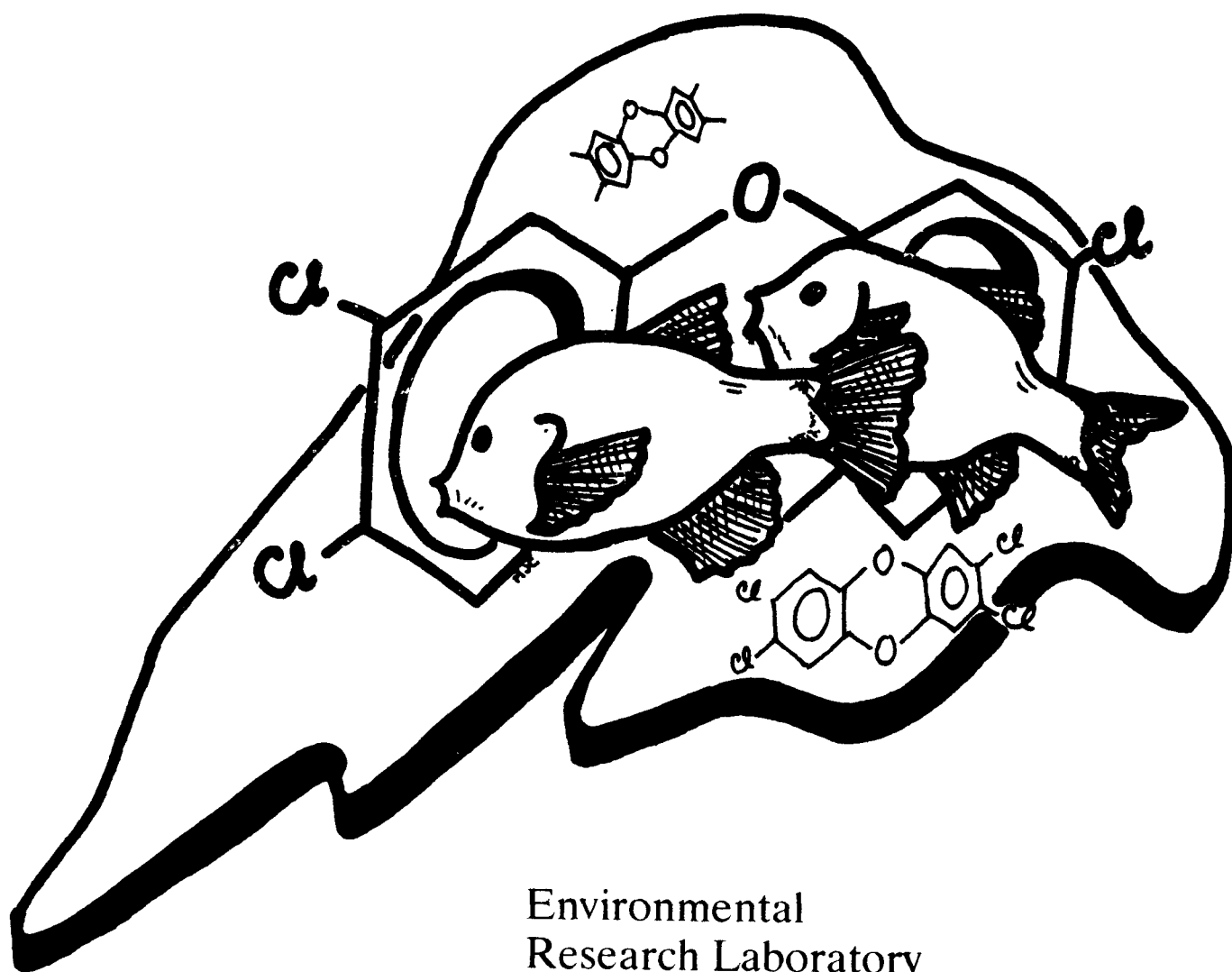
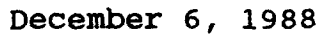
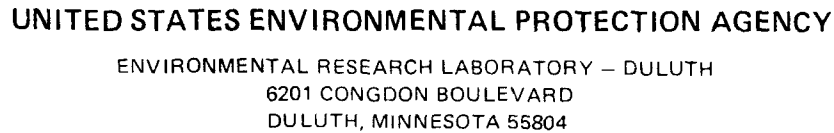





QUARTERLY PROGRESS REPORT  
JULY - SEPTEMBER 1988



Environmental  
Research Laboratory  
Duluth, Minnesota 55804



**SUBJECT: Fourth Quarter FY88 Progress Report on Projects of the Environmental Research Laboratory-Duluth (ERL-D)**

FROM: Nelson A. Thomas, Chair  NAT  
Strategic Communication Council, ERL-Duluth

**TO: Addressees**

Attached is a copy of the ERL-Duluth progress report on research projects for the fourth quarter. The following are highlights from various projects/activities:

- Emphasis is being placed on toxicity testing by combining these tests with chemical fractionation, to aid in toxicity reduction evaluation (TIEs). This permits more positive coupling of chemical identifications with toxicity. Project 5, page 3.
- Preliminary results consisting of a 28-day exposure period and a six-month depuration phase suggest that fish may be a sensitive screen for detecting carcinogenic responses. Project 3, page 10.
- Field studies show concentrations of selenium in water are not directly responsible for impacts found on fish. The major route of exposure is thought to be through the consumption of food that has accumulated selenium. Project 3, page 10.
- Studies on the uptakes of formulated Bacillus thuringiensis var israelensis (Bti) continue. Project 6, page 25.
- Computerized system for QSAR evaluation of chemicals delivered to OTS. It contains a CLOGP program for state-of-the-art Log P calculation as well as an expert system for chemical evaluation. Other accomplishments are highlighted. Project 13, page 31.
- Final report entitled "Factors controlling the recovery of aquatic systems from disturbance" submitted this quarter. Project 31, page 33.

Attachment

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FOURTH QUARTER STATUS REPORT ON FY'88 PROJECT DESCRIPTIONS  
Office of Environmental Processes and Effects Research  
ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: B101 WATER QUALITY  
ISSUE: A WQBA/PERMITTING  
PPA (L): 09 Aquatic Life Sediment Criteria Development

RC: N ERL DLTH

PROJECT: 35 Aquatic Life Sediment Criteria Development

PROJECT OFFICER: Anthony R. Carlson

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PLANNED START: 10/01/87 PLANNED END: 12/31/99

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PROJECT DESCRIPTION:

GOAL: Develop sediment quality criteria protocols for use in protecting aquatic life.

RATIONALE: Sediment quality criteria can be used to form the basis for state sediment quality standards, NPDES permits and assessment of in-place sediment contaminants.

APPROACH: Determine relationships between tissue residue and just barely safe toxic endpoints for sediment-associated organisms chronically exposed to specific non-polar organic chemicals and metals. Calculate criteria based on just barely safe residue concentrations. Evaluate and validate under field conditions.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

Data has been compiled from the literature for use in determining the relative sensitivity of benthic and non-benthic organisms to specific chemicals. Cultures of five benthic invertebrates have been established for use in long-term or chronic exposure to chemicals via sediment. Construction of test apparatus for chronic testing is nearing completion.

Sediment samples for 13 Fox River/Green Bay systems of Lake Michigan have been collected and homogenized and stored at ERL-D for later use in bioassay and chemical characterization. Macroinvertebrate samples for chemicals have been collected. Macroinvertebrate communities at each site have been sampled and are being sorted. Preliminary studies indicate that pore water for 5 of 10

of the sites are acutely toxic.

STATUS AND SCHEDULE OF DELIVERABLES:

- 7896 DUE: 08/31/89 REVISED: COMPLETED:  
REPORT ON DEVELOPMENT OF TEST METHODS WITH BENTHIC ORGANISMS TO DEFINE THE  
BIOAVAILABILITY AND/OR SEDIMENT-BOUND TOXICANTS.
- 7969 DUE: 05/31/89 REVISED: COMPLETED:  
Report on minimum tox. data set for Sed.Qual.Criteria based on relative  
sensitivity of benthic and non-benthic organisms.
- 7971 DUE: 05/31/89 REVISED: COMPLETED:  
Report on Biological Assessment of known sediment-activity of metal ions in  
Pore water and its toxicity.
- 7973 DUE: 05/31/89 REVISED: COMPLETED:  
Report on Field Verification Studies of laboratory observations with field  
measurements using benthic data of metal.

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FMS-060

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FOURTH QUARTER STATUS REPORT ON FY'88 PROJECT DESCRIPTIONS  
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ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: B101 WATER QUALITY  
ISSUE: A WQBA/PERMITTING  
PPA (L): 11 WQ TOXICITY-BASED NPDES PERMIT METHODS

RC: N ERL DLTH  
PROJECT: 05 WQ Toxicity-Based NPDES Permits Methods

PROJECT OFFICER: Nelson A. Thomas

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PLANNED START: 10/01/85 PLANNED END: 12/01/91

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PROJECT DESCRIPTION:

GOAL: Develop the scientific basis for the incorporation of the toxicity approach into the control of toxics from effluents.

RATIONALE: There is a need to control toxics in effluents when chemical specific criteria are not available and/or the toxicant is not known. The major need is the new emphasis on the use of Water Quality Criteria in the next round of NPDES industrial permits. There is a need to identify and evaluate the causes of toxicity in toxic effluents.

APPROACH: Short-term chronic toxicity tests have been and will continue to be developed for testing municipal and industrial effluents and receiving waters. The tests have been positively evaluated as to their ability to predict ecosystem impact through a series of field studies. A protocol for conducting the effluent and ambient tests will be prepared and tested. As validation has been established, issues related to persistence, bioaccumulation, additivity of multiple discharges, fractionation/separation and permit development under an integrated approach will be the focus of the research. Increased emphasis will be placed on the evaluation and identification of a chemical causing the toxicity. A protocol for assessing bioaccumulation is being developed and will be field tested.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

Evaluations are complete on the 7-day chronic Ceriodaphnia and fathead minnow toxicity tests to predict instream impact at nine sites. Site reports are complete and the revised statistical methods to analyze the combined effects of mortality and production of young-per-female for the Ceriodaphnia and weight for the fathead minnows were developed. An approach to determine the persistence of toxicity has been developed. A new statistical technique is

complete and a preview was sent to Regional biologists. A workshop is planned for Region 9 in December. A methods data interpretation and site study results workshop was conducted in Region 6 in July. Results of the feeding studies, water types in generation studies will be presented at the SETAC meeting. The duckweed method is ready for review. Ceriodaphnia cultures are being sent to states, EPA regions, contract laboratories, universities and industry. Cooperative agreements are in place to evaluate 4-d vs. 7-d Ceriodaphnia tests, and to develop techniques to generate ehippial egg production and hatching. Development of a bioconcentratable identification procedure in effluents is in progress.

A chemical analysis procedure is being developed and tested to identify bioconcentratable materials in effluents. A contract to collect effluents and place clams in streams to evaluate the bioaccumulation potential of an effluent is complete. Samples are being extracted and analyzed. A guideline on this approach is available.

The emphasis of CETIS has shifted from data entry and checking to programming to insure that others can enter new data. A PC version in DBASE, including a users manual, has been developed.

Emphasis is being placed on toxicity testing to aid in toxicity reduction evaluations. ERL-D is combining toxicity testing with chemical fractionation, called toxicity identification evaluations (TIEs). This permits more positive coupling of chemical identifications with toxicity. Acute toxicity tests with Ceriodaphnia, Daphnia magna, medaka and fathead minnows are used to assess toxicity of whole effluents and effluent fractions. A new document of the Phase I TIE procedure is available. One TIE indicated that a treated effluent owed its toxicity to more than 600 ug/l nickel, nearly 8 times the lethal limit for aquatic organisms. At the request of Region 9, an extensive evaluation of the Las Vegas POTW determined that diazinon and dichlorvos were the primary cause of toxicity and 5 effluents have been partially identified. Overall 46 effluents were evaluated at least once as potential candidates for the TIE work. A report on the TIE completed on the Hollywood POTW was sent to Region 4. Toxicants responsible for the toxicity were diazinon and chlorfenvinphos. In addition, 4 effluents are being tested and characterized for cause of toxicity. At the request of Region 5, one effluent sample was sent to Duluth to determine whether something other than ammonia is causing the toxicity. This effluent was only characterized, but we determined that ammonia did not cause the toxicity.

The announcement of the National Effluent Toxicity Assessment Center (NETAC) was made in March and each region was requested to submit one candidate effluent for a TIE evaluation. Candidates must have acute toxicity. At present 9 of the 10 regions have formally submitted candidates and 4 effluents were chosen. A workshop on the TIE techniques was presented by Don Mount to Region 4 contract labs. Five more workshops are planned for the next fiscal year. An extensive field project involving ERL-D, ERL-N, EPA-Newport working with the California Regional Water Quality Board to assess the toxicity and impact of selected discharges into the San Francisco Bay was conducted. The effort consisted of TIE work and a comparison of the fresh- and saltwater methods. TIE and toxicity tests on site in Casper, WY were conducted to demonstrate to Region 8 the feasibility of conducting the procedures and to

determine whether toxicity in the mining operations was due to more than salt generated during the mining process. Reports on both sites are now available. Based on the analysis of POTW's in our TIE work, diazinon has appeared in several effluents. A survey is in progress of 20-25 POTW plants in the 10 EPA regions to determine whether the occurrence of diazinon is widespread. Samples have all been tested and data are being summarized.

The results of 3 effluents will be summarized and sent to the Regions. Several papers will be presented at the SETAC meeting in November. Participation in the Virginia Water Pollution Control Association Seminar and a November Aquatic Toxicity Workshop are planned.

STATUS AND SCHEDULE OF DELIVERABLES:

- 7163 DUE: 12/31/87 REVISED: 04/30/89 COMPLETED:  
MANUSCRIPT ON TOXICITY IDENTIFICATION IN EFFLUENTS.
- 7814 DUE: 06/30/88 REVISED: COMPLETED: 06/30/88  
REPORT ON THE FIELD AND LABORATORY TESTING OF THE BIOCONCENTRATION  
FACTOR (BCF) PROTOCOL USING FRESHWATER ORGANISMS.
- 7815 DUE: 05/31/88 REVISED: COMPLETED:  
REPORT ON THE TOXICITY IDENTIFICATION OF THE TOXIC COMPONENT(S) OF  
EFFLUENTS
- 7816 DUE: 06/30/88 REVISED: COMPLETED: 05/31/88  
REVISED TOXICITY IDENTIFICATION PROTOCOL TO IDENTIFY THE CAUSES OF  
TOXICITY IN EFFLUENTS
- 7823 DUE: 09/30/89 REVISED: COMPLETED:  
PROTOCOL FOR A FOUR-DAY CERIODAPHNIA DUBIA TEST METHOD
- 7824 DUE: 09/30/89 REVISED: COMPLETED:  
REPORT ON THE COMPARATIVE SENSITIVITY OF A FOUR-DAY TO SEVEN DAY  
CERIODAPHNIA DUBIA TEST TO SINGLE TOXICANTS



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CODE TITLE

BUDGET SUB-ACTIVITY: B101 WATER QUALITY  
ISSUE: A WQBA/PERMITTING  
PPA (L): 12 INTEGRATED WATER QUALITY ASSESSMENT TECHNIQUES

RC: N ERL DLTH

PROJECT: 01 Water Quality Assessment Techniques

PROJECT OFFICER: Anthony R. Carlson

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PLANNED START: 10/01/85 PLANNED END: 09/01/88

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PROJECT DESCRIPTION:

GOAL: Develop, evaluate and/or demonstrate the validity of toxicological concepts for deriving numerical water quality criteria for use in protecting aquatic life from point and non-point pollutants.

RATIONALE: Scientifically defensible methodologies for use in protecting aquatic life and its uses are needed by program offices.

APPROACH: Evaluate water quality criteria protectiveness and new criteria derivation methodologies to assess their validity under semi-natural conditions of outdoor experimental streams located at the Monticello Ecological Research Station and in real world situations. Apply water quality criteria, effluent toxicity and effluent toxicant identification methodologies to non-point source pollutant control. Conceptualize and study fluctuating exposure-dose response relationships and apply results to water quality criteria derivation. Develop concepts and guidelines for toxicity factors in criteria applications. Develop a basic approach of coupling non-point pollution loadings and aquatic life impacts with the goals of identifying remedial benefits of BMP's.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

Ambient toxicity results were completed on the spring and summer surface water samples collected from the Upper Illinois River basin. Biosurveys were also conducted at the same stations for macroinvertebrates and fish by Region V E.S.D. personnel. Growth stimulation, inhibition and lethality were found at some of the stations. Preliminary analyses of the bioassay information indicate a less diverse community in the heavily urbanized areas. Further analysis will reveal the level of agreement in surface water degradation with

the laboratory toxicity, field bioassay and chemical results.

Laboratory results were conducted on 13 sediments and overlying water samples from the Fox River/Green Bay watershed. The overlying water samples were not toxic, but 40% of the water associated with the sediment was toxic to Ceriodaphnia and fathead minnows. Work will continue this fall to confirm the toxic locations and the causative agent(s) in the sediments.

STATUS AND SCHEDULE OF DELIVERABLES:

- 7170 DUE: 09/30/87 REVISED: 09/30/89 COMPLETED:  
REPT. ON THE FEAS. OF PRED. THE EFFECTS AND INCORP. FLUTUATING EXP. IN THE  
APPLICATION OF WQC AND EFFLUENT TOXICS TESTS.
- 7187 DUE: 03/31/88 REVISED: COMPLETED: 03/31/88  
Report on Impacts of Ammonia/Chlorine on Ecosystem Structure and  
Function in Experimental Streams
- 7827 DUE: 04/30/89 REVISED: COMPLETED:  
PROGRESS REPORT ON THE INFLUENCE OF SELENIUM IV ON BLUEGILL REPRODUCTION IN  
OUTDOOR EXPERIMENTAL STREAMS
- 7830 DUE: 10/31/90 REVISED: COMPLETED:  
REPORT ON APPLICABILITY OF WATER QUALITY CRITERIA AND ENVIRONMENTAL GOALS -  
GREEN BAY, WISCONSIN
- 7831 DUE: 10/31/88 REVISED: COMPLETED:  
REPORT ON FEASIBILITY OF MERGING OF USGS AND EPA DATA BASES FOR USE IN  
REGIONAL WATER QUALITY ASSESSMENT.
- 8086 DUE: 12/31/89 REVISED: COMPLETED:  
PROGRESS REPORT ON NUTRIENT LOADS, ATTACHED ALGAL, AND ENVIRONMENTAL GOALS  
IN CLARK FORK RIVER AND LAKE PEND OREILLE

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CODE TITLE

BUDGET SUB-ACTIVITY: B101 WATER QUALITY  
ISSUE: A WQBA/PERMITTING  
PPA (L): 13 ECOLOGICAL RESEARCH WITH THE PEOPLE'S REPUBLIC OF CHINA

RC: N ERL DLTH

PROJECT: 02 Ecological Research with the People's Republic of China

PROJECT OFFICER: Nelson A. Thomas

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PLANNED START: 10/01/84 PLANNED END: 09/01/89

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PROJECT DESCRIPTION:

GOAL: To participate jointly with the People's Republic of China (PRC) in mutually beneficial studies through a cooperative research program. Scientists from both countries will participate in research and exchange scientific information on the environmental processes and effects of pollution on freshwater organisms.

RATIONALE: In support of the United States' policy to provide scientific and technological cooperation with China, the USEPA and PRC in 1980 entered into an agreement known as the US-PRC Environmental Protection Protocol. This agreement provides for establishment of a cooperative research program.

APPROACH: Participating scientists from both countries will discuss and identify the specific projects that will be conducted in the research program. Projects (subject to modification and approval) include emphasis on toxicity tests methods, effect of environmental variables on toxicity and toxicity mixtures. Scientists from PRC will study at ERL-D to develop an understanding of the testing of single chemicals and complex effluents.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

The four visiting scientists completed their studies and returned to China. Wang Shida and Zhuang Dehui studied fish and invertebrate test procedures while here and are transferring these procedures to the Wuhan Laboratory. The second group is conducting tests with the mini diluter constructed at ERL-D. Field studies were undertaken in the U.S. and PRC to conduct toxicity tests on effluents and heavy metals. Two experts from ERL-D traveled to Wuhan to begin the joint testing with Chinese species of aquatic life. Toxicity testing and culture procedures will be the focus of the exchanges in the PRC. Field

evaluation of the Effluent Protocol was tested at a steel mill in Wuhan. Two toxicologists from ERL-D traveled to Wuhan to complete cooperative testing using cadmium and effluent samples. Reports are being prepared on heavy metal toxicity and effluent testing. Joint research is currently being conducted on the detection of teratogenic and carcinogenic effects of fish in areas containing contaminated sediments. Two field collections are complete on the Fox River. Black bullheads were collected for histopathological analyses.

STATUS AND SCHEDULE OF DELIVERABLES:

7832 DUE: 04/30/89 REVISED: COMPLETED:  
REPORT ON THE APPLICATION OF U.S. TEST METHODS FOR WQC DEVELOPMENT,  
EFFLUENT TOXICITY TESTING, & AMBIENT TOXICITY ASSESSMENT IN THE PRC

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CODE TITLE

BUDGET SUB-ACTIVITY: B101 WATER QUALITY  
ISSUE: A WQBA/PERMITTING  
PPA (L): 14 AQUATIC LIFE WQ CRITERIA DEVELOPMENT/MODIFICATION

RC: N ERL DLTH  
PROJECT: 03 Aquatic Life WQ Criteria Development/Modifications

PROJECT OFFICER: Anthony R. Carlson

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PLANNED START: 10/01/84 PLANNED END: 09/01/88

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PROJECT DESCRIPTION:

GOAL: Formulate guidelines for the development of aquatic life water quality criteria and advisories. Prepare aquatic life water quality criteria and advisories. Test criteria under site-specific conditions as to aquatic life protection afforded.

RATIONALE: Many states are using the site-specific modification protocol, thus requiring additional testing of its application. With the need to develop additional water quality, testing of the minimum data set requirements is necessary. Field validation of present and new criteria is required.

APPROACH: Laboratory and field studies will be undertaken for the development and validation of the guidelines and criteria. Chronic testing and evaluation of more sensitive endpoints will be undertaken for compounds for which criteria are to be developed. The protection of ecosystem functions will be determined. Issuing aquatic life advisories with minimum data sets will be assessed. The expression of concentration, duration and frequency in the new aquatic life criteria requires the development of methodologies to classify and assess impact on ecosystem as well as predict recovery.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

Drafts of eight criteria documents (acenaphthene, antimony III, 2,4,5-trichlorophenol, DEHP, phenanthrene, hexachlorobenzene, silver and 1,2,4-trichlorobenzene) were updated after Headquarters review and were resubmitted for the public comment process. Five criteria documents (phenol, thallium, 2,4-D, diazinon and methyl parathion) are in preparation.

Work to expand and improve the quality of criteria documents is underway; several factors such as CAS numbers, molecular descriptors, partition coefficients, chemical usage and more detailed descriptions of the data are now

being included in criteria documents. Format changes are also being made to give a clearer explanation of the criteria and their implementation.

The Aquatic Information Retrieval (AQUIRE) toxicity data base is a major source of literature data used for developing water quality criteria for toxic pollutants. Currently the AQUIRE data base has over 102,400 individual test results on computer file. These tests contain information for 5,200 chemicals and 2,400 organisms, extracted from over 5,700 publications. Toxicity test results for the effects of 650 organic chemicals to the fathead minnow were appended from an independent laboratory data file. All entries have been subjected to established quality assurance procedures.

Acute and chronic tests to fill data gaps needed to derive water quality criteria for 2,4,-D were conducted. Acute values for rainbow trout and fathead minnows were approximately 1000 mg/l whereas chronic values determined from early-life stage tests with these species were slightly less than 50 mg/l. Chronic tests with other species indicated that daphnids were more sensitive (factor of two) to 2,4-D than fish, but both fish species were about six times more sensitive to this chemical than plants (duckweed). New chemicals are currently being selected with the Office of Water for the development of next year's criteria documents.

Research testing with several other chemicals and fish was conducted to develop new test endpoints for determining long-term adverse effects on aquatic organisms. Preliminary results of 11 tests consisting of a 28-day exposure period and a six-month depuration phase have indicated that fish may be a sensitive screen for discerning carcinogenic responses. Five of eleven tests were analyzed and results showed that three chemicals were positive and resulted in fish tumors within seven months or less.

The streams at Monticello were exposed to selenium since February 1987. Two streams were dosed at 30 ug/l, two at 10 ug/l, and two are control streams. Results of field studies have suggested that these concentrations of selenium in the water are not directly responsible for impacts found on fish in aquatic systems. The major route of exposure is thought to be through the consumption of food that has accumulated selenium.

After eight months of exposure and before spawning, a population count of bluegills was made in the streams. Substantial mortality (>50%) had occurred in streams exposed to 30 ug/l. This was an unexpected result since laboratory data predicted that this would be a safe concentration. During the summer of 1988 the remaining fish at this concentration died. Fish exposed in streams dosed at 10 ug/l appeared healthy. However, edema caused very few of the newly hatched larvae in this stream to survive past 5-7 days. Edema has been associated with the death of larvae from parents exposed to selenium in food.

The effects of selenium in the streams on mallard duck reproduction and immuno-responses is being evaluated. Ducks were placed in the streams in late April where they remained into August. Many pairs of ducks have active nests, but no obvious effects on reproduction were found. There is preliminary evidence that some immunosuppression may have resulted from the exposures.

A journal article on the life-cycle chronic toxicity of fathead

minnows exposed to H<sup>+</sup> ions, low Ca and elevated Al was submitted for journal publication. Initial exposures of embryos and larvae of yellow perch, largemouth bass and rock bass are complete and described in a submitted journal article. Additional lab tests and in-situ field exposures of rock bass, yellow perch, largemouth bass and black crappies have been completed and are being summarized prior to manuscript preparation. Young-of-the-year largemouth bass are being acclimated to laboratory conditions prior to their use in over-winter, low-temperature survival testing.

A review of the Appendix D of the Technical Support Document for Water Quality Based Toxics Control was prepared as scheduled, indicating the need for additional research and analysis of the research literature to better understand the impact of frequency and duration of exposure. Literature review has resulted in the compilation of over 100 case studies in which some aspect of recovery from disturbance was investigated. An in-house report and potential journal article is being prepared. This report will relate case studies to relevant ecological theory and discuss needs for additional research.

STATUS AND SCHEDULE OF DELIVERABLES:

- 6525 DUE: 09/30/85 REVISED: 09/30/88 COMPLETED:  
Report evaluating the need for revising national  
guidelines for deriving water quality criteria (WQC)
- 6958 DUE: 06/30/85 REVISED: 09/30/88 COMPLETED:  
Report on the need and feasibility of revising the other  
aquatic life criteria.
- 6964 DUE: 09/30/87 REVISED: 11/30/89 COMPLETED:  
REPORT ON ANALYSIS OF FREQUENCY OF CRITERIA EXCEEDANCES AS RELATED TO  
AQUATIC COMMUNITY IMPACT
- 7088 DUE: 04/30/87 REVISED: 01/31/88 COMPLETED: 01/31/88  
Report on Toxicity of Metals and Hydrogen Ions in Low  
Alkalinity/Hardness Water
- 7171 DUE: 12/31/90 REVISED: COMPLETED:  
Report on Field Validation of Methods for Predicting and  
Assessing Fluctuating Exposure Effects
- 7838 DUE: 09/30/88 REVISED: COMPLETED:  
FINAL AQUATIC LIFE CRITERIA DOCUMENTS FOR 11 COMPOUNDS
- 7843 DUE: 09/30/88 REVISED: COMPLETED:  
DRAFT AQUATIC LIFE CRITERIA DOCUMENTS FOR UP TO 10 COMPOUNDS TO BE  
SELECTED AND PREPARED JOINTLY WITH THE OFFICE OF WATER
- 7844 DUE: 09/30/88 REVISED: COMPLETED:  
DRAFT AQUATIC LIFE ADVISORIES FOR UP TO 45 COMPOUNDS TO BE SELECTED  
AND PREPARED JOINTLY WITH THE OFFICE OF WATER

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CODE TITLE

BUDGET SUB-ACTIVITY: B101 WATER QUALITY  
ISSUE: A WQBA/PERMITTING  
PPA (L): 16 WETLANDS RES. ON WQ, MITIGATION & CUMULATIVE EFFECTS OF LOSS

RC: N ERL DLTH  
PROJECT: 39 Wetlands Research on Mitigation & Cumulative Effects of Loss  
PROJECT OFFICER: William D. Sanville

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PLANNED START: 01/01/00 PLANNED END: 01/01/00

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PROJECT DESCRIPTION:

GOAL: Develop rapid assessment procedures which enable Section 404 permit reviewers to forecast the loss of water quality and aquatic life support functions associated with loss or contamination by pollutants.

RATIONALE: Beneficial wetland functions in region watersheds include stabilization of erosion, uptake and/or transformation of inorganic and organic pollutants and maintenance of aquatic life support systems. Adverse impacts on wetlands cause both discrete as well as cumulative impacts on watershed quality. Current methods are inadequate to directly limit impacts on wetlands to adverse impacts on regional water quality.

APPROACH: This project will use a combination of literature review efforts on wetland assimilation models, basic research on critical wetland processes and comparative assessments over different wetland and watershed types to develop guidelines for estimating relationships between wetlands and watershed quality. Selection of sites currently undergoing transition and/or mitigation will be used to evaluate the guidelines. Working with the Wetland Coordinator at ERL-Corvallis, the guidelines and other assessment technologies will be transferred to Regional staff.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

NO STATUS AND ACCOMPLISHMENTS TO DATE AVAILABLE

STATUS AND SCHEDULE OF DELIVERABLES:

NO DELIVERABLES AVAILABLE



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CLIENT OFFICE GLNPO

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Office of Environmental Processes and Effects Research  
ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: B101 WATER QUALITY  
ISSUE: B MARINE, ESTUARIES & LAKES  
PPA (L): 26 SOURCES-FATE-EFFECTS OF TOXIC SUBSTANCES IN GREAT LAKES

RC: N ERL DLTH  
PROJECT: 29 Sources-Fate-Effects of Toxic Substances in Great Lakes  
PROJECT OFFICER: Russell G. Kreis

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PLANNED START: 06/01/85 PLANNED END: 12/31/95

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PROJECT DESCRIPTION:

GOAL: Develop methods to predict effects of in-place pollutants, identify and prioritize sites for remedial action, determine the optimal combination of mitigative strategies, and simulate the results/consequences of actions.  
RATIONALE: The contaminated sediment problem impacts both freshwater and marine ecosystems; in-place pollutants is a priority research topic in the Great Lakes. The problem of in-place pollutants is long-term even if zero discharge is assumed. Regulatory offices require guidance to establish a cost-effective mitigation policy.

APPROACH: An interdisciplinary approach will be used to develop and verify methods to identify and prioritize remedial strategies. Research consists of: 1) field collection, 2) field experimentation, 3) laboratory experimentation, 4) data base development, 5) model development and 6) remedial action guidance. The test sites include impacted "Areas of Concern": Detroit River (1985-1988), lower Fox River - inner Green Bay complex (1987-1992), and Lake Ontario (1990-1995). Methods and strategies developed can be used in any "Area of Concern" or other national waterways and may relate to sediment criteria development, implementation of the Clean Water Act and the US/Canada agreements. Methods will be applied to other areas as resources allow.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

The In-Place Pollutants Project (IPP) is being conducted in the Trenton Channel of the Detroit River as a component of the Upper Great Lakes Connecting Channels Study (UGLOCS). The project is multidisciplinary and encompasses

toxicity tests, measurements of heavy metals and organic contaminants, sediment resuspension, transport and deposition dynamics, vertical toxicity and contamination of sediment, fish tumor surveillance and mathematical modeling. All field work and analytical chemistry has been completed. A final UGLOCS report was submitted during the quarter. Statistical analyses are underway, journal articles have been submitted and all tasks for the Detroit River are nearing completion. Final project reports will be due during the next quarter. A research strategy for contaminated sediments has been developed for the lower Fox River to meet the requirements of three initiatives: 1) Assessment and Remedial Strategies for Contaminated Sediments, 2) Sediment Criteria, and 3) Green Bay-lower Fox River Mass Balance. Field studies for FY88 have been completed and analyses will continue through the next quarter. Project on target.

STATUS AND SCHEDULE OF DELIVERABLES:

- 7204 DUE: 05/31/88 REVISED: 12/31/88 COMPLETED:  
Report on Methods for Predicting Probability Distribution of Exposure  
for Toxic Substances in Freshwater Ecosystems
- 7205 DUE: 09/30/88 REVISED: 12/31/88 COMPLETED:  
Report on Methods for Predicting Biological Impacts of In-place  
Pollutants in the Upper G.L. Connecting Channels.
- 7877 DUE: 06/30/91 REVISED: COMPLETED:  
Report on Impacts of resuspension and diffusion of contaminants in Green  
Bay/Fox River (Tentative).

PRINT DATE: 11/29/88  
PMS-060

CLIENT OFFICE GLNPO

FOURTH QUARTER STATUS REPORT ON FY'88 PROJECT DESCRIPTIONS  
Office of Environmental Processes and Effects Research  
ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: B101 WATER QUALITY  
ISSUE: B MARINE, ESTUARIES & LAKES  
PPA (L): 26 SOURCES-FATE-EFFECTS OF TOXIC SUBSTANCES IN GREAT LAKES

RC: N ERL DLTH

PROJECT: 33 Mass Balance Models for Toxics in Freshwater Systems

PROJECT OFFICER: William Richardson

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PLANNED START: 06/01/85 PLANNED END: 09/30/95

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PROJECT DESCRIPTION:

GOAL: Conduct mass balance research to link identified ecosystems effects with their causes, assuring that results are related to possible remedial actions.

RATIONALE: Over 833 chemical compounds have been identified in Great Lakes ecosystems and biological effects continue to be documented. Fish contamination in many areas has resulted in health advisories and closing of commercial fishing. Site specific mass balance research is required to quantitate the processes and flux of contaminants to predict consequences of remedial actions.

APPROACH: Mathematical models for toxic substances based on mass balances, including transport, fate and bioaccumulation processes will be developed, calibrated and verified for important freshwater systems. The research includes: 1) development and application of sampling and analytical chemistry methods appropriate for low level contaminants, 2) development and maintenance of data bases, 3) development and application of mathematical models and other computational techniques. Application will be made in important freshwater systems. Models will be used in other areas as requested and as resources allow.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

All Cooperative Agreements, Interagency Agreements and Interlab Agreements are in place with FY88 funding completed. A meeting of the final Green Bay Committee was held during the quarter to bring all investigators up to date and to provide feedback on the field/experimental plan to GLNPO. The first shakedown cruise took place during the week of September 1st.

STATUS AND SCHEDULE OF DELIVERABLES:

- 7203 DUE: 12/31/87 REVISED: COMPLETED: 12/31/87  
REPORT DESCRIBING MASS BALANCES OF TOXICANTS OF CONCERN IN THE  
UPPER GREAT LAKES CONNECTING CHANNELS.
- 7875 DUE: 03/31/88 REVISED: COMPLETED: 03/31/88  
Report on Alternative Models and associated monitoring requirements for  
Green Bay Project Planning.
- 7876 DUE: 12/31/90 REVISED: COMPLETED:  
Report on Mass Balance and Food Chain Models for contaminants of concern  
in Green Bay.

PRINT DATE: 11/29/88  
PMS-060

CLIENT OFFICE GLNPO

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ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: B101 WATER QUALITY  
ISSUE: B MARINE, ESTUARIES & LAKES  
PPA (L): 26 SOURCES-FATE-EFFECTS OF TOXIC SUBSTANCES IN GREAT LAKES

RC: N ERL DLTH

PROJECT: 34 Tech Assist. for GLNP, OW, IJC, Regions, States & Local Gov.

PROJECT OFFICER: William Richardson

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PLANNED START: 01/01/71 PLANNED END: 01/01/99

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PROJECT DESCRIPTION:

GOAL: To assure Great Lakes research is applied to the regulatory process and to the needs of the Great Lakes Water Quality Agreement.

RATIONALE: EPA has a primary role in fulfilling the requirements of the 1978 Water Quality Agreement with Canada. The ORD Great Lakes Program at the Large Lakes Research Station is the primary focus for EPA's response. ORD/LLRS staff and on-site contractors have the experience and knowledge to efficiently fulfill technical assistance requests from GLNPO, IJC, Regions, Office of Water, and State and local governments.

APPROACH: Technical assistance will be provided on a priority basis to EPA Program Offices, IJC, Regions, States, and local governments. Specific areas of support will include: 1) maintenance, documentation, application and training for mathematical models, 2) computer service support for water quality and point source data bases, 3) participation on IJC committees and boards, state and local government committees, and 4) providing information to the regulatory community including consultants working for government agencies.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

Documentation of the Point Source File System was completed and storage of Michigan, Ontario MOR's was begun. Conversion of Great Lakes eutrophication models was completed. Storage of Canadian phosphorus data was completed.

STATUS AND SCHEDULE OF DELIVERABLES:

8085 DUE: 12/31/88 REVISED: COMPLETED:  
PILOT CONFINED DISPOSAL FACILITY BIOMONITORING FIELD AND DATA REPORT

PRINT DATE: 11/29/88  
PMS-060

CLIENT OFFICE OSW

FOURTH QUARTER STATUS REPORT ON FY'88 PROJECT DESCRIPTIONS  
Office of Environmental Processes and Effects Research  
ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: D109 HAZARDOUS WASTE  
ISSUE: C WASTE CHARACTERIZATION  
PPA (L): 96 Waste Futures and Aquatic Impacts

RC: N ERL DLTH  
PROJECT: 37 Leachate Toxicity Profiles for Haz. Waste Characterization

PROJECT OFFICER: Gerald J. Niemi

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PLANNED START: 01/31/88 PLANNED END: 09/30/95

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PROJECT DESCRIPTION:

GOAL: To develop leachate toxicity profiles which accurately predict the hazards to aquatic lifeforms and alteration in subsurface transport.  
RATIONALE: Current technology permits the measurement of potency of constituents or whole leachates to a variety of lifeforms. There is no acceptable protocol to extrapolate these data to aquatic impacts and no methods to accurately forecast the modification of whole leachate toxicity due to the chromatographic effects of subsurface transport. This project will provide a new profile which expands current practices to fill these voids.  
APPROACH: The toxicity profile will be expanded to meet the minimum needs established by the National Water Quality Data Guidelines to protect aquatic lifeforms. New methods to cost effectively assess the broad spectrum of chronic effects will be assimilated. The profile will include the distribution of toxicity in existing waste fractionation methods and be aligned with existing subsurface transport models.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

Protocols for fractionation, identification and evaluation of toxicity in hazardous leachate effluents are being submitted for publication. These protocols have been successfully used to fractionate and identify components causing toxicity in a number of samples. Components identified as causing toxicity in effluents includes chlorine, ammonia, chelatable metals and non-polar organics. Research and development on methods for polar organics and nonchelatable metals continues.

In addition, the possibilities of incorporating information on biomarkers in

leachate toxicity profiles continues. An indicator of damage to mammalian DNA/RNA from toxic organic contaminants is the change in the profile of modified nucleosides released in blood plasma and urine relative to creatinine. A sensitive HPLC method has been developed to characterize these nucleosides in fish. Fish on one hundred and thirty samples from the Fox River, WI have been collected and are being analyzed to detect modified nucleosides in plasma. These results will be correlated to histopathological examination of fish liver for cancerous growths. Completion of nucleoside profiles is expected by June 1, 1989. Also, blood cells and portions of liver have been saved for the development of DNA-adduct methods as possible additional biomarkers for toxicity profiles.

STATUS AND SCHEDULE OF DELIVERABLES:

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|------|---|----------|------------|
| 8090 | DUE: 08/31/88   | REVISED: | COMPLETED: |
|      | REPORT ON METHODS FOR LEACHATE TOXICITY IDENTIFICATION  |          |            |
|      |   |          |            |
| 8092 | DUE: 04/30/89   | REVISED: | COMPLETED: |
|      | FEASIBILITY REPORT FOR THE USE OF TOXICITY PROFILES TO PREDICT AQUATIC IMPACTS OF WHOLE LEACHATE COMPONENTS |          |            |

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FOURTH QUARTER STATUS REPORT ON FY'88 PROJECT DESCRIPTIONS  
Office of Environmental Processes and Effects Research  
ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: D109 HAZARDOUS WASTE  
ISSUE: C WASTE CHARACTERIZATION  
PPA (L): 96 Waste Futures and Aquatic Impacts

RC: N ERL DLTH  
PROJECT: 38 Predicting Aquatic Toxicity of HW Constituents and Exposures  
PROJECT OFFICER: Russell J. Erickson

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PLANNED START: 01/31/88 PLANNED END: 09/30/95

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PROJECT DESCRIPTION:

GOAL: To develop toxic effects models, suitable for thousands of waste stream constituents, which enable aquatic impact assessment for diverse habitats and exposure conditions.

RATIONALE: We have the capability to assess the toxic impact of organic chemicals and metals only under constant exposure. The uncertainties in risk assessment of this limited approach are unacceptably large. Current methods also grossly underestimate the toxicity of specific classes of waste constituents. This project provides OSW with the critical effects models to accurately assess the impact of waste stream constituents on aquatic systems.

APPROACH: Aquatic impacts will be estimated based on a model which integrates fluctuating exposures with the total dose and residue in representative aquatic lifeforms. The fate of constituents within organisms will be linked to specific toxicity effects models to determine dilution factors which minimize risk.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

A model which was developed to relate gill exchange of organic chemicals to cardiac and respiratory parameters, has been demonstrated to provide useful results for large rainbow trout, and is being further refined. Experiments are underway to compare uptake of organic chemicals by smaller fish to relationships already established for large rainbow trout and to consumption of oxygen. Experiments are underway to establish rates of elimination of a set of chlorinated alkanes via various routes in rainbow trout and to support development of better toxicokinetic models. The relationship of chemical accumulation to effects is being reviewed and studies on the utility of kinetic-based effects models for predicting effects of fluctuating concentrations are being initiated in cooperation with other projects.



STATUS AND SCHEDULE OF DELIVERABLES:

8091 DUE: 08/31/89 REVISED: COMPLETED:  
REPORT ON AQUATIC EFFECTS MODEL FOR FLUCTUATING TRANSIENT EXPOSURES

8093 DUE: 04/30/89 REVISED: COMPLETED:  
REPORT ON EFFECTS MODEL FOR HIGHLY HAZARDOUS WASTE CONSTITUENTS

PRINT DATE: 11/29/88  
PMS-060

CLIENT OFFICE OPP

FOURTH QUARTER STATUS REPORT ON FY'88 PROJECT DESCRIPTIONS  
Office of Environmental Processes and Effects Research  
ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: E104 PESTICIDES  
ISSUE: D ECOLOGY: TRANSPORT/FATE/FIELD VALIDATION  
PPA (L): 06 FIELD VALIDATION FOR HAZARD ASSESSMENT TECHNIQUES

RC: N ERL DLTH

PROJECT: 19 Field Validation for Hazard Assessment Techniques

PROJECT OFFICER: Richard E. Siefert

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PLANNED START: 10/01/83 PLANNED END: 09/30/90

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PROJECT DESCRIPTION:

GOAL: Design an approach to validate current methodologies to measure pesticide impact on non-target organisms under natural pesticide use conditions. Data generated will be used to design more appropriate tests for hazard assessments.

RATIONALE: Accurate hazard assessments are needed to effectively regulate pesticides. This field research will assist in validation of existing freshwater test methods as well as develop improved field protocols.

APPROACH: Conduct natural pond studies using actual pesticide application procedures and determine the pesticide effects on non-target organisms. Primary and secondary (ecological) effects will be studied on microbes, algae, microinvertebrates, macroinvertebrates and fish. Environmental chemistry studies will include both water and sediment. Biota recovery studies will be conducted after pesticide applications. Results will be combined with information obtained from the literature to improve the accuracy and predictability of pesticide effects by freshwater laboratory methodology, and will provide field testing protocols.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

A national workshop entitled "Aquatic Field Testing: Experimental Mesocosms and Field Techniques" was hosted by ERL-D on September 14-17. Attending were experts on aquatic field research from the pesticide industry, academia, private consulting firms and government agencies.

Studies in 1985 and 1986 indicated that use of littoral enclosures in natural waters is feasible to improve hazard evaluation testing. Field work using

multiple enclosures built in a pond and treated with three concentrations of a high use pesticide (chlorpyrifos) was accomplished. Included in this mesocosm enclosure design are controls and replications for sound statistical analyses, precise environmental chemistry (both in application of the pesticide and analyses of the water and sediment), and primary and secondary (ecological) effect measurements of microbes, algae, macrophytes, microinvertebrates, macroinvertebrates, and fish. Analyses of chemical and biological samples, biota recovery studies, investigations on environmental chemistry (pesticide concentration profiles), fish reproduction studies and other work to refine protocol were completed. A final report describing this new field testing protocol and the results of testing chlorpyrifos has been submitted to the user groups.

The littoral enclosure protocol is currently being validated. The SS isomer of fenvalerate (Asana) is the pyrethroid pesticide used in this year's study. Asana is the high priority pesticide recommended to be tested by the Ecological Effects Branch of OPP. Field work for this study has been completed and analyses on chemical and biological samples are underway.

The project will result in a field testing guidance document for the Office of Pesticide Program for use in the registration of new pesticides, as well as provide ecological effects data on those pesticides tested in the littoral enclosures.

STATUS AND SCHEDULE OF DELIVERABLES:

- 7368 DUE: 09/30/87 REVISED: 03/31/88 COMPLETED: 03/31/88  
FIELD VALIDATION ENCLOSURE STUDY ON EFFECTS OF PESTICIDES IN A NATURAL POND
- 7592 DUE: 09/30/88 REVISED: 03/31/89 COMPLETED:  
REPORT ON FIELD VALIDATION OF ENCLOSURE PROTOCOLS FOR EVALUATING  
PESTICIDES ON NATURAL WATERS. (N)

PRINT DATE: 12/05/88  
PMS-060

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Office of Environmental Processes and Effects Research  
ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: E104 PESTICIDES  
ISSUE: H BIOTECHNOLOGY/MICROBIAL AND BIOCHEMICAL PEST CONTROL AGENTS  
PPA (L): 12 DEVELOP GUIDELINE PROTOCOLS AND TEST FOR BCA EFFECTS

RC: N ERL DLTH  
PROJECT: 06 Develop Guideline Protocols and Test for BCA Effects

PROJECT OFFICER: Richard L. Anderson

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PLANNED START: 10/01/83 PLANNED END: 11/30/89

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PROJECT DESCRIPTION:

GOAL: Develop or improve methods that can determine the effects on freshwater ecosystems of microbial pest control agents (MPCA).

RATIONALE: Ecological risk assessment requires knowledge of an agents toxicity, concentration in the system and the populations that may be exposed after the agent enters the system. For a MPCA, knowledge of the pathology of the agent is also essential for a risk assessment.

APPROACH: The pathology experiments are directed towards the organism and how it is affected by the MPCA. The toxicity program is divided in two categories. One is to develop methods that determine direct acute and chronic toxicity to non-target animals and the second is to develop methods to measure direct acute or chronic effects on populations, communities and ecosystems. The ecological studies are to develop methods to measure the relationship of the MPCA to the ecosystem and how other populations, not directly affected respond to its introduction.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

Our immediate goal is to develop acute and chronic laboratory tests for target and non-target invertebrates and fish and to establish a microcosm test system that will accurately portray events in outdoor, natural systems. Our extended goal is to evaluate the predictive capacity of laboratory data in situations where the agents are applied.

During the last quarter, activities were mainly confined to research. Administrative activities were limited to coordination of program activities with Gulf Breeze, Corvallis and Headquarters. Efforts were also directed

toward preparation of reports for the "all hands" meeting in Baltimore in October.

The research activities centered on continuation of research projects. Data from a section that studied the uptake of formulated *Bacillus thuringiensis* var *israelensis* (Bti) by fathead minnows and brook trout was recently compiled. Fish rapidly picked up suspended Bti and most appeared to be deposited in the gut. After transfer to Bti-free water, there was a rapid clearance from the gut. The fecal material was toxic to mosquitoes showing that the toxicity was retained during the gut passage. These uptake and loss results show that fish could be an active factor in the distribution of an agent. Laboratory exposures of caddisflies were continued with an emphasis on short time exposures designed to simulate the short-exposure conditions associated with blackfly control activities. We were able to show that even in short (<30 min) exposures, Bti was accumulated and retained for several days.

STATUS AND SCHEDULE OF DELIVERABLES:

- 7254 DUE: 12/31/87 REVISED: COMPLETED: 12/31/87  
REPORT ON THE MOVEMENT AND SURVIVAL OF A BIOLOGICAL CONTROL  
AGENT IN TWO NATURAL SYSTEMS.
- 7674 DUE: 10/30/87 REVISED: COMPLETED: 10/30/87  
REPORT ON FRESHWATER TESTS OF SINGLE SPECIES EXPOSED TO PESTICIDAL  
AND NON-PESTICIDAL MICROBES. (N)
- 7675 DUE: 10/30/88 REVISED: COMPLETED:  
REPORT ON THE DEVELOPMENT AND VALIDATION OF SINGLE SPECIES TEST PROTOCOLS  
FOR PESTICIDAL AND NON-PESTICIDAL MICROBES. (N)
- 7894 DUE: 10/31/88 REVISED: COMPLETED:  
REPORT ON ACUTE AND CHRONIC TEST PROTOCOLS FOR EXPOSING  
FRESHWATER FISH TO BCA'S.
- 7895 DUE: 11/30/89 REVISED: COMPLETED:  
RPT. ON THE EFFECT OF TARGET & NON-TARGET INVERTEBRATES ON THE DISTRIBUTION,  
PERSISTENCE & VIRULENCE OF BCA IN FRESHWATER MICROCOSMS & NATURAL SYSTEMS.

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ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: E104 PESTICIDES  
ISSUE: I ECOLOGY: ECOTOXICITY AND RISK ASSESSMENT  
PPA (L): 13 DEVELOPMENT OF INTEGRATED RISK ASSESSMENT MODELS

RC: N ERL DLTH  
PROJECT: 32 Develop Methods of Predicting Susceptible Populations  
PROJECT OFFICER: Frank S. Stay

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PLANNED START: 01/01/86 PLANNED END: 07/25/89

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PROJECT DESCRIPTION:

GOAL: To integrate information from toxicology, biochemistry and physiology with ecosystem models, develop a method of predicting the most susceptible population to a freshwater stressor, and develop a computerized ranking system for populations within designated communities.

RATIONAL: The research in this project will compile a biological data base for a test set of 2400 aquatic species covering major taxa. The parameters will include information on anatomy, life history, ecology, physiology, and biochemistry for each organism.

APPROACH: Initial efforts include extensive literature reviews of methods. Methods for comparative bioenergetics, metabolism, and detoxification are being developed for generating missing data in the second and third years. Methods of clustering organisms with respect to susceptibility parameters instead of conventional taxonomy will be evaluated. Finally a chemical-specific species ranking system will be computerized to direct subsequent risk assessments.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

Computerized databases have been developed for organism parameters related to toxicological response, including respiration, cardiovascular function and metabolism. Application and analyses of these databases to predicting susceptibility and identification of additional parameters useful for predicting susceptibility, are in progress.

Two microcosm experiments were conducted and preliminary analysis of the sensitivity of the populations contained in these laboratory communities provided insights which aided in the selection of ASANA exposure concentrations used in the littoral enclosure experiment. Future analyses and studies will develop information which can be used to test the ranking of species in more complex systems, to evaluate the accuracy of microcosms through comparisons

with littoral enclosures, and to describe the effect of ecosystem age on community sensitivity.

STATUS AND SCHEDULE OF DELIVERABLES:

- 7470 DUE: 07/31/89 REVISED: COMPLETED:  
Report on Biological Data Base for Risk Assessment
- 7781 DUE: 04/30/90 REVISED: COMPLETED:  
Final Report on Resistance and Resilience of Pond and Stream  
Ecosystems to Toxicant Stress
- 7985 DUE: 02/28/88 REVISED: COMPLETED: 02/28/88  
THE IDENTIFICATION AND EVALUATION OF AQUATIC COMMUNITY ECOSYSTEM MODELS FOR  
USE IN ESTIMATING ECOLOGICAL RISK.

PRINT DATE: 11/29/88  
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Office of Environmental Processes and Effects Research  
ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: L104 TOXICS  
ISSUE: A TEST METHOD DEVELOPMENT  
PPA (L): 04 AQUATIC TOXICOLOGY

RC: N ERL DLTH  
PROJECT: 17 Aquatic Toxicology  
PROJECT OFFICER: Steven J. Broderius

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PLANNED START: 10/01/80 PLANNED END: 10/01/88

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PROJECT DESCRIPTION:

GOAL: To develop and validate methods for using small aquarium fish to assess the toxicological properties of chemicals.

RATIONALE: Low cost, validated assays developed on sound toxicological principles which provide data applicable for extrapolation to other species and with multiple endpoints are necessary for accurate environmental and health hazard assessments.

APPROACH: Many of the in vivo assays being used to ascertain the carcinogenic potential of synthetic chemicals are very costly. Relatively less expensive assays using small fish have shown promise for establishing endpoints such as reproductive toxicity and teratogenicity. Appropriate exposure techniques and endpoint analysis designed on sound toxicokinetic and toxicodynamic principles will provide useful data on several endpoints which can be extrapolated to other species as well as provide a data base for SAR predictions.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

The deliverable #8095A entitled "Validation of the medaka assay for chemical carcinogens: A progress report" was completed and submitted to OEPR in August, 1988. Summary results of the report state that 4-chloroaniline and aniline cause tumors in medaka while hexachlorobenzene does not. DEHP might also be a carcinogen in medaka. Further work is being done to confirm this result. Research on characterization of peroxisome proliferation in medaka hepatocytes after DEHP exposure is progressing favorably. Medaka from six other exposures are being prepared for pathology analysis. Additionally, fish from seven more exposures are in the "grow-out" phase of the assay. Exposures to other chemicals are being planned and will be initiated shortly.



STATUS AND SCHEDULE OF DELIVERABLES:

7623 DUE: 06/30/88 REVISED: COMPLETED: 06/30/88  
REPORT ON COMPARATIVE TOX. DATABASE FOR SPECIES/SPECIES EXTRAPOLATIONS  
AMONG AQUATIC ORG. (N)

8094 DUE: 03/31/89 REVISED: COMPLETED:  
REPORT ON PRELIMINARY ASSESSMENT OF USING MEDAKA FOR PREDICTING THE  
CARCINOGENIC POTENTIAL OF CHEMICALS

8095 DUE: 08/31/88 REVISED: COMPLETED:  
PROGRESS REPORT ON VALIDATION OF THE MEDAKA CARCINOGENESIS ASSAY

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CODE TITLE

BUDGET SUB-ACTIVITY: L104 TOXICS  
ISSUE: G STRUCTURE ACTIVITY RELATIONSHIPS  
PPA (L): 20 STRUCTURE-ACTIVITY RELATIONSHIPS AND ESTIMATION TECHNIQUES  
  
RC: N ERL DLTH  
PROJECT: 13 Structure-Activity Relationships and Estimation Techniques  
PROJECT OFFICER: Gilman D. Veith

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PLANNED START: 10/01/80 PLANNED END: 09/01/93

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PROJECT DESCRIPTION:

GOAL: To develop comprehensive SAR models for the aquatic toxicology of chronic effects of industrial chemicals. The SAR models address non-specific as well as specific toxicity mechanisms for new and existing chemicals.

RATIONALE: Fewer than one percent of chemicals on the TSCA inventory have been tested and many of the PMN chemicals have no test data. To screen for potential effects rapidly, structure-activity methods have been the only technically sound approach. The TSCA inventory is generically categorized and systematic test sets are generated for each important endpoint such as LC50. Molecular descriptors are generated for each chemical and structure-activity relationships derived. The relationships are validated by independent testing and provided to OTS with full documentation.

APPROACH: A systematic reference data base for acute effects of chemicals was developed for industrial chemicals. The reference data set is used to develop mechanism-specific SAR models. Representative chemicals for each mechanism are being selected for the development of a high quality chronic effects data base which will validate SAR models for growth and reproduction effects in aquatic organisms.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

The theoretical research on predictive toxicology has been somewhat delayed while the critical short-term objectives are being addressed. The in-house research is completing phase I. QSAR methods for ecotoxicity, QSAR work on acute and chronic toxicity and specific modes of action is progressing on schedule, with extensive participation by OTS staff.

Accomplishments 1. A computerized system for QSAR evaluation of chemicals was delivered to OTS. It contains a CLOGP program for state-of-the-art Log P calculation as well as an expert system for chemical evaluation. 2. A major report on electrophile-nucleophile profiles of industrial chemicals was completed. 3. A method to draw and analyze structures of reactive chemicals in three dimensions from SMILES was perfected for QSAR. 4. A file of natural substrates in living organisms has been compiled to define a natural products universe. 5. A QSAR model for polar narcotic chemicals has been defined. 6. We are continuing to define fish acute toxicity syndromes (FATS) and joint toxic action methodology that is used to help assign chemical structures to specific modes of toxic action. 7. Additional progress has been made in developing an expert system that will define metabolic pathways and rates of metabolism for industrial chemicals. 8. The first volume containing chronic data from 37 early life-history-stage tests with fathead minnows was completed. 9. A preliminary procedure for developing ecotoxicity profiles for SARA Title III chemicals has been developed through an interface of the ERL-D QSAR system and the AQUIRE data base. 10. Ecological hazard fact sheets have been prepared for SARA Title III Eco I chemicals. Similar work is progressing for Eco II and III chemicals.

STATUS AND SCHEDULE OF DELIVERABLES:

7911	DUE: 05/31/88	REVISED:	COMPLETED: 05/31/88
	REPORT ON FATHEAD MINNOW CHRONIC TOXICITY DATA BASE FOR QSAR MODELS OF ECOTOXICITY		
7912	DUE: 07/31/88	REVISED:	COMPLETED:
	PROGRESS REPORT ON SAR METHODS OF PREDICTING METABOLISM FROM CHEMICAL STRUCTURE		
7913	DUE: 08/31/89	REVISED:	COMPLETED:
	FINAL REPORT ON SAR METHODS OF PREDICTING METABOLISM FROM CHEMICAL STRUCTURE		
7915	DUE: 10/31/89	REVISED:	COMPLETED:
	REPORT ON METHODS TO COMPUTE REACTIVITY PARAMETERS FOR ELECTROPHILES		

PRINT DATE: 11/29/88  
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CODE TITLE

BUDGET SUB-ACTIVITY: L104 TOXICS  
ISSUE: I ECOLOGY: ECTOXICITY AND RISK ASSESSMENT  
PPA (L): 26 DEVELOP METHODOLOGIES FOR ECOLOGICAL RISK ASSESSMENT

RC: N ERL DLTH  
PROJECT: 31 Predicting Ecosystem Resiliency  
PROJECT OFFICER: Steven F. Hedtke

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PLANNED START: 10/01/06 PLANNED END: 09/01/91

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PROJECT DESCRIPTION:

GOAL: Develop risk assessment protocols for ecosystems through the study of the dynamic response of aquatic communities to various contaminants and perturbations.

RATIONALE: The base program addresses methods of assessing impacts of toxicants on aquatic ecosystems. This initiative will also provide predictive and field assessment methods for judging recovery period in a given aquatic ecosystem. ERL-D is currently studying aquatic ecosystem impacts in lakes, ponds, streams, mesocosms and microcosms. Although current evidence suggests that contaminant effects can be predicted from laboratory data, many factors influencing responses in the field are absent from lab tests.

APPROACH: Studies in the systems mentioned above are evaluating the accuracy of predictions derived from lab tests, as well as looking for a limited number of additional indications of detrimental effects. Two complementary studies have recently been initiated as part of the Ecological Risk Assessment Initiative: 1) a literature survey and data analysis of factors controlling recovery of ecosystems from damage; and 2) a field study intended to advance our understanding of important and sensitive community and ecosystem level properties that should be protected to maintain ecosystem health.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

A project was initiated to create data bases on recovery processes in aquatic ecosystems. Information from the published literature is being collected and compiled in such a manner as to facilitate retrieval and statistical analysis. A generalized freshwater ecosystem data base is being developed using detailed data on systems which were extensively studied. A second data base specifically

related to systems where recovery was quantified is also being developed. These data bases will be used to identify factors controlling recovery, to evaluate the ability to extrapolate between systems, to develop a classification scheme based on recovery rates, and to determine minimum variables needed to predict recovery.

The PARADOX data base management system has been used to enter and collate the physical, biological and chemical data gathered for aquatic systems across North America. Information has been obtained on more than 150 systems from approximately 120 publications which meet criteria for accurate interpretations of recovery time.

A final report which satisfies deliverable 7465A entitled "Factors controlling the recovery of aquatic systems from disturbance" was submitted this quarter. The majority (75%) of aquatic systems studied for recovery are less than 4th order streams with most of the remaining consisting of small lentic systems. The most common impacts reviewed are acute toxic (e.g., DDT and rotenone) and chronic physical (e.g., logging and channelization) forms of stress. As part of this study, the major hypotheses proposed to explain recovery rates have been reviewed. Unfortunately there is generally insufficient data available to test many of them. The factors that did emerge as most important in the case studies are: (1) availability of refugia which enables populations to recolonize, (2) the high flushing rates for the small lotic systems, and (3) life history characteristics that allow fast population growth or recolonization rates.

A workshop designed to bring together approximately 30 national experts to discuss the application of current ecosystem theory to predict recovery of stressed lotic ecosystems has been organized and will be held October 3-6. The proceedings and recommendations will be published following the workshop.

Response variables used in littoral enclosure experiments were reviewed and additional measurements were identified which would make the results of the littoral enclosure protocol more compatible for testing current ecosystem models.

#### STATUS AND SCHEDULE OF DELIVERABLES:

7465	DUE: 08/31/88	REVISED:	COMPLETED:
	Report on Methods to Determine Ecosystem Recovery Periods		

PRINT DATE: 11/29/88  
PMS-060

CLIENT OFFICE QAR OPD

FOURTH QUARTER STATUS REPORT ON FY'88 PROJECT DESCRIPTIONS  
Office of Environmental Processes and Effects Research  
ERL DLTH: JULY - SEPTEMBER 1988

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CODE TITLE

BUDGET SUB-ACTIVITY: N104 MULTI-MEDIA ENERGY  
ISSUE: E UNDERSTAND & QUANTIFY AQUATIC EFFECTS  
PPA (L): 05 Watershed Manipulation Project

RC: N ERL DLTH  
PROJECT: 25 Watershed Manipulation Project  
PROJECT OFFICER: John G. Eaton

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PLANNED START: 10/01/83 PLANNED END: 09/01/92

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PROJECT DESCRIPTION:

GOAL: Determine the early indicator, as well as later, more dramatic chemical and biological responses of a warmwater bass lake to acid additions causing 0.5 pH unit reductions (from 6.0 to 4.5) every other year; evaluate the current state of the art of predicting acid effects; use results to substantiate assessments of impacts inferred from lab or survey data; obtain mechanistic data needed for acid effects modeling; evaluate the use of lab data for predicting acid effects on fish populations in the field.

RATIONALE: Experimental studies on whole ecosystems are a powerful technique for determining acid effects; very few such studies have been conducted; chemical and biological results will be relatable to conditions in lakes elsewhere in the U.S. and Canada; mechanistic data result in stronger models than correlative data; no lab data validation studies have been conducted for low pH.

APPROACH: Acidify one-half of a clear, warmwater, low alkalinity lake in northern Wisconsin after dividing it with a removable plastic barrier; reduce the pH over 6 years after a 2-year baseline study; compare extensive preacidification effect predictions with observed results; conduct lab bioassays to help elucidate organism- and population-level acid effects, and to explore organism-level sublethal response indicators.

PROJECT STATUS AND ACCOMPLISHMENTS TO DATE:

Nearly six years of this eight-year study have been completed and the ambient pH of 6.0 is being maintained at 5.1 for the second consecutive year. Responses have been observed by nearly all biological groups in the lake (microbes, phytoplankton, zooplankton, benthos and fish). Effect mechanisms are being explored for some of these organisms (zooplankton, macroinvertebrates,

fish) and results from these studies have been described in several recent technical journal publications. Indirect effects, mediated through food web or other organism interactions, have been implicated or demonstrated in several cases. Some consideration is being given to maintaining a pH of 5.1 for three years instead of two because of the subtlety of some responses, and acidifying the lake to a pH of 4.5 for only a single year. Cooperative agreements have been negotiated for the terminal phase of the study. A new sea-curtain was installed in July to insure continued separation of the acidified and reference basins of Little Rock Lake. All milestones have been met on schedule.

STATUS AND SCHEDULE OF DELIVERABLES:

- 7324 DUE: 03/31/88 REVISED: COMPLETED: 03/31/88  
Journal Article: Fish Population Changes and Mechanisms Associated with  
Changes in Acidified Lake
- 7325 DUE: 03/31/88 REVISED: COMPLETED: 03/31/88  
Journal Article on Response of Little Rock Lake to Artif. Acidif. Water  
Chemistry, Productivity, Nutrients, Hydrology