branch-Indian Creek System for many years. His contributions include effective and successful coordination of the Review Panel activities with the local community. His efforts have resulted in a spirit of cooperation and understanding within the community.

Mayor Foster was the Director of the Equal Employment Office at the National Aeronautics and Space Agency, George C. Marshall Space Flight Center in Huntsville, Alabama until his retirement in January 1987. He has a bachelor of science degree in mathematics and chemistry from Alabama A & M, and has taken graduate courses at that university.

Olin Corporation

Mrs. Laura B. Tew
Director, Community Outreach
Olin Corporation
PO Box 248
Charleston, TN 37310

E-Mail: lbtew@corp.olin.com

Period of Review Panel service: 1998 to present

Mrs. Tew is Director of Corporate Community Outreach with Olin Corporation's Public Affairs department. She has been with Olin for twenty-two years and has served on the Review Panel as Olin's non-voting member since 1998. Mrs. Tew has an undergraduate degree in chemistry from the University of North Carolina at Greensboro, advanced studies in chemistry at Duke University, and an MBA in marketing from Pace University in White Plains, NY. Mrs. Tew's career with Olin has included positions in quality, environmental, production management and marketing. She was plant manager of Olin's packaging facility in Livonia, MI. Mrs. Tew holds an advanced certificate from Boston College, Center for Corporate Community Relations.

# FORMER REVIEW PANEL MEMBERS

## Past Chairs

U.S. Environmental Protection Agency

Mr. Howard D. Zeller
Period of Review Panel service: June 14, 1983 through December 31, 1987

Mr. Zeller served as the first Chair of the Review Panel and the United States' designated Program Coordinator for the implementation of the Consent Decree in U.S. vs Olin Corporation. Mr. Zeller was the Assistant Administrator for Policy and Management for the U.S. Environmental Protection Agency in Atlanta, Georgia until his retirement in January 1987. Mr. Zeller retired with more than thirty years experience in environmental matters. He lead the Review Panel through the initial phases of implementing the Consent Decree and adopting procedures for functioning as a body. Mr. Zeller has a bachelor of science degree in biology and chemistry from the University of Nebraska and a master of science degree in zoology from the University of Missouri.

Ms. Anne Asbell
Period of Review Panel service: June 14, 1983 through November 2, 1996

Ms. Asbell was the second Chair of the Review Panel from January 1987 until her death, November 2, 1996. She served as the Legal Counsel for the Review Panel from 1983 until her appointment as Chair. She was an Associate Regional Counsel for the U.S. Environmental Protection Agency, Region IV, in Atlanta, Georgia. Ms. Asbell represented the Region in the litigation that led to the Consent Decree and the establishment of the Review Panel. She was actively involved in all aspects of the Review Panel activities and the implementation of the Consent Decree. Ms. Asbell had a juris doctor degree from Woodrow Wilson College of Law.

## Former Members

Tennessee Valley Authority

Mr. Bruce Brye
Period of Review Panel service: June 14, 1983 to December 31, 1990

During Mr. Brye's service as TVA's representative on the Review Panel, he also served as Chairman of Review Panel's Inspection Committee. Mr. Brye was a staff Environmental Engineer in the TVA's Division of Water Resources and served as TVA's senior technical expert on water quality issues. Since 1963, Mr. Brye has been involved in the environmental review , permitting, licensing, and litigation of many major TVA projects. During 1979-1980, Mr. Brye was extensively involved in the data acquisition activities for the DDTR studies of the environment in the Huntsville Spring Branch-Indian Creek System. During 1981-1983, he provided assistance to the U.S. Environmental Protection Agency and the Department of Justice in the development and review of technical documents during the negotiations which led to the final consent decree in U.S. vs. Olin Corporation. After his retirement from TVA in 1991, Mr. Brye was retained by the Review Panel as a consultant. Mr. Brye has a bachelor of arts in mathematics from Wartburg College, a bachelor of science in civil engineering (sanitary option) from the University of Iowa, and a master of science in sanitary engineering from the University of Iowa. He is a Diplomat in the American Academy of Environmental Engineers, a Certified Hazardous Materials Manager, and a registered professional engineer in 14 states including Alabama.

U.S. Fish and Wildlife Service

1. Mr. W. Waynon Johnson

Period of Review Panel service: June 14, 1983, to March 10, 1987
Mr. Johnson was the Senior Staff Specialist with the US FWS in Atlanta, Georgia.

2. Dr. Lee A. Barclay

Period of Review Panel service–March 10, 1987, to December 3, 1987
Dr. Barclay was the Environmental Contaminants Specialist with the US FWS in Cookville, Tennessee.

3. Dr. Donald P. Schultz

Period of Review Panel service: December 3, 1987 through June 15, 1990
Dr. Schultz was the contaminant coordinator for the Southeast Region of the U.S. FWS.

4. Mr. R. Mark Wilson

Period of Review Panel service: June 15, 1990-December 12, 1992
Mr. Wilson was the Environmental Contaminants Specialist with the US FWS in Cookville, Tennessee.

4. Dr. Charles Facemire

Period of Review Panel service: December 12, 1992 - July 15, 1993
Dr. Facemire was the Regional Contaminants Coordinator for U.S. Fish and Wildlife Service, Atlanta, Georgia during that time.

Department of the Army

1. Colonel Dahl J. Cento (Retired)

Period of Review Panel service: June 14, 1983 to October 30, 1985
Colonel Cento was the Deputy Post Commander of Redstone Arsenal during his Review Panel service. He was active in soliciting participation by the Corps of Engineers.

2. Colonel James A. Hall (Retired)

Period of Review Panel service–August 1986 to June 1988.
Colonel Hall was named Deputy Post Commander, Redstone Arsenal in August 1986.

3. Colonel Perry C. Butler (Retired)

Period of Review Panel service: July 1988 to July 1991.
Colonel Butler was assigned as Deputy Post Commander in July 1988.

4. Colonel Stephen Peter Moeller (Retired)

Period of Review Panel service: July 1994 to July 1996.
Colonel Moeller was assigned as Deputy Post Commander in June 1994.

5. Colonel Duane E. Brandt

Period of Review Panel service: July 1996 to July 1998.
Colonel Brandt was assigned as Deputy Post Commander, Redstone Arsenal, Alabama in July 1996.

## Former Non- Voting Review Panel Members

Olin Corporation

Mr. William G. McGlasson
Corporate Director, Environment, Health, & Safety
Olin Corporation
PO Box 248
Charleston, TN 37310

Phone: (423) 336-4734

Period of Review Panel service: 1990 to 1998

Mr. McGlasson was Corporate Director, Environmental, Health, and Safety for Olin Corporation and Olin's designated Program Coordinator for the implementation of the Consent Decree in U. S. vs. Olin Corporation from 1990 to 1998. He succeeded Mr. Verrill Norwood in July, 1990, who was Olin's primary technical representative in the negotiation of the Consent Decree and the development and implementation of the environmental remedy in the Huntsville Spring Branch-Indian Creek System. Mr. McGlasson served as Olin's non-voting member of the Review Panel from 1990 to until his retirement in 1998. During 22 years of service with Olin, Mr. McGlasson served in various technical and management positions within Olin Corporation. He has a Bachelor of Science degree in Chemical Engineering from the University of Missouri and a Master of Science degree in Chemical Engineering from Louisiana State University.

## Olin Advisor to the Technical Committee/Review Panel and Former Review Panel Participant

Mr. Verrill M. Norwood
Olin Consultant

116 Sunburst Lane NW
Cleveland, TN 37312

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Period of Review Panel service: 1983 to 1990

Mr. Norwood was Vice President, Environmental Affairs, for Pioneer Chlor Alkali and is retired. Previously, he was Vice President, Environmental Affairs, for Olin Corporation and Olin's designated Program Coordinator for the implementation of the Consent Decree in U. S. vs. Olin Corporation. He was Olin's primary technical representative in the negotiation of the Consent Decree. Mr. Norwood served as Olin's non-voting member of the Review Panel from its inception until he was succeeded by Mr. William G. McGlasson in July, 1990. Mr. Norwood has continued on a contract basis to be an advisor to Olin and participate in the Technical Committee and Review Panel meetings. Mr. Norwood has a Bachelor of Science degree in Chemical Engineering from the Massachusetts Institute of Technology and a Master of Science degree in Chemical and Metallurgical Engineering from University of Michigan.

# Appendix D. Inspection Committee Letter

# ADEM

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

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JAMES W. WARR
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FOB JAMES, JR.
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Laboratory: 277-6718
Education/Outreach: 213-4399


October 2, 1998

Dr. Edward S. Bender
Chair, Review Panel
U.S. EPA Headquarters
401 M Street, S.W.
Washington, DC 20460

Dear Dr. Bender:

This letter summarizes the observations and findings of the Review Panel Inspection Team for the calendar years 1991-1998. Since the last report of the Review Panel activities, the Inspection Team and others have made on-site reviews of the remediation site at least annually. Consistent with those reviews, our records reflect assessments of structural integrity were also performed in 1991, 1992, 1993, 1994, 1996, and 1998.

In my capacity as leader of the Inspection Team, I have reviewed the reports on structural integrity for the referenced years and find that a consistently applied assessment process reflects that natural succession has and is occurring without threatening the stability of the remedy. The area is now in an essentially natural state and I find no cause for concern relative to the integrity of the remediation. In fact, the most recent assessment suggests that intrusive actions may be necessary for access if reviews are to continue on an annual basis.

Sincerely,

James W. Warr
Director

JWW/rdg


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Mobile Branch – Coastal Section
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Mobile, Alabama 36615-1421
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(334) 432-6598 [Fax]

Appendix E. Olin Reports Submitted to the Review Panel

| Report Title | Date |
|---|---|
| Huntsville Quality Assurance/Method Equivalency Report | August 1, 1983 |
| Huntsville Quarterly Report No. 1 | September 1, 1983 |
| Huntsville Groundwater Report | November 17, 1983 |
| Huntsville Quarterly Report No. 2 | December 1, 1983 |
| Huntsville Analytical Methods Manual | February 22, 1984 |
| Huntsville Quarterly Report No. 3 | March 1, 1984 |
| Huntsville Quarterly Report No. 4 | June 1, 1984 |
| Huntsville Remedial Action Report | June 1, 1984 |
| Huntsville Quarterly Report No. 5 | September 1, 1984 |
| Huntsville Quarterly Report No. 6 | December 1, 1984 |
| HSB-IC Long-Term Data Acquisition Report | February 1, 1985 |
| Draft 404/26a Permit Application | February 5, 1985 |
| Huntsville Quarterly Report No. 7 | March 1, 1985 |
| Huntsville Engineering Quarterly Report No. 1 | March 1, 1985 |
| Huntsville Preliminary Engineering Drawings | April 1, 1985 |
| Second Draft 404/26a Permit Application | April 19, 1985 |
| A Cultural Resource Survey for the Huntsville Remedial Action Plan | May 13, 1985 |
| Huntsville Quarterly Report No. 8 | June 1, 1985 |
| Huntsville Engineering Quarterly Report No. 2 | June 1, 1985 |
| Final Engineering Drawings and Specifications | July 1, 1985 |
| 404/26a Permit Application | July 1, 1985 |
| Environmental Analysis for the Huntsville Remedial Action Plan | July 1, 1985 |
| Field and Laboratory Investigations of the HSB-IC System | July 1, 1985 |
| Report on DDT in HSBM 4.0 to 2.4 (Lower Reach A) | August 1, 1985 |
| HSB-IC Post Remedial Action Interim Goals | August 1, 1985 |
| Huntsville Quarterly Report No. 9 | September 1, 1985 |
| Huntsville Engineering Quarterly Report No. 3 | September 1, 1985 |
| Huntsville Groundwater Monitoring Program | November 20, 1985 |
| Springs Report | November 27, 1985 |
| Huntsville Quarterly Report No. 10 | December 1, 1985 |

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|---|---|
| Huntsville Engineering Quarterly Report No. 4 | December 1, 1985 |
| Huntsville Remedial Action Plan Policy and Procedures Manual | January 6, 1986 |
| Cultural Resources Survey Report (Oxbow Alternative) | January 7, 1986 |
| Assessment of Revegetation Needs for the Olin Corporation Huntsville Remedial Action Plan | January 15, 1986 |
| Final Engineering Drawings (Oxbow Alternative) | January 15, 1986 |
| Huntsville Quarterly Report No. 11 | March 1, 1986 |
| Huntsville Engineering Quarterly Report No. 5 | March 1, 1986 |
| HSB-IC Long-Term Data Acquisition Report | March 1, 1986 |
| HSB-IC Substitute Fish Species Report | March 1, 1986 |
| HSB-IC DDT in Fish and Water Baseline Report | March 1, 1986 |
| Huntsville Engineering Quarterly Report No. 6 | June 1, 1986 |
| 404/26a Permit Modification | June 26, 1986 |
| Catastrophic Subsidence Action Plan | July 30, 1986 |
| Draft 404/26a Permit Application (Lower Reach A) | August 18, 1986 |
| Huntsville Quarterly Report No. 12 (Semiannual No. 1) | September 1, 1986 |
| Huntsville Engineering Quarterly Report No. 7 | September 1, 1986 |
| Report on DDT in Reach B and Reach C of the HSB-IC System | September 1, 1986 |
| 404/26a Permit Application (Lower Reach A) | September 15, 1986 |
| Environmental Analysis for the Huntsville Remedial Action Plan (Lower Reach A) | September 15, 1986 |
| Preliminary Engineering Drawings (Lower Reach A) | October 1, 1986 |
| Technical Specifications for the Huntsville Remedial Action Plan (Lower Reach A) | October 1, 1986 |
| Cultural Resource Assessment (Lower Reach A) | October 15, 1986 |
| Endangered Species Monitoring Report | October 20, 1986 |
| Revised 404/26a Permit Application (Lower Reach A) | October 27, 1986 |
| Huntsville Engineering Quarterly Report No. 8 | December 1, 1986 |
| HSB-IC Long-Term Monitoring Program (Draft) | February 1, 1987 |
| Evaluation of Substitute Fish for Largemouth Bass | February 6, 1987 |
| Huntsville Semiannual Report No. 2 | March 1, 1987 |
| Huntsville Engineering Quarterly Report No. 9 | March 1, 1987 |
| HSB-IC Long-Term Monitoring Program (Draft) | May 5, 1987 |
| Huntsville Engineering Quarterly Report No. 10 | May 29, 1987 |
| HSB-IC Long-Term Monitoring Program | August 14, 1987 |
| Huntsville Engineering Quarterly Report No. 11 | August 27, 1987 |

| | |
|---|---|
| Huntsville Semiannual Report No. 3 | September 1, 1987 |
| Huntsville Project "As Built" Drawings | September 2, 1987 |
| Huntsville Engineering Quarterly Report No. 12 | December 8, 1987 |
| Huntsville Semiannual Report No. 4 | March 1, 1988 |
| Huntsville Semiannual Report No. 5 | September 1, 1988 |
| Huntsville Long-Term Monitoring Report No. 1 | April 15, 1989 |
| Huntsville Long-Term Monitoring Report No. 2 | April 15, 1990 |
| Huntsville Long-Term Monitoring Report No. 3 | April 15, 1991 |
| Huntsville Long-Term Monitoring Report No. 4 | April 15, 1992 |
| 1992 HSB-IC Interlaboratory Data Comparison | March 18, 1993 |
| Huntsville Long-Term Monitoring Report No. 5 | April 15, 1993 |
| 1993 HSB-IC Interlaboratory Data Comparison | May 11, 1994 |
| Huntsville Long-Term Monitoring Report No. 6 | June 1, 1994 |
| 1994 HSB-IC Interlaboratory Data Comparison | April 19, 1995 |
| Huntsville Long-Term Monitoring Report No. 7 | May 15, 1995 |
| Huntsville Quality Assurance Meeting | September 13, 1995 |
| 1995 HSB-IC Interlaboratory Data Comparison | April 30, 1996 |
| Report on Interlaboratory Quality Assurance and Quality Control | May 17, 1996 |
| Huntsville Long-Term Monitoring Report No. 8 | June 1, 1996 |
| Post Remediation Sediment Investigation – Reach A and Reach B | January 6, 1997 |
| 1996 HSB-IC Interlaboratory Data Comparison | March 17, 1997 |
| Huntsville Long-Term Monitoring Report No. 9 | May 15, 1997 |
| 1997 HSB-IC Interlaboratory Data Comparison | March 24, 1998 |
| Huntsville Long-Term Monitoring Report No. 10 | May 15, 1998 |
| Long-Term Monitoring Plan for Time Extension | February 1, 1999 |
| Interim Goals for Time Extension | February 1, 1999 |
| Contingency Plans for Time Extension | February 1, 1999 |

Appendix F. Decision Document No. 8,
Groundwater Monitoring, December 6, 1990

REVIEW PANEL DECISION DOCUMENT NUMBER 8
GROUNDWATER MONITORING

## I. Introduction

In the April 15, 1990 Long Term Monitoring Program Annual Report Number 2, Olin proposed to discontinue groundwater sample collection. Their proposal covers two sets of wells: a) Five existing groundwater wells on Redstone Arsenal and five public drinking water wells that were identified in the Technical Proposal to the Consent Decree; and b) Thirty seven wells, arranged in five traverses, across the filled channel of the remedial action site. These are referred to here as the "Technical Proposal" groundwater wells (or "Far Field wells") and the "Filled Channel" groundwater wells (or "Near Field wells") respectively.

The Consent Decree (paragraph 10) requires Olin to conduct groundwater studies as set forth in the Technical Proposal. These studies included monitoring water samples from prescribed wells before construction, during construction and every two years following construction of the remedial action. Groundwater sampling of the Technical Proposal wells would be discontinued after three consecutive samples confirmed no significant concentrations of DDT in the groundwater. Olin proposed that monitoring of the Technical Proposal wells would be discontinued because three consecutive samplings confirmed no significant concentratons of DDT in these wells.

A second groundwater monitoring program was developed by Olin at the request of the Review Panel to study the potential for DDT contamination and movement in the groundwater around the filled channel (HSBM 5.4 to 4.0). This program is described in the HSB-IC Long-Term Monitoring Program (August, 1987). Review Panel Decision Document No. 6 approved the program and established a schedule for monitoring each well. Initially, all thirty-seven wells were sampled quarterly and then in years 2,4,8, and 10 following construction of the remedial action. In Olin's April 1990 Report, Olin proposed discontinuing monitoring of the Filled Channel wells after year two.

## II. Decision

### A. Monitoring of the Technical Proposal ("Far Field") Wells

The decision of the Review Panel is to accept Olin's proposal for discontinuing the monitoring of the Technical Proposal groundwater wells. The Technical Committee of the Panel has reviewed the results of three years of sampling from these wells and agree that no significant DDT have been found in the public

water supplies. If DDT is found in the filled channel wells in the future, the Review Panel may require further sampling of specific Technical Proposal wells to evaluate the extent of migration.

B. Monitoring of the Filled Channel ("Near Field") Wells

The decision of the Review Panel is to discontinue monitoring of the Filled Channel wells in years 4 and 8 but to resume monitoring those wells for year 10 or during the year following the initial demonstration of attainment as specified in the Consent Decree. Olin shall also sample and analyze groundwater from all of the filled channel wells as part of the demonstration of continued attainment before the termination of the Consent Decree.

III. Conclusion

This decision document confirms the Review Panel's decision from its June 14, 1990 meeting. This document consists of 2 pages of text and comprises the Review Panel decision and is accepted and adopted by the representatives of the Review Panel member agencies and concurred in by the nonvoting participants as shown by the signatures affixed hereto.

MEMBERS

Ms. Anne L. Asbell
Chairperson, Review Panel

Dr. Donald P. Schultz
U.S. Fish and Wildlife Service

Dr. Edward S. Bender
EPA - Washington, D.C.

for Col. Charles Wood, U.S. Army, Redstone Arsenal

Bruce Brye
Tennessee Valley Authority

for James W. Warr
Alabama Department of Environmental Management

NONVOTING PARTICIPANTS

Honorable Clyde Foster
Town of Triana, Alabama

William G. McGlasson
Olin Corporation

DATED: Dec 6, 1990

Appendix G. Decision Document No. 9,
Process for Review of Monitoring Data and
Olin Notification of Compliance by the Technical Committee,
January 23, 1992.

REVIEW PANEL DECISION DOCUMENT NUMBER 9
PROCESS FOR REVIEW OF MONITORING DATA
AND OLIN NOTIFICATIONS OF COMPLIANCE
BY THE TECHNICAL COMMITTEE

## I. Introduction

Pursuant to the requirements of the Consent Decree, U.S. vs. Olin Corp., May 31, 1983, the Review Panel is authorized to review the remedial action implemented by Olin and determine whether the remedy has achieved compliance with the Performance Standard consistent with the goals and objectives of the Consent Decree. The Review Panel may review a variety of information and data to assess the adequacy of the remedy and compliance with the Performance Standard, including the Long-Term Monitoring Reports (Decision Document No. 6) and the Interim Goals (Decision Document No. 5).

The Review Panel established a Technical Committee to advise it on technical issues related to the development and implementation of a remedial action and the monitoring of its efficacy. The Technical Committee has met regularly to evaluate the data presented by Olin and has applied sound analytical and technical principles to the task. The Technical Committee recommended revisions to the quality assurance and quality control (QA/QC) plan developed as part of the Joint Technical Proposal to the Consent Decree, which were incorporated into the QA/QC requirements through Decision Document Number 7. During reviews of the long-term monitoring programs data, the Technical Committee has observed instances when it would be appropriate for them to have guidance and principles for their evaluations of the data. As a result, the following areas will be addressed in this Review Panel document to aid the Technical Committee in its review of the data presented by Olin:

1. What data should be available to determine compliance with the Performance Standard consistent with the goals of the Consent Decree?

2. What principles should be applied to evaluate the quality of that data?

3. What procedures should be followed to evaluate the data and what factors should be considered to provide technical assistance and recommendations to the Review Panel?

The purpose of this document is to provide the Review Panel's guidance to the Technical Committee on how to address these questions and provide recommendations to the Review Panel

for its consideration and decision.

II. Decision:

The decision of the Review Panel is that both the Review Panel and the Technical Committee will continue to receive information and data from Olin as set forth below. Further, the Technical Committee will continue to apply sound analytical and technical principles to evaluate the data and advise the Review Panel on the status of the remedial action in attaining and/or maintaining compliance with the Consent Decree.

A. Data to Evaluate Compliance

1. The Technical Committee and the Review Panel members will continue to receive information and monitoring data from Olin as part of the regular monitoring programs (Decision Documents No. 6, 7, and 8). A partial list of the information that Olin will be reporting in the Annual Report starting with the report due April 15, 1992, is presented in Appendix A. In addition, Olin has conducted and will conduct special studies to investigate particular aspects of the remedy (e.g., Decision Documents No. 2 on Baseline Data, Substitute Species and Interim Goals for Fish and Water, and No. 7 on Quality Assurance and Fish Sample Sizes) either on its own initiative, at the request of the Technical Committee or the Review Panel. From time to time, the Technical Committee and Olin may recommend modifications to the monitoring program or modifications to the analysis and presentation of data that are consistent with the Performance Standard, the goals and objectives of the Consent Decree, the Joint Technical Proposal, and the Decision Documents approved by the Review Panel. Additional monitoring and data analysis by Olin will depend upon the results of the monitoring information and the Technical Committee's recommendations.

2. The Technical Committee, with the concurrence of the Review Panel, has determined that detailed sediment mapping of the HSB-IC system is needed to review the remedial action. Sediment mapping will establish the areas of sediment deposition and erosion which exist following implementation of the remedial action and following major hydrologic events. This baseline and future sediment mapping will permit the Review Panel to make informed decisions on the stability and long-term integrity of the remedial action (especially in Reaches B and C). Detailed mapping should be compared to previous transects surveyed by Olin. Such comparisons and in conjunction with periodic updated mapping will permit the Review Panel to determine which areas are erosional and which are depositional. Olin

has agreed to conduct such mapping during 1992 to establish post-remedial action baseline conditions and at appropriate intervals thereafter to account for the effects of major flood or hydrologic events (e.g., 25 year headwater flood) on sediment profiles. If such events do not occur, then this data should be collected prior to the final demonstration of continued attainment and again prior to the termination of the Consent Decree.

B. Data Evaluation Principles

The following principles will be used to review monitoring data and information submitted for the remedial action program on the HSB-IC system.

1. The Consent Decree, the Joint Technical Proposal, and the Review Panel Decision Documents will continue to serve as the basis for all procedures and requirements.

2. The Review Panel is charged with the authority to determine compliance with the provisions of the Consent Decree. The Review Panel may exercise its authority to modify the remedial action, develop or modify implementation schedules, and require additional monitoring and studies from Olin.

3. Trends in long-term monitoring are of prime importance, in evaluating the efficacy of the remedial action. Standardized methodologies established at the outset of the Consent Decree will be maintained as long as monitoring is required so that comparability with the baseline conditions is maintained.

4. Sampling, analysis, and data interpretation will follow standard methods and QA/QC procedures as outlined in the reference documents or as modified by any subsequent Review Panel decisions.

5. All monitoring data collected will be retained and reported. Technical justification for rejection of any monitoring data collected must be well documented.

6. The remedial action must achieve compliance with the Performance Standard for DDT[1] levels in channel catfish, largemouth bass, and smallmouth buffalo consistent with the goals and objectives of the Consent Decree.

---

[1] DDT is defined in the consent decree as the sum of isomers and degradation products of DDT; including p,p'- and o,p'- DDT, DDD, and DDE.

7. All methods of data evaluation will be considered which are appropriate for the interpretation of the data developed under the Consent Decree.

C. Procedures for Review and Evaluation of Monitoring Data

1. Each year, following the submission of the Long-Term Monitoring Report, the Technical Committee, on behalf of the Review Panel, will review the data and any recommendation from Olin that compliance has been attained or continued to be attained for any performance standard fish species. The Technical Committee will review the data and recommendation for completeness, quality assurance certification, and accuracy.

2. The Technical Committee review will include considerations of the trends in DDT levels, requirements for additional monitoring by Olin, supplemental data from participating agencies, and modifications to the monitoring program or construction and implementation schedules as approved by the Review Panel.

a. Changes in Fish DDT Levels. The Review Panel recognizes that DDT residues are highly variable among individual fish and, therefore, reserves the option to focus on the long-term trend(s) of this contaminant in the community of fish within the specified study reaches. If the Technical Committee determines it is appropriate, it may utilize other measures of central tendency (e.g., geometric means, medians) or pool data among reaches to evaluate the effect of individual fish on the arithmetic average.

b. Partitioning of DDT among various media. A dynamic relationship exists between the levels of DDT in sediment, suspended sediments, water, and fish tissue. Fish residues are also influenced by the level of DDT in the food, percent of lipids, age, feeding behavior, and movements in and out of contaminated areas. In reviewing trends of DDT concentrations in fish tissue, the Technical Committee will compare the levels of DDT in various media with the levels of DDT in each Performance Standard fish species. Although the level of DDT in any one medium (water or sediment) is expected to vary, it will be used as one indication of the efficacy of the remedial action. The Committee will also examine relationships between DDT residues in fish and percent lipids in the filet, age of the fish and the level of DDT in filets, and the percent of each isomer in the total DDT level using data and analyses provided by Olin.

c. Use of resampling, reanalysis, or additional studies for continued attainment. Following the attainment of the Performance Standard, the Technical Committee may require additional information to evaluate changes in DDT levels. For example, it may recommend that QA/QC split sample analysis be conducted for all performance standard fish of concern in each reach after the initial attainment of the Performance Standard. It may also recommend that larger sample sizes be collected, particular fish be reanalyzed, or that the age of all fish be verified. After the Performance Standard has been met for three consecutive years (by species and reach) collection and analysis may be discontinued but all samples collected shall be maintained in a repository.

d. Use of data from other sources. The Technical Committee may use monitoring data from other sources to evaluate changes in DDT levels in the HSB-IC system; however, analytical measurements must be supported by evidence of strict protocols and QA/QC must be demonstrated to be equivalent to that required of Olin. Any discrepancies in collection of samples, preparation of tissues for extraction, or analytical procedures must be justified to the Technical Committee.

e. Data analysis and presentation. The Technical Committee may consider other statistical analyses of the Olin data sets (e.g., geometric means, medians), pooling of the reach data, and testing the means for sensitivity to individual data points to determine trends and patterns of the monitoring results.

D. Evaluation of the Remedial Action

1. The Technical Committee will advise the Review Panel if, based on their review of the data and the notification of compliance, they believe that the Performance Standard was attained and/or continued to be attained in a manner consistent with the goals and objectives of the Consent Decree.

a. If the Technical Committee finds that the Performance Standard has been attained consistent with the goals and objectives of the Consent Decree, the Technical Committee may advise the Review Panel whether or not they believe the Performance Standard will continue to be met consistent with the requirements of the Consent Decree as well as document the basis for such determination.

b. If the Technical Committee finds that the Performance Standard is not being attained, but that the remedial action is consistent with the goals and objectives of the Consent Decree, they will advise the Review Panel whether or not they believe the remedial action can attain the Performance Standard over a longer period of time and whether or not further remedies are necessary.

c. If the Technical Committee finds that the end of the compliance period is reached without DDT levels in fish having reached the Performance Standard for all of the required species within all study reaches as specified in the consent decree, it may recommend: extending the compliance period, further sampling to define/refine any trends, or other options, consistent with the procedures set forth in the Consent Decree.

2. Following a determination of compliance with the Performance Standard for channel catfish, largemouth bass, and smallmouth buffalo, consistent with the goals and objectives of the Consent Decree discussed in paragraph D.1 of this document, Olin shall submit to the Review Panel a proposed list of future monitoring activities, DDT measurements, studies, and other information by which Olin would demonstrate that the remedy has provided, is providing and will continue to provide achievement of the Performance Standard once the Consent Decree terminates.

a. The Technical Committee will review the proposal of monitoring activities and advise the Review Panel on its adequacy and/or recommend modifications to the proposal. The proposal should explain how the future monitoring activities, studies, and information will be integrated with existing data.

b. The Technical Committee will seek to coordinate the monitoring activities of DDT in HSB-IC among the members, agencies and Olin to minimize duplicative requirements.

3. Following the approval and implementation of the monitoring activities and data collection discussed under paragraph D.2 of this document, the Review Panel and the Technical Committee will review this information for compliance with paragraph 54 of the Consent Decree.

## III. Conclusion

This decision document is the Review Panel's decision from its January 23, 1992 meeting. This document consists of 7 pages of text and one appendix of three pages and comprises the Review Panel decision. It is accepted and adopted by the representatives of the Review Panel member agencies and concurred in by the nonvoting participants as shown by the signatures affixed hereto.

**MEMBERS**

Anne L. Asbell
Chairperson, Review Panel

R. Mark Wilson
U.S. Fish and Wildlife Service

Dr. Edward S. Bender
EPA - Washington, D.C.

Col. Joseph M. Mabry
U.S. Army, Redstone Arsenal

Robert J. Pryor
Tennessee Valley Authority

James W. Warr
Alabama Department of Environmental Management

**NONVOTING PARTICIPANTS**

Honorable Clyde Foster
Town of Triana, Alabama

William G. McGlasson
Olin Corporation

**DATED:** JAN 23 1992

Review Panel Decision Document No. 9

Appendix A

Long Term Monitoring Data Reporting

Review Panel Decision Document No. 6, as amended, requires the submission of an annual report describing the previous year's activities and the data collected. The types of information and environmental data which are reported are described in the following sections. Some additional data which are being reported for the first time in 1992 and they are marked with an asterisk.

1. Fish Monitoring Program

The fish monitoring program consists of the collection of performance standard fish, substitute fish, and other fish species in the spring and a collection of young-of-year performance standard fish in the fall. General data to be reported includes species of fish, numbers of fish collected, field observations and water quality data (pH, dissolved oxygen and water temperature).

a. Individual fish data to be reported include:

-length
-weight
-filet weight
-total DDT in filet
-DDT isomers in filet
-lipids in filet
-location of capture
-date of capture

b. Additional data on the performance standard fish collected in the spring include:

-age(either using standard aging techniques or length-weight relationships)*
-condition factor*

2. Surface Water Monitoring Program

The surface water monitoring program consists of semi-annual water sampling and velocity-discharge measurements. General data to be reported include stage elevation, water quality (pH, dissolved oxygen and water temperature), flowrate, flow velocity and direction, and field observations.

Individual sample data to be reported include:
-sample location

-sample date and time
-total DDT
-filterable DDT
-total suspended solids
-total organic carbon (3 sampling locations only)

3. Other Environmental Studies

Other monitoring studies may be conducted. These may include daily water sampling, macroinvertebrate studies and sediment sampling. Data to be reported will vary from study to study but will generally include:

-samples collected
-measurements made
-sample/measurement location
-time and date of sampling/measurements
-analytical data (DDT, moisture, etc. as applicable)

4. Quality Assurance/Quality Control Data

All field sampling and laboratory analyses include a quality assurance program. Data generated for quality assurance purposes will also be reported. These data include field, intralaboratory and interlaboratory data such as:

-split sample results
-spike sample results
-duplicate sample results
-SRM sample results

5. Data Evaluation

Data evaluation will utilize statistical analysis to describe the data collected for fish, water and other media.

a. Analysis of Fish Data

Analysis of fish data will include the following:

-DDT by reach by species
-DDT by system by species
-DDT by age class by species *
-DDT by lipid content by species*

b. Statistics and Comparisons

Various statistical parameters will be determined and presented where appropriate for fish and other data. These

include:

-arithmetic mean
-geometric mean*
-median*
-standard deviation
-range
-sample size
-statistical distribution
-other evaluations to describe the data

Comparisons of data to baseline values and previous sampling years will be presented. Trends in data will be evaluated by reach and by species for fish data. Trends in water and sediment data will also be compared where appropriate.

c. Water Data Evaluation

Evaluation of water data will include:

-DDT concentrations by site
-DDT transport by site
-total suspended sediment concentrations by site
-suspended sediment transport by site

Trends and comparisons of water quality data including DDT concentrations to past data and baseline data will be presented.

d. Quality Assurance Evaluations

Evaluation of the quality assurance data will also be presented. Both intralaboratory and interlaboratory data will be evaluated for accuracy and precision. The referee laboratory's certification will also be included.

# Appendix H. Decision Document No. 10, Process for Review of Olin's Notifications of Continued Attainment by the Technical Committee

Decision Document 10-Appendix A , Finding of Continued Attainment, Largemouth Bass, Reach C, January 19, 1995.

Decision Document 10-Appendix B, Finding of Continued Attainment Largemouth Bass, Reach A, July 20, 1995.

Decision Document 10-Appendix C, Finding of Continued Attainment Largemouth Bass, Reach B, July 20, 1995

**REVIEW PANEL DECISION DOCUMENT NUMBER 10**
**PROCESS FOR REVIEW OF OLIN'S NOTIFICATIONS OF CONTINUED ATTAINMENT BY THE TECHNICAL COMMITTEE**

## I. Introduction

Pursuant to the requirements of the Consent Decree, U.S. vs. Olin Corp., May 31, 1983, the Review Panel is authorized to review the remedial action implemented by Olin and determine whether the remedy has achieved compliance with the performance standard consistent with the goals and objectives of the Consent Decree. The Review Panel may review all significant information and supporting data to assess the adequacy of the remedy and compliance with the performance standard, including the Long-Term Monitoring Reports (Decision Document No. 6), the Interim Goals (Decision Document No. 5), and advice and data evaluations from the Technical Committee (Decision Document No. 9).

Pursuant to the Consent Decree and Decision Documents No. 6 and No. 9, Olin will notify the Review Panel and the Technical Committee when Olin determines that it has attained the performance standard and when it has demonstrated continued attainment of the performance standard. The Joint Technical Proposal to Implement Remedial Activities Pursuant to Consent Decree at Section 7.3.2, Measurement of Performance Standard, defines Attainment and Continued Attainment as follows:

> **The performance standard is a DDT level of 5 ppm in fillets of channel catfish, largemouth bass and smallmouth buffalo in Reaches A, B, and C. Olin shall be deemed to "attain the performance standard" when the average DDT concentration in the fillets of each of the aforementioned fish species is five ppm (or less) in Reaches A, B, and C. "Continued attainment of the performance standard" occurs when the average DDT concentration in the fillets of each of the aforementioned fish species is five ppm (or less) for three (3) consecutive years (including year of Attainment) in Reaches A, B, and C.**

On behalf of the Review Panel, the Technical Committee will evaluate Olin's notification of attainment and continued attainment of the performance standard for each species in each Reach and determine if attainment and continued attainment of the Performance Standard have been satisfactorily demonstrated for purposes of compliance with the Consent Decree and will make recommendations to the Review Panel. The process for the Technical Committee review of the monitoring data, other appropriate factors, and recommendations to the Review Panel is described in Decision Document No. 9.

The purpose of this document is to establish procedures for recording the Decisions of the Review Panel relative to attainment and continued attainment of the performance standard. The procedures are intended to provide guidance for consistent reviews and to document the rationale for the decisions in one easily accessible location. In that spirit, all future "continued attainment" Decisions will be added as appendices to Decision Document No. 10.

II. Decision The decision of the Review Panel is:

A. The Technical Committee will review Olin's notification of attainment and continued attainment of the performance standard and supporting data. Through the application of sound analytical and technical principles, the Technical Committee will evaluate the data and advise the Review Panel on the status of the remedial action in attaining and/or demonstrating continued attainment with the performance standard. Following this evaluation, the Technical Committee will make recommendations to the Review Panel on the continued attainment demonstration for each species in each Reach and recommend preparation of an appendix to Decision Document No. 10.

B. The Review Panel will review the recommendations of the Technical Committee and make a decision as to the demonstration of continued attainment of the performance standard.

C. The Review Panel will acknowledge the notification of the attainment of the performance standard for a species in the Minutes of the Review Panel meeting.

D. Decisions related to continued attainment of the performance standard will be documented in signed appendices to this Decision Document. Each appendix will identify the notification, the supporting data from Olin including the EPA Certification of the data set, and any recommendations of the Review Panel for additional monitoring or modifications to the remedial action plan.

E. Once the Review Panel determines that continued attainment has been achieved for a performance standard species in a particular Reach, compliance for that species in that Reach will not be reevaluated until the seventh year of the seven year period prior to termination of the Consent Decree. Olin may continue to monitor that species in that Reach for informational purposes and will report the results of any informational monitoring to the Review Panel in the Annual Report.

## III. Conclusion

This Decision Document confirms the Review Panel decision at its July 21, 1994 meeting. This document consists of three pages of text and Appendix A with four Attachments and comprises the Review Panel decision. Appendices for subsequent determinations of continued attainment of the performance standard will be attached and incorporated herein as they are developed, approved, and signed by the Review Panel. Acceptance and adoption of this document by the representatives of the Review Panel member agencies and concurrence by the nonvoting participants are shown by the signatures affixed hereto.

MEMBERS

Anne L. Asbell
Chairperson, Review Panel

Dr. W. Allen Robison
U.S. Fish and Wildlife Service

Dr. Edward S. Bender
EPA - Washington, D.C.

Col. Stephen P. Moeller
U.S. Army, Redstone Arsenal

Robert J. Pryor
Tennessee Valley Authority

James W. Warr
Alabama Department of Environmental Management

NONVOTING PARTICIPANTS

Honorable Clyde Foster
Town of Triana, Alabama

William G. McGlasson
Olin Corporation

DATED: JAN 19 1995

# Review Panel Decision Document No. 10

## Appendix A

## Finding of Continued Attainment
## Largemouth Bass, Reach C

### I. Introduction

Pursuant to the requirements of the Consent Decree, U.S. vs. Olin Corp., May 31, 1983, the Review Panel is authorized to review the remedial action implemented by Olin and determine whether the remedy has achieved compliance with the performance standard consistent with the goals and objectives of the Consent Decree. This Appendix documents the Decision of the Review Panel regarding Olin's demonstration of continued attainment of the performance standard for Largemouth bass in Reach C.

### II. Findings of the Review Panel

A. Notification: Olin provided notification that Largemouth bass had demonstrated continued attainment of the performance standard of 5 ppm DDT in Reach C on June 1, 1994 in Annual Report Number 6 for the Huntsville Spring Branch Indian Creek Long-Term Monitoring Program. The data showing DDT concentrations in Largemouth bass by Year are presented on Table 22 of the June 1, 1994 Report (copy of Table 22 is attached hereto and incorporated herein).

B. Data: The Technical Committee reviewed the data and determined that the average DDT concentrations in fillets of Largemouth bass in Reach C have been less than 5 parts per million for four consecutive years, based on data from annual fish collections from 1990 through 1993.

C. Quality Assurance Evaluations: The EPA referee laboratory Certifications for each set of data are attached to this Appendix A and confirm that the data are acceptable for use in determining achievement of the performance standard set forth in the Consent Decree.

D. Recommendations for Further Studies or Analysis: There are no recommendations for further study or analysis by Olin at this time.

III. Decision

The Review Panel has evaluated the recommendation of the Technical Committee and determined that the data provided by Olin for Largemouth bass for DDT concentrations in fillets demonstrate continued attainment with the performance standard of 5 parts per million for Largemouth bass in Reach C.

IV. Conclusion

This decision document confirms the Review Panel decision at its July 21, 1994 meeting. This document consists of two pages of text and four attachments and comprises the Review Panel decision. Acceptance and adoption of this document by the representatives of the Review Panel member agencies and concurrence by the nonvoting participants are shown by the signatures affixed hereto.

MEMBERS

Anne L. Asbell
Chairperson, Review Panel

Dr. W. Allen Robison
U.S. Fish and Wildlife Service

Dr. Edward S. Bender
EPA - Washington, D.C.

Col. Stephen P. Moeller
U.S. Army, Redstone Arsenal

Robert J. Pryor
Tennessee Valley Authority

James W. Warr
Alabama Department of Environmental Management

NONVOTING PARTICIPANTS

Honorable Clyde Foster
Town of Triana, Alabama

William G. McGlasson
Olin Corporation

DATED: AUG 19 1995

## TABLE 22

### AVERAGE DDT CONCENTRATIONS IN FISH BY YEAR

### LARGEMOUTH BASS

| Reach | Parameter | Baseline* | Year 1 1988 | Year 2 1989 | Year 3 1990 | Year 4 1991 | Year 5 1992 | Year 6 1993 |
|---|---|---|---|---|---|---|---|---|
| A | n | 21 | 10 | 17 | 18 | 14 | 11 | 10 |
| | ave | 7.1 | 5.6 | 4.9 | 4.3 | 9.7 | 1.5 | 1.2 |
| | s.d. | 7.8 | 5.5 | 4.1 | 4.2 | 6.8 | 2.4 | 1.3 |
| | min | 1.2 | .7 | 0.2U | 0.11J | 2.0 | 0.27 | 0.13 |
| | max | 28 | 16 | 15 | 16 | 23 | 8.0 | 3.8 |
| B | n | 3 | 9 | 13 | 14 | 10 | 18 | 15 |
| | ave | 37 | 5.0 | 2.2 | 3.7 | 9.5 | 1.3 | 3.8 |
| | s.d. | 11 | 8.5 | 2.4 | 4.0 | 5.6 | 1.4 | 3.5 |
| | min | 28 | 0.4 | 0.2U | 0.45 | 2.3 | 0.03U | 0.08 |
| | max | 49 | 27 | 8.8 | 16 | 21 | 5.6 | 14 |
| C | n | 34 | 17 | 26 | 14 | 13 | 26 | 12 |
| | ave | 8.2 | 2.7 | 6.4 | 2.4 | 4.9 | 0.78 | 1.4 |
| | s.d. | 6.0 | 4.8 | 13 | 1.4 | 3.7 | 0.89 | 1.7 |
| | min | 1.2 | 0.2 | 0.2U | 0.64 | 0.03U | 0.03U | 0.50 |
| | max | 24 | 16 | 56 | 5.0 | 12 | 4.0 | 6.8 |

* Decison Document No. 2 [1982-1985 Fish Collection (Year Group II-V)]
DDT concentrations are ppm (mg/kg) in filets

n is number of samples analyzed
ave is average DDT concentration (ppm) of samples analyzed
s.d. is standard deviation of the DDT concentrations (ppm)
min is the minimum DDT concentration (ppm) analyzed
max is the maximum DDT concentration (ppm) analyzed

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA 30613

May 25, 1994

4ES-AS-LES

SUBJECT: Huntsville DDT Project

FROM: H. Lavon Revells HLR
Senior Staff Specialist
Analytical Support Branch

TO: Anne Asbell 6/1/94
Office of Regional Counsel

I have reviewed the fish inter-laboratory comparison data for the 1993 Huntsville DDT Project and find it acceptable. There were 38 fish samples split with EPA as the Referee laboratory and Olin-Charleston as the Primary laboratory. The average % RSD was 18.8, which is well within the required % RSD of 30. However, a data bias check performed by Keith Roberts determined that there was bias between laboratories. Of the 38 split samples, Olin's results were less than EPA's for 32 of them. Keith Roberts and I have begun studies to determine the cause of this difference.

cc: Dr. Edward Bender (1400F, HDQTR)
Mr. Keith Roberts (Olin-Charleston)
James Finger (ESD)
Wade Knight (ESD)

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA

AUGUST 17, 1994

4ES-AS-LES

MEMORANDUM

SUBJECT: OLIN'S 1991 AND 1992 FISH MONITORING DATA

FROM: Lavon Revells, Chemist HAR
Senior Staff Specialist

TO: Anne L. Asbell 8/17/94
Chairperson, Review Panel

As you know, Olin's 1991 and 1992 fish monitoring data were flagged because the percent relative standard deviation (%RSD) of split fish sample results between Olin and EPA Region IV Laboratories was greater than the target goal of 30. Since the reporting of the 1991 fish data, representatives from our EPA laboratory and Olin's primary and secondary laboratories had several meetings and discussions in an effort to determine the cause of the high %RSD. As a result of these discussions, a series of studies were designed and conducted to identify the problem areas. While all laboratories were using the same analytical method, the studies indicated that slight variations in laboratory procedures could give different results. For this reason, the procedures were standardized and incorporated into the method. Subsequently, thirty fish samples representing the 1991 and 1992 fish collection were split between the three laboratories and analyzed according to the standardized procedures. All samples that had results greater than 5 PPM DDT met the goal of 30% RSD between Olin's primary and EPA Laboratories.

The Technical Committee in it's July 1993 meeting recommended that other QC parameters in addition to %RSD be used in evaluating fish monitoring data. The Committee agreed that 30% RSD is not as important, if the sample results from the Olin and EPA laboratories are below 5 PPM DDT.

After reviewing the analytical data and the conclusions of the Technical Committee, I concur with the recommendation of the Technical Committee and the decision of the Review Panel to remove the asterisk from the 1991 and 1992 fish data. The data are appropriate for use by the Review Panel in making decisions regarding compliance with the performance standard of 5 PPM DDT in fillets of performance standard fish.

FIGURE 3

EPA QUALITY ASSURANCE DATA CERTIFICATION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA 30613

March 11, 1991

Anne Asbell
US Environmental Protection Agency
Office of Regional Counsel
345 Courtland St. NE
Atlanta, GA 30365

Dear Anne,

I have reviewed the fish inter-laboratory comparison data for the 1990 Huntsville DDT Project and find it acceptable. There were 26 fish samples split with EPA as the Referee lab and Olin-Charleston as the Primary lab. The average %RSD was 25%, which is quite acceptable for fish tissue split samples. Also, a data bias check performed by Keith Roberts determined that there was no bias between labs.

Sincerely yours,

E. William Loy, Jr., Chemist
Analytical Support Branch

cc: Keith Roberts, Olin-Charleston

Review Panel Decision Document No. 10

Appendix B

Finding of Continued Attainment
Largemouth Bass, Reach A

I. Introduction

Pursuant to the requirements of the Consent Decree, U.S. vs. Olin Corp., May 31, 1983, the Review Panel is authorized to review the remedial action implemented by Olin and determine whether the remedy has achieved compliance with the performance standard consistent with the goals and objectives of the Consent Decree. This Appendix documents the Decision of the Review Panel regarding Olin's demonstration of continued attainment of the performance standard for Largemouth bass in Reach A.

II. Findings of the Review Panel

A. Notification: Olin provided notification that Largemouth bass had demonstrated continued attainment of the performance standard of 5 ppm DDT in Reach A on May 15, 1995 in Annual Report Number 7 for the Huntsville Spring Branch Indian Creek Long-Term Monitoring Program. The data showing DDT concentrations in Largemouth bass by Year are presented on Table 22 of the May 15, 1995 Report (copy of Table 22 is attached hereto and incorporated herein).

B. Data: The Technical Committee reviewed the data and determined that the average DDT concentrations in fillets of Largemouth bass in Reach A have been less than 5 parts per million for three consecutive years, based on data from annual fish collections from 1992 through 1994.

C. Quality Assurance Evaluations: The EPA referee laboratory Certifications for each set of data are attached to this Appendix B and confirm that the data are acceptable for use in determining achievement of the performance standard set forth in the Consent Decree.

D. Recommendations for Further Studies or Analysis: There are no recommendations for further study or analysis by Olin at this time.

III. Decision

The Review Panel has evaluated the recommendation of the Technical Committee and determined that the data provided by Olin for Largemouth bass for DDT concentrations in fillets demonstrate continued attainment with the performance standard of 5 parts per million for Largemouth bass in Reach A.

IV. Conclusion

This decision document confirms the Review Panel decision at its July 20, 1995 meeting. This document consists of two pages of text and four attachments and comprises the Review Panel decision. Acceptance and adoption of this document by the representatives of the Review Panel member agencies and concurrence by the nonvoting participants are shown by the signatures affixed hereto.

MEMBERS

Anne L. Asbell
Chairperson, Review Panel

Dr. W. Allen Robison
U.S. Fish and Wildlife Service

Dr. Edward S. Bender
EPA - Washington, D.C.

Col. Stephen P. Moeller
U.S. Army, Redstone Arsenal

Robert J. Pryor
Tennessee Valley Authority

James W. Warr
Alabama Department of Environmental Management

NONVOTING PARTICIPANTS

Honorable Clyde Foster
Town of Triana, Alabama

William G. McGlasson
Olin Corporation

DATED: JUL 20 1995

## TABLE 22

## AVERAGE DDT CONCENTRATIONS IN FISH BY YEAR

## LARGEMOUTH BASS

| Reach | Parameter | Baseline* | Year 1 1988 | Year 2 1989 | Year 3 1990 | Year 4 1991 | Year 5 1992 | Year 6 1993 | Year 7 1994 |
|---|---|---|---|---|---|---|---|---|---|
| A | n | 21 | 10 | 17 | 18 | 14 | 11 | 10 | 17 |
| | ave | 7.1 | 5.6 | 4.9 | 4.3 | 9.7 | 1.5 | 1.2 | 1.6 |
| | s.d. | 7.8 | 5.5 | 4.1 | 4.2 | 6.8 | 2.4 | 1.3 | 1.7 |
| | min | 1.2 | .7 | 0.2U | 0.11J | 2.0 | 0.27 | 0.13 | 0.03U |
| | max | 28 | 16 | 15 | 16 | 23 | 8.0 | 3.8 | 5.6 |
| B | n | 3 | 9 | 13 | 14 | 10 | 18 | 15 | 12 |
| | ave | 37 | 5.0 | 2.2 | 3.7 | 9.5 | 1.3 | 3.8 | 1.9 |
| | s.d. | 11 | 8.5 | 2.4 | 4.0 | 5.6 | 1.4 | 3.5 | 2.3 |
| | min | 28 | 0.4 | 0.2U | 0.45 | 2.3 | 0.03U | 0.08 | 0.03U |
| | max | 49 | 27 | 8.8 | 16 | 21 | 5.6 | 14 | 8.2 |
| C | n | 34 | 17 | 26 | 14 | 13 | 26 | 12 | 15 |
| | ave | 8.2 | 2.7 | 6.4 | 2.4 | 4.9 | 0.78 | 1.4 | 1.1 |
| | s.d. | 6.0 | 4.8 | 13 | 1.4 | 3.7 | 0.89 | 1.7 | 1.1 |
| | min | 1.2 | 0.2 | 0.2U | 0.64 | 0.03U | 0.03U | 0.50 | 0.03U |
| | max | 24 | 16 | 56 | 5.0 | 12 | 4.0 | 6.8 | 3.8 |

DDT concentrations are ppm (mg/kg) in fillets

* Decison Document No. 2 [1982-1985 Fish Collection (Year Group II-V)]

n is number of samples analyzed
ave is average DDT concentration (mg/kg) of samples analyzed
s.d. is standard deviation of the DDT concentrations (mg/kg)
min is the minimum DDT concentration (mg/kg) analyzed
max is the maximum DDT concentration (mg/kg) analyzed

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA 30613

MAY 03 1995

4ES-AS-OCS

MEMORANDUM

SUBJECT: Huntsville DDT Project, 1994

FROM: H. Lavon Revells HLR
Senior Staff Specialist
Analytical Support Branch

TO: Anne Asbell 5/10/95
Office of Regional Counsel

I have reviewed the fish inter-laboratory comparison data for the 1994 Huntsville DDT project and find it acceptable. There were 37 fish samples split with EPA as the Referee laboratory and Olin-Charleston as the Primary laboratory. The average % RSD was 18.1, which is well within the required 30% RSD. Also, a data bias check performed by Keith Roberts determined that there was bias between laboratories. However, this appears to be a minor problem at this time.

cc: Dr. Edward Bender (1400F, HDQTR)
Mr. Keith Roberts (Olin-Charleston)
Mr. Russell Wright (ESD)
Mr. Charles Hooper (ESD)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA 30613

May 25, 1994

4ES-AS-LES

SUBJECT: Huntsville DDT Project

FROM: H. Lavon Revells HLR
Senior Staff Specialist
Analytical Support Branch

TO: Anne Asbell 6/1/94
Office of Regional Counsel

I have reviewed the fish inter-laboratory comparison data for the 1993 Huntsville DDT Project and find it acceptable. There were 38 fish samples split with EPA as the Referee laboratory and Olin-Charleston as the Primary laboratory. The average % RSD was 18.8, which is well within the required % RSD of 30. However, a data bias check performed by Keith Roberts determined that there was bias between laboratories. Of the 38 split samples, Olin's results were less than EPA's for 32 of them. Keith Roberts and I have begun studies to determine the cause of this difference.

cc: Dr. Edward Bender (1400F, HDQTR)
Mr. Keith Roberts (Olin-Charleston)
James Finger (ESD)
Wade Knight (ESD)

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA

AUGUST 17, 1994

4ES-AS-LES

MEMORANDUM

SUBJECT: OLIN'S 1991 AND 1992 FISH MONITORING DATA

FROM: Lavon Revells, Chemist HLR
Senior Staff Specialist

TO: Anne L. Asbell 8/17/94
Chairperson, Review Panel

As you know, Olin's 1991 and 1992 fish monitoring data were flagged because the percent relative standard deviation (%RSD) of split fish sample results between Olin and EPA Region IV Laboratories was greater than the target goal of 30. Since the reporting of the 1991 fish data, representatives from our EPA laboratory and Olin's primary and secondary laboratories had several meetings and discussions in an effort to determine the cause of the high %RSD. As a result of these discussions, a series of studies were designed and conducted to identify the problem areas. While all laboratories were using the same analytical method, the studies indicated that slight variations in laboratory procedures could give different results. For this reason, the procedures were standardized and incorporated into the method. Subsequently, thirty fish samples representing the 1991 and 1992 fish collection were split between the three laboratories and analyzed according to the standardized procedures. All samples that had results greater than 5 PPM DDT met the goal of 30% RSD between Olin's primary and EPA Laboratories.

The Technical Committee in it's July 1993 meeting recommended that other QC parameters in addition to %RSD be used in evaluating fish monitoring data. The Committee agreed that 30% RSD is not as important, if the sample results from the Olin and EPA laboratories are below 5 PPM DDT.

After reviewing the analytical data and the conclusions of the Technical Committee, I concur with the recommendation of the Technical Committee and the decision of the Review Panel to remove the asterisk from the 1991 and 1992 fish data. The data are appropriate for use by the Review Panel in making decisions regarding compliance with the performance standard of 5 PPM DDT in fillets of performance standard fish.

Review Panel Decision Document No. 10

Appendix C

Finding of Continued Attainment
Largemouth Bass, Reach B

## I. Introduction

Pursuant to the requirements of the Consent Decree, U.S. vs. Olin Corp., May 31, 1983, the Review Panel is authorized to review the remedial action implemented by Olin and determine whether the remedy has achieved compliance with the performance standard consistent with the goals and objectives of the Consent Decree. This Appendix documents the Decision of the Review Panel regarding Olin's demonstration of continued attainment of the performance standard for Largemouth bass in Reach B.

## II. Findings of the Review Panel

A. Notification: Olin provided notification that Largemouth bass had demonstrated continued attainment of the performance standard of 5 ppm DDT in Reach B on May 15, 1995 in Annual Report Number 7 for the Huntsville Spring Branch Indian Creek Long-Term Monitoring Program. The data showing DDT concentrations in Largemouth bass by Year are presented on Table 22 of the May 15, 1995 Report (copy of Table 22 is attached hereto and incorporated herein).

B. Data: The Technical Committee reviewed the data and determined that the average DDT concentrations in fillets of Largemouth bass in Reach B have been less than 5 parts per million for three consecutive years, based on data from annual fish collections from 1992 through 1994.

C. Quality Assurance Evaluations: The EPA referee laboratory Certifications for each set of data are attached to this Appendix C and confirm that the data are acceptable for use in determining achievement of the performance standard set forth in the Consent Decree.

D. Recommendations for Further Studies or Analysis: There are no recommendations for further study or analysis by Olin at this time.

## III. Decision

The Review Panel has evaluated the recommendation of the Technical Committee and determined that the data provided by Olin for Largemouth bass for DDT concentrations in fillets demonstrate continued attainment with the performance standard of 5 parts per million for Largemouth bass in Reach B.

## IV. Conclusion

This decision document confirms the Review Panel decision at its July 20, 1995 meeting. This document consists of two pages of text and four attachments and comprises the Review Panel decision. Acceptance and adoption of this document by the representatives of the Review Panel member agencies and concurrence by the nonvoting participants are shown by the signatures affixed hereto.

MEMBERS

Anne L. Asbell
Chairperson, Review Panel

Dr. W. Allen Robison
U.S. Fish and Wildlife Service

Dr. Edward S. Bender
EPA - Washington, D.C.

Col. Stephen P. Moeller
U.S. Army, Redstone Arsenal

Robert J. Pryor
Tennessee Valley Authority

James W. Warr
Alabama Department of Environmental Management

NONVOTING PARTICIPANTS

Honorable Clyde Foster
Town of Triana, Alabama

William G. McGlasson
Olin Corporation

DATED: JUL 20 1995

TABLE 22

AVERAGE DDT CONCENTRATIONS IN FISH BY YEAR

## LARGEMOUTH BASS

| Reach | Parameter | Baseline* | Year 1 1988 | Year 2 1989 | Year 3 1990 | Year 4 1991 | Year 5 1992 | Year 6 1993 | Year 7 1994 |
|---|---|---|---|---|---|---|---|---|---|
| A | n | 21 | 10 | 17 | 18 | 14 | 11 | 10 | 17 |
| | ave | 7.1 | 5.6 | 4.9 | 4.3 | 9.7 | 1.5 | 1.2 | 1.6 |
| | s.d. | 7.8 | 5.5 | 4.1 | 4.2 | 6.8 | 2.4 | 1.3 | 1.7 |
| | min | 1.2 | .7 | 0.2U | 0.11J | 2.0 | 0.27 | 0.13 | 0.03U |
| | max | 28 | 16 | 15 | 16 | 23 | 8.0 | 3.8 | 5.6 |
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| | s.d. | 11 | 8.5 | 2.4 | 4.0 | 5.6 | 1.4 | 3.5 | 2.3 |
| | min | 28 | 0.4 | 0.2U | 0.45 | 2.3 | 0.03U | 0.08 | 0.03U |
| | max | 49 | 27 | 8.8 | 16 | 21 | 5.6 | 14 | 8.2 |
| C | n | 34 | 17 | 26 | 14 | 13 | 26 | 12 | 15 |
| | ave | 8.2 | 2.7 | 6.4 | 2.4 | 4.9 | 0.78 | 1.4 | 1.1 |
| | s.d. | 6.0 | 4.8 | 13 | 1.4 | 3.7 | 0.89 | 1.7 | 1.1 |
| | min | 1.2 | 0.2 | 0.2U | 0.64 | 0.03U | 0.03U | 0.50 | 0.03U |
| | max | 24 | 16 | 56 | 5.0 | 12 | 4.0 | 6.8 | 3.8 |

DDT concentrations are ppm (mg/kg) in fillets

* Decison Document No. 2 [1982-1985 Fish Collection (Year Group II-V)]

n is number of samples analyzed
ave is average DDT concentration (mg/kg) of samples analyzed
s.d. is standard deviation of the DDT concentrations (mg/kg)
min is the minimum DDT concentration (mg/kg) analyzed
max is the maximum DDT concentration (mg/kg) analyzed

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA 30613

MAY 03 1995

4ES-AS-OCS

MEMORANDUM

SUBJECT: Huntsville DDT Project, 1994

FROM: H. Lavon Revells HLR
Senior Staff Specialist
Analytical Support Branch

TO: Anne Asbell 5/10/95
Office of Regional Counsel

I have reviewed the fish inter-laboratory comparison data for the 1994 Huntsville DDT project and find it acceptable. There were 37 fish samples split with EPA as the Referee laboratory and Olin-Charleston as the Primary laboratory. The average % RSD was 18.1, which is well within the required 30% RSD. Also, a data bias check performed by Keith Roberts determined that there was bias between laboratories. However, this appears to be a minor problem at this time.

cc: Dr. Edward Bender (1400F, HDQTR)
Mr. Keith Roberts (Olin-Charleston)
Mr. Russell Wright (ESD)
Mr. Charles Hooper (ESD)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA 30613

May 25, 1994

4ES-AS-LES

SUBJECT: Huntsville DDT Project

FROM: H. Lavon Revells HLR
Senior Staff Specialist
Analytical Support Branch

TO: Anne Asbell A 6/1/94
Office of Regional Counsel

I have reviewed the fish inter-laboratory comparison data for the 1993 Huntsville DDT Project and find it acceptable. There were 38 fish samples split with EPA as the Referee laboratory and Olin-Charleston as the Primary laboratory. The average % RSD was 18.8, which is well within the required % RSD of 30. However, a data bias check performed by Keith Roberts determined that there was bias between laboratories. Of the 38 split samples, Olin's results were less than EPA's for 32 of them. Keith Roberts and I have begun studies to determine the cause of this difference.

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U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV
ENVIRONMENTAL SERVICES DIVISION
ATHENS, GEORGIA

AUGUST 17, 1994

4ES-AS-LES

MEMORANDUM

SUBJECT: OLIN'S 1991 AND 1992 FISH MONITORING DATA

FROM: Lavon Revells, Chemist
Senior Staff Specialist

TO: Anne L. Asbell
Chairperson, Review Panel

As you know, Olin's 1991 and 1992 fish monitoring data were flagged because the percent relative standard deviation (%RSD) of split fish sample results between Olin and EPA Region IV Laboratories was greater than the target goal of 30. Since the reporting of the 1991 fish data, representatives from our EPA laboratory and Olin's primary and secondary laboratories had several meetings and discussions in an effort to determine the cause of the high %RSD. As a result of these discussions, a series of studies were designed and conducted to identify the problem areas. While all laboratories were using the same analytical method, the studies indicated that slight variations in laboratory procedures could give different results. For this reason, the procedures were standardized and incorporated into the method. Subsequently, thirty fish samples representing the 1991 and 1992 fish collection were split between the three laboratories and analyzed according to the standardized procedures. All samples that had results greater than 5 PPM DDT met the goal of 30% RSD between Olin's primary and EPA Laboratories.

The Technical Committee in it's July 1993 meeting recommended that other QC parameters in addition to %RSD be used in evaluating fish monitoring data. The Committee agreed that 30% RSD is not as important, if the sample results from the Olin and EPA laboratories are below 5 PPM DDT.

After reviewing the analytical data and the conclusions of the Technical Committee, I concur with the recommendation of the Technical Committee and the decision of the Review Panel to remove the asterisk from the 1991 and 1992 fish data. The data are appropriate for use by the Review Panel in making decisions regarding compliance with the performance standard of 5 PPM DDT in fillets of performance standard fish.

Appendix I. Decision Document No. 11,
Extension of Time for Meeting the Performance Standard
for Channel Catfish and Smallmouth Buffalo,
December 3, 1998.

REVIEW PANEL DECISION DOCUMENT NUMBER 11

# EXTENSION OF TIME FOR MEETING THE PERFORMANCE STANDARD FOR CHANNEL CATFISH AND SMALLMOUTH BUFFALO

## INTRODUCTION

On May 31, 1983, the United States District Court for the Northern District of Alabama (Northeastern Division, the Honorable Robert B. Propst presiding) entered, as part of an overall order settling litigation between the United States of America, the state of Alabama, and four sets of private parties against Olin Corporation (Olin), a Consent Decree (CD) that governs development and implementation of remedial action for DDTR[1] contamination in the Huntsville Spring Branch-Indian Creek (HSB-IC) system.

The CD requires Olin to develop and implement a Remedial Action to meet the performance standard of 5 parts per million (ppm) of DDTR in filets of channel catfish, largemouth bass, and smallmouth buffalo in specified reaches of the HSB-IC system:

Reach A-Huntsville Spring Branch mile (HSBM) 5.4-2.4
Reach B-HSBM 2.4-0.0, and
Reach C-Indian Creek mile (ICM) 5.6-0.0.

The purpose of the remedy, monitoring, and other actions that Olin is required to perform under the CD is to isolate DDTR in the HSB-IC system from people and the environment, to minimize transport of DDTR out of the HSB-IC system, and to protect human health and the environment. The performance standard is to be achieved by a remedy consistent with the goals and objectives of the CD, which are summarized below:

1. Isolate DDTR from people and the environment;

2. Minimize the transport of DDTR out of the HSB-IC system;

3. Minimize adverse environmental impacts of remedial actions;

4. Mitigate effect of DDTR on wildlife habitats in Wheeler National Wildlife Refuge (WNWR);

---

[1] For purposes of the CD and as used in this report, DDTR is defined as 1,1,1-trichloro-2, 2-bis- (p-chlorophenyl) ethane, including its isomers, and the degradation products and metabolites DDD or TDE (1,1-dichloro-2,2-bis (p-chlorophenyl) ethane), and DDE (1,1-dichloro-2,2-bis (p-chlorophenyl) ethylene), and the isomers thereof.

5. Minimize adverse effects on operations at Redstone Arsenal (RSA), Wheeler Reservoir, and WNWR;

6. Avoid any increase in flooding, especially at the city of Huntsville and RSA, except those increases in water level that can reasonably be expected in connection with implementation of remedial action, provided Olin takes all reasonable steps to minimize or prevent such increases; and

7. Minimize the effect of loss of storage capacity for power generation, in accordance with the TVA Act.

The Review Panel reviewed and approved the proposed remedy for Reach A (Decision Documents Numbers 1 and 3) and a Long Term Monitoring Program (Decision Document Number 6) for evaluating progress toward meeting the performance standard.

The performance standard must be achieved within ten years after completion of construction of the remedial action. The remedial action plan, the long-term monitoring program, and the attainment of the performance standard are all subject to the review and approval of the Review Panel.

Paragraph 40 of the Consent Decree provides "If Olin and the United States agree that Olin has acted in good faith consistent with the schedule set forth in this Consent Decree but has failed to meet the performance standard within the time set forth herein, Olin and the United States shall agree to an extension of time for meeting the performance standard...".

## DATA

Olin implemented the remedial action plan for Reach A as approved by the Review Panel. Construction was completed in January 1, 1988. Beginning January 1, 1988, Olin implemented the Long-term Monitoring Program which was approved by the Review Panel in Decision Document Number 6.

The long-term monitoring plan measured DDTR concentrations in surface water, ground water, sediments, and fish tissue as an indicator of effectiveness of the remedy in meeting the goals of the CD. A baseline of conditions for surface water and DDTR concentrations in performance standard species and other species of fish was established before the remedial action. Other biota were also monitored periodically by Olin and other agencies to measure DDTR concentrations and assess trends.

Olin submits annual monitoring reports to the Review Panel. Results for 1997 (representing the 10th year after completion of the remedial action) were received in 1998. Baseline vs. 1997 fish sampling results are as follows:

## DDTR in Performance Standard Fish Over Time

| Species | Reach | DDTR Concentration (ppm) in Fish Filets | | | % Reduction from Baseline |
|---|---|---|---|---|---|
| | | Baseline | 1988 | 1997 | |
| Channel Catfish | A | 95 | 33 | 5.0 | 95 |
| | B | 69 | 45 | 6.9 | 90 |
| | C | 66 | 36 | 5.5 | 92 |
| Largemouth Bass | A | 7.1 | 5.6 | 1.5 (1996) | 79 |
| | B | 37 | 5 | 1.1 (1996) | 97 |
| | C | 8.2 | 2.7 | 0.5 (1996) | 94 |
| Smallmouth Buffalo | A | 140 | 31 (1989) | 12 | 91 |
| | B | 180 | 82 | 21 | 88 |
| | C | 110 | 89 | 9.4 | 92 |

Largemouth bass have met the performance standard and continued attainment has been demonstrated in all three reaches for this species in 1994. Channel catfish in Reach A also met the performance standard in 1997. Channel catfish in Reaches B and C and smallmouth buffalo in Reaches A, B, and C have not yet met the performance standard. Channel catfish are very close to the standard and smallmouth buffalo are approaching it. All three (3) species have shown a 90% reduction in DDTR overall and the trend appears to be continuing toward further reductions.

DDTR concentrations in the water column are believed to be an important route of exposure for fish in HSB-IC. Baseline vs. 1997 water sampling results are as follows:

## DDTR in HSB-IC Water Over Time

| Sample Location | Reach | Total DDTR Concentration (ppb) in Water | | | % Reduction from Baseline |
|---|---|---|---|---|---|
| | | Baseline | 1988 | 1997 | |
| HSBM 9.75 | Upstream of A | 0.77 | 0.0* | 0.0* | |
| HSBM 4.85 | A | 3.4 | 0.0* | 0.0* | >98 |
| HSBM 3.9 | A | 12 | 0.35 | 0.0* | >98 |
| HSBM 2.4 | A | 13 | 1.23 | 0.05 | >98 |
| ICM 4.6 | C | 4.3 | 1.51 | 0.11 | >97 |
| ICM 0.38 | C | 1.7 | 0.54 | 0.0* | >98 |
| ICM 8.2 | Upstream of C | 0.6 | 0.0* | 0.0* | |

* Below quantitation limit of the analytical method.

As shown in the above table, average DDTR concentrations in the water column are reduced by 97% or greater below the baseline conditions (pre-remedial action) throughout the entire HSB-IC system. Water column concentrations are affected by sediment DDTR concentrations within the HSB-IC system. The remedial action in Reach A isolated significant quantities of DDTR in sediments.

The Remedial Action Plan developed by Olin, reviewed and approved by the Review Panel, has been implemented consistent with all of the goals and objectives of the CD. Even though the ten year monitoring period has expired, Olin has continued, in good faith, the monitoring to evaluate changes in DDTR concentrations in performance standard species. The results for 1998 should be available by the summer of 1999.

Although significant reductions in DDTR concentrations for channel catfish and smallmouth buffalo have occurred, these species have not achieved the performance standard in each of the stream reaches. In anticipation of this situation, the Review Panel requested that Olin provide an evaluation of the progress achieved through the initial ten years and an analysis of when the performance standard would be achieved. In Olin's HSB-IC Long-Term Monitoring Program, Annual Report No. 10, May 15, 1998, Olin included extensive trend and statistical evaluation of the results and projections of when performance standards would be achieved. Results of this evaluation conclude that channel catfish and smallmouth buffalo would achieve the performance standard in all three reaches within 5 and 10 years respectively. Based on these results, Olin made the following recommendations:

1. The attainment period for the channel catfish be extended by five (5) years to December 31, 2002.

2. The attainment period for the smallmouth buffalo be extended by ten (10) years to December 31, 2007.

## PUBLIC INVOLVEMENT

On September 15, 1998, the Review Panel held a public information meeting at the Triana Youth Center to inform the public on: a) the progress that had been achieved through 1997 and b) the Review Panel proposal to extend the time to attain the performance standard for channel catfish and smallmouth buffalo.

At the meeting, members of the Review Panel and other agency representatives discussed the background of the problem, the design and implementation of the remedy, and the progress toward meeting the performance standard which is summarized here. Questions were answered in one-on-one discussions with members of the public. One hundred and fourteen people attended the sessions. Oral and written comments at the meeting supported the recommendation of the Review Panel to extend the time to attain compliance with the performance standards, while requiring monitoring, interim goals, and contingency plans. However, questions from the public also reflected their concerns about the permanence of the remedy, the necessity for the time extension, groundwater or water supply contamination, and the risks of eating fish today. Many individuals said that the monitoring results were very encouraging, they believed that the remedy would work, and they were pleased with the commitment of all involved.

After the public meeting the record remained open for the receipt of written comments until October 9, 1998. Comments offered at the meeting or in writing were consolidated by topic and are presented with Review Panel responses in Appendix A to this decision document.

## RATIONALE FOR THIS DECISION

The Review Panel members recognized the following points in developing this decision:

1. DDTR concentrations in the HSB-IC system have declined significantly in fish, sediments, and surface water following the construction of the remedial action. Analysis of existing data predict that further reductions should occur in the future.

2. There is no evidence of contamination of groundwater. Extensive monitoring supports the conclusion that DDTR does not move in groundwater at this site.

3. DDTR concentrations are expected to continue to gradually decline in sediments and water due to natural processes, including hydrologic mixing with clean sediments, burial from

deposition, microbial degradation and metabolism to other compounds, binding with organic particles, and photolysis. There is no evidence that additional sources of DDTR are contributing to the HSB-IC system loadings.

4. The remedial action structures containing the known sources, i.e., DDTR in sediments, have continued to maintain their integrity and isolate DDTR. Engineering inspections by the Review Panel's Inspection Committee (comprised of staff from all represented agencies) confirm that the remedy has been stable and has not required repair or maintenance.

5. The HSB-IC system is a valuable resource, water quality is improving, and desirable species of fish and wildlife are increasing in abundance and diversity. Independent studies and evaluations by Fish and Wildlife Service, Tennessee Valley Authority, Department of the Army (both USACE and Redstone Arsenal), the Environmental Protection Agency, and Alabama support these conclusions.

6. The DDTR concentrations of fish in Wheeler reservoir have decreased to levels sufficient that the Alabama Department of Public Health removed its fish consumption advisory from the Tennessee River in 1996.

7. The Review Panel has reviewed Olin Annual Report No. 10 and concurs that the predictions of time to achieve the performance standard for channel catfish and smallmouth buffalo are reasonable estimates based on current data.

8. At this time, it is unclear whether further remedial action would decrease the time to attain the performance standard.

9. The Review Panel will monitor progress and require action as needed.

## DECISION

Based on consideration of achievements to date and public comments, the decision of the Review Panel is that Olin has acted in good faith with the provisions of the Consent Decree. Monitoring data verifies that DDTR levels in fish have declined significantly. Concentrations in fish, sediment and water have all decreased. Analysis of existing data on fish, water and distribution of DDTR in sediments support the conclusion that this trend will continue. Largemouth Bass have met the performance standard in all three reaches since 1992 (with continued attainment since 1994) and concentrations in channel catfish and smallmouth buffalo have declined significantly toward the performance standard. Furthermore, all of the goals and objectives of the CD have been achieved.

The Review Panel concludes that an extension of the time to attain the performance standard for channel catfish of 5 years (until December 31, 2002) and for smallmouth buffalo of 10 years (until December 31, 2007) should be granted. These extensions are subject to the conditions that Olin:

a) monitor to evaluate attainment of the performance standard for these fish species and the effectiveness of the remedy during the period of the extension;

b) establish interim goals to evaluate progress toward compliance; and

c) develop contingency plans if the interim goals are not achieved, the performance standard(s) is not attained, or the performance standard(s) cannot be maintained as defined by the CD.

Within 60 days following the date of this decision document, Olin shall submit to the Review Panel for review and approval, proposals for:

1) a monitoring program for the balance of the time extension;

2) interim goals for the time extension; and

3) contingency plans in the event that the interim goals or performance standards are not achieved within the period of this time extension, or the performance standard cannot be maintained.

Olin shall submit this information to the Review Panel for approval. The current monitoring program will remain in effect until the Review Panel approves a modification.

CONCURRENCE

This Decision Document, consisting of text (including this concurrence section) and appendix A, comprises the Review Panel decision and is accepted and adopted by the representatives of the Review Panel member agencies and concurred in by the nonvoting participants as shown below by the signatures affixed hereto.

MEMBERS

Edward S. Bender, Ph.D.
Chairman, Review Panel

W. Allen Robison, Ph.D.
U.S. Fish and Wildlife Service

Alan Yarbrough
Environmental Protection Agency

Colonel Steven C. Hamilton
U.S. Army, Redstone Arsenal

Robert Pryor
Tennessee Valley Authority

James W. Warr
Alabama Department of
Environmental Management

NONVOTING PARTICIPANTS

Honorable Clyde Foster
Town of Triana, Alabama

Laura B. Tew
Olin Corporation

Dated: DEC 21 1998

Appendix A.
Review Panel Responses to Public Comments

Comments[2] listed here are a consolidation of oral and written public comments and questions on the Review Panel proposed decision to extend the time for meeting the performance standard for channel catfish and smallmouth buffalo under the terms and conditions of the Consent Decree, U.S. v. Olin Corporation.

Comment: The remedy has been given ten years to reach the performance standard, why should more time be granted?

Response: The remedial action for the Huntsville Spring Branch-Indian Creek System has been very effective in reducing DDTR concentrations in fish, water and sediments. Concentrations in some fish are declining more slowly than expected when the Consent Decree was signed. However, monitoring data show that concentrations continue to decline.

There is convincing evidence that the remedy is working and, given additional time, will fully comply with the Consent Decree. People and the environment would experience fewer additional adverse effects by extending the time to allow the trends to continue declining than by undertaking additional remedial actions that probably would release additional DDTR into the environment temporarily.

If Olin has acted in good faith consistent with the schedule set forth in the Consent Decree but has failed to meet the performance standard, the Consent Decree provides that the Review Panel shall grant an extension of time for meeting the performance standard. The Review Panel has concluded that Olin has acted in good faith in planning, construction, and monitoring the remedial action project. Consequently, at this point, a time extension is prudent and consistent with the Consent Decree.

Comment: What is the basis for the time period of the extension?

Response: Monitoring data have shown that the average concentrations of DDTR are declining in the water column and in fish filets. Analysis of this data can be used to estimate the amount of time required to achieve the performance standard. The Review Panel reviewed analyses supplied by Olin and concurred with predictions of the time for channel catfish and smallmouth buffalo to reach the performance standard.

Comment: What will Olin do if they are given more time to reach the performance standard?

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[2] Comments received about the medical fund monies were forwarded to the Chair of the Health Review Panel because the issues raised were outside the scope of this Review Panel.

Response: During the period of the extension, Olin must continue to monitor DDTR concentration trends and maintain the remedy. Olin also must continue to report annually to the Review Panel on progress toward achieving the performance standard. If progress toward achieving the performance standard is not considered to be adequate by the Review Panel, Olin must pursue contingency plans. In addition, Olin must comply with all other provisions of the Consent Decree.

Comment: What is the current status of DDTR contamination in fish for the Triana area?

Response: In 1996, the State of Alabama lifted the fish consumption advisory in the Tennessee River in the vicinity of Triana. Average DDTR concentrations in channel catfish and smallmouth buffalo in Indian Creek and Huntsville Spring Branch continued to exceed the performance standard in 1997, and the fish consumption advisory for bottom-feeding fish (primarily channel catfish and smallmouth buffalo) in Indian Creek and Huntsville Spring Branch remains in effect. Largemouth bass have achieved the performance standard and are not subject to the fish consumption advisory in the HSB-IC system or the Tennessee River.

# Appendix J
# Joint Petition for Modification of Schedule to Meet Consent Decree Performance Standards and Court Order

THE UNITED STATES DISTRICT COURT FOR THE
NORTHERN DISTRICT OF ALABAMA
NORTHEASTERN DIVISION

| | | |
|---|---|---|
| UNITED STATES OF AMERICA, | ) | |
| | ) | |
| Plaintiff, | ) | CIVIL ACTION |
| | ) | |
| OLIN CORPORATION, | ) | NO. CV80-PT-5300-NE |
| | ) | |
| Defendant. | ) | |
| | ) | |

JOINT PETITION FOR MODIFICATION OF SCHEDULE TO MEET CONSENT DECREE PERFORMANCE STANDARDS

The United States of America, on behalf of the U.S. Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (FWS), the U.S. Department of the Army (DOA), and the Tennessee Valley Authority (TVA), joins with Olin Corporation in filing this Petition for Modification of Schedule to Meet Performance Standards. This Petition is being filed pursuant to Paragraph 40 of the Consent Decree entered by this Court on May 23, 1983. A copy of the Consent Decree is attached to this Petition as Attachment A.

## I. BACKGROUND

On December 4, 1980, the United States filed a Complaint against Olin Corporation alleging that Olin's discharge of DDT into the waters of the United States, the Wheeler National Wildlife Refuge, and the environment from Olin's DDT manufacturing plant located on the Redstone Arsenal, had created an imminent and substantial endangerment to human health and the environment.

The United States sought relief under federal statutory law and common law.[1]

On May 31, 1993, this Court entered a Consent Decree between the United States and Olin Corporation under which Olin agreed to conduct cleanup activities at its former DDT plant (also known as the Olin Superfund Site) in order to abate the risk of harm. More specifically, the Consent Decree required Olin to develop and implement a remedial action plan which will isolate DDT contaminated soils and sediments from people and the environment, and reduce DDT levels in filets of three selected indicator fish species to 5 parts per million (ppm) within ten (10) years after Olin completed construction of the remedy. The Consent Decree established a Review Panel with voting members from EPA, TVA, FWS, and DOA, and the State of Alabama[2], and non-voting members from Olin and the Town of Triana, Alabama. The Review Panel is authorized to make decisions concerning the selection and modification of the remedy, achievement of performance standards, compliance with the goals and objectives of the Decree, and other activities required under the Decree. The Review Panel approved Olin's proposed remedial action plan.

Olin implemented the remedial action and completed construction on January 1, 1988. A ten-year monitoring period began on January 1, 1988, and the 5

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[1]Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA" or "Superfund") in 1980.

[2]The State of Alabama filed a separate suit (Civ. Action No. CV79-PT-5174-NE) against Olin seeking similar relief to that requested by the United States. The Court consolidated the cases.

ppm performance standard was required to have been achieved by December 31, 1997. During the monitoring period, Olin measured DDT concentrations in the surface water, ground water, sediments, and fish tissue as an indicator of the effectiveness of the remedy. Results for 1997, representing the 10th year after construction of the remedy, were received in 1998 and indicated that while the remedy has been successful in achieving the Goals and Objectives set out in paragraph 13 of the Decree, the performance standards have not yet been met in all 3 fish species in all 3 reaches of the river system.

Largemouth bass have met the performance standard and continued attainment has been demonstrated in all three reaches for this species in 1996. Channel catfish in Reach A have also met the performance standard. Channel catfish in Reached B and C and smallmouth buffalo in Reaches A, B, and C have not yet met the performance standard. All three species have shown a 90% reduction in DDT overall and the trend appears to be continuing toward further reductions. Based on these results, the Review Panel requested Olin to provide and evaluation of the progress achieved during the ten-year monitoring period and projection of when the performance standard would be met for channel catfish and smallmouth buffalo. Olin's Annual Report No. 10, dated May 15, 1998, included extensive trend and statistical analyses of the monitoring results, and concludes that channel catfish would achieve the performance standard within 5 years, and

smallmouth buffalo within 10 years. Based on this report, Olin recommended that:

1. The schedule for attainment of the performance standard for channel catfish be extended five years to December 31, 2002;

2. The schedule for attainment of the performance standard for smallmouth buffalo be extended by ten years to December 31, 2007.

After extensive review and evaluation of Olin's recommendations, the Review Panel concurs with Olin's conclusions and recommendations concerning the attainment of the performance standard. The evidence in the record strongly indicates that the decline in DDT levels will continue and that the performance standard will be met without the need for additional remedial action. The Review Panel's findings and concurrence with Olin's recommendations are set forth in Decision Document #11 (attached hereto as Attachment B)[3/]. Prior to signing the Decision Document, the Review Panel issued a Proposed Plan which explained the Review Panel's findings and the proposed schedule extension. A public meeting was conducted on September 15, 1998, and the public comment period remained open until October 9, 1998. None of the comments received by the Review Panel presented compelling facts or circumstances which demonstrated that the schedule extension agreed to by Olin and the Review Panel Review is inappropriate, unfair or unlawful. A summary of the public comments submitted to the Review Panel and

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[3/]The Decision Document requires Olin to submit to the Review Panel, for review and approval, proposals for a monitoring program and establishments of interim goals to be met during the time extension, and contingency plans in the event that the interim goals or performance standards are not achieved within the period of the extension.

the Review Panel's responses thereto are included in Decision Document #11. The review Panel members, including the non-voting members Olin Corporation and the City of Triana, have signed Decision Document #11.

Paragraph 40 of the Consent Decree provides "If Olin and the United States agree that Olin has acted in good faith consistent with the schedules set forth in this Consent Decree but has failed to meet the performance standards within the time set forth herein, Olin and the United States shall agree to an extension of time for meeting the performance standard, shall jointly petition the Court for a modification of the schedule and Olin shall not be liable for penalties set forth in paragraph 35 based solely on its failure to meet the performance standard within the time required during such extended period." The Review Panel (comprised of 4 agencies of the United States) and Olin have agreed that Olin has acted in good faith with the Consent Decree. Therefore, under paragraph 40 of the Decree, the parties are petitioning the Court to grant an extension of time for Olin to achieve the performance standard.

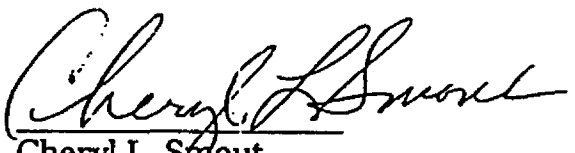
## II. REQUEST FOR MODIFICATION OF SCHEDULE

Based on the foregoing facts and circumstances, the United States and Olin Corporation hereby request the Court approve a modification of the schedule in the Consent Decree for compliance with the performance standard as follows:

1. The time for attainment of the performance standard for channel catfish shall be extended from December 31, 1997, until December 31, 2002.

2. The time for attainment of the performance standard for smallmouth buffalo shall be extended from December 31, 1997, until December 31, 2007.

Respectfully Submitted,



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Signature Page for Joint Petition For Modification Of Schedule To Meet Consent Decree Performance Standards in United States v. Olin Corporation CV80-PT-5300-NE (N.D.Ala.)

ON BEHALF OF OLIN CORPORATION

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UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ALABAMA
NORTHEASTERN DIVISION



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|---|---|---|
| JAMES CLOUD, ET AL., | ) | |
| PLAINTIFFS, | ) | |
| VS. | ) | CV79-S-5128-NE<br>CV79-S-5174-NE |
| OLIN CORPORATION, ET AL., | ) | CV80-S-5057-NE<br>CV80-S-5098-NE |
| DEFENDANTS. | ) | CV80-S-5300-NE<br>CV80-S-5115-NE |



**ORDER**

This action is before the court on the joint petition for modification of schedule to meet consent decree performance standards filed February 26, 1999. The court has reviewed the Consent Decree entered May 31, 1983 (the "Decree"), the attachments and submittals of the parties, particularly the Review Panel Decision Document No. 11 dated January 5, 1999, and is of the opinion that the petition should be granted. Accordingly, it is ORDERED, ADJUDGED, and DECREED as follows: (1) the time for attainment of the performance standard for channel catfish shall be extended from December 31, 1997, until December 31, 2002; and (2) the time for attainment of the performance standard for smallmouth buffalo shall be extended from December 31, 1997, until December 31, 2007.

DONE this 23rd day of April, 1999.

United States District Judge