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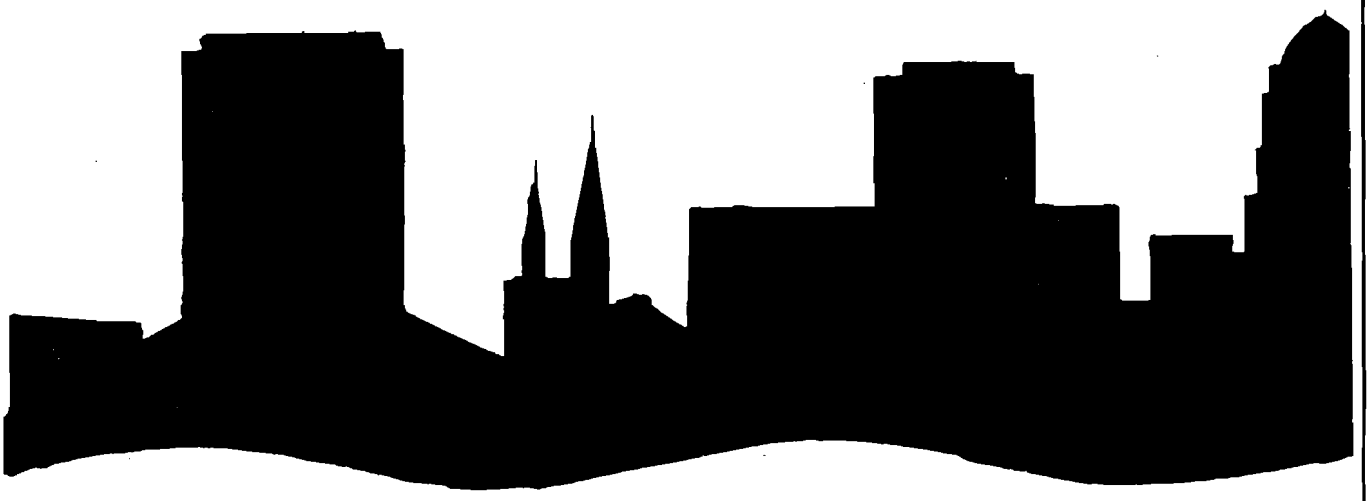
Department of Environmental Conservation

Division of Water

Buffalo River Remedial Action Plan

ANNUAL REPORT

June 1993



New York State Department of Environmental Conservation

MARIO M. CUOMO, *Governor* THOMAS C. JORLING, *Commissioner*

BUFFALO RIVER

REMEDIAL ACTION PLAN

ANNUAL REPORT

June 1993

New York State Department of Environmental Conservation

This Buffalo Remedial Action Plan Annual Report was prepared by the New York State Department of Environmental Conservation in cooperation with the Buffalo River Remedial Advisory Committee.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

In November 1989 the Buffalo River Remedial Action Plan (RAP) was issued. A Remedial Advisory Committee (RAC) was formed early in 1990 to assist the DEC in the implementation of the RAP. The RAC is representative of concerned groups within the community that have an interest in the Buffalo River.

The Remedial Action Plan contained initial agency commitments to implement the remedial action strategy. Subsequent commitments and accomplishments were reported in two earlier annual reports. This report summarizes the accomplishments through March 1993 and identifies the activity projections for the fiscal year April 1993 through March 1994.

Stream Water Quality Monitoring

- A flow activated sampling station was established by DEC on the Buffalo River at Ohio Street. Event related sampling has been undertaken and was continued into the 1992-93 year. A report on the findings is under preparation.

- A dissolved oxygen sampling program was undertaken by DEC. The data analysis indicated the need for computer modeling of stream interactions to assess the data relative to dissolved oxygen demand. The computer modeling and analysis activity is ongoing.

Bottom Sediments

- Requirements for sediment transport model improvements were developed by a contractor for DEC. Funding of the model improvements will be

deferred as sediment transport modeling of the Buffalo River is being undertaken by USEPA under the Assessment and Remediation of Contaminated Sediments (ARCS) program.

- A dredging technology evaluation program was undertaken along the Buffalo River by the U.S. Army Corps of Engineers during 1992-93. The efficiency of several dredging cutter heads were assessed in the evaluation program. A report on the evaluation is under preparation.

- Methods for determining sediment criteria are continuing to be developed by USEPA.

Inactive Hazardous Waste Sites

- All Phase I investigations for sites in the Buffalo River basin have been completed.

- Phase II investigations have been completed for all but four sites. An investigation is currently underway at one of these sites.

- Two Remedial Investigation/Feasibility Studies (RI/FS) are currently underway at the Niagara Transformer and the ARO Corporation sites.

- Remedial design is currently ongoing at two sites, Union Road and Buffalo Color.

- A remedial waste removal action is currently underway at the Bern Metal site and a remedial construction action is currently underway at the Madison Wire site.

Municipal & Industrial Wastewater Facilities

- Discharge permit monitoring and renewal activities are ongoing. Pollution prevention measures are being initiated.

Combined Sewer Overflows

- A combined sewer system model has been developed and verified for the main interceptors of the Buffalo Sewer Authority collection system network. Operational simulations have been undertaken and cost estimates of alternatives for overflow reduction/treatment have been developed.

- System modeling is being initiated on a sub-system basis to assess flow conveyance capability and the potential to enhance in-system storage within each sub-basin.

Fish & Wildlife Habitat

- A plan to assess fish and wildlife habitat conditions and improvement potential has been developed. Funding to initiate habitat assessment has been obtained and field work was initiated by DEC during 1991-92. A compilation of existing habitat conditions in the Area of Concern and the immediate upstream watershed was completed during 1992-93. A report on the findings is under preparation.

- Funding was also provided by the USEPA for faculty and students at the New York State University College at Buffalo to conduct physical mapping, siltation rate evaluations and additional biological surveys within the Area of Concern.

- Upon completion of the Phase I assessment, a determination of additional needs to develop a habitat improvement scheme will be prepared by the U.S. Fish and Wildlife Service under an agreement with Erie County and with DEC.

CHAPTER I
INTRODUCTION

The Buffalo River Remedial Action Plan (RAP) was completed and issued in November 1989. To track implementation of the Remedial Action Plan, DEC has issued a report on an annual basis to illustrate the progress on remediation by listing accomplishments in the previous fiscal year [1/] and describing commitments for the current fiscal year. This is the fourth annual report which has been issued since the completion of the RAP.

To assist DEC in the remediation process a Remedial Advisory Committee (RAC) was formed early in 1990. The RAC is representative of concerned groups within the community that have an interest in the Buffalo River. The groups include government officials, public interest groups (non-economic), economic interests and private citizens. In addition to RAC members, agencies at all levels of government are asked to participate and provide input in RAP implementation as needed.

DEC and other responsible agencies have been, and are currently carrying out remediation of environmental problems along the Buffalo River. The remedial strategy outlined in the RAP included initial commitments to be undertaken to advance the remediation of the Buffalo River. A summary of the status of these undertakings and an overview of commitments for 1993-94 is presented.

1/ The New York State fiscal year extends from April 1 to March 31.

CHAPTER 2
ACCOMPLISHMENTS THROUGH 1992-93

An overview of accomplishments through 1992-93 describing the objectives, responsible agency and status is shown in Table 1. A more detailed description follows. Under each accomplishment the "Next step:" heading denotes those actions needed to carry forward the overall RAP strategy.

A. Stream Water Quality Monitoring

1. Flow Activated Sampling Station

Establish a flow activated sampling station on the lower Buffalo River.

DEC established a flow activated sampling station at Ohio Street for sample collection during high flow events. The station has been used to collect water samples during high flow periods. The station was utilized to collect samples for the determination of pesticides, mirex, PCBs, PAHs, hexachlorobenzene and metals.

Next step: A report on the findings is being prepared.

2. Dissolved Oxygen Measurements

Conduct dissolved oxygen measurements on the Buffalo River.

DEC made extensive dissolved oxygen measurements under a variety of conditions and at different depths and cross sections. In addition,

biochemical oxygen demand measurements were made to determine upstream, bottom sediment, and other sources of oxygen demand. The data analysis indicated the need for detailed computer modeling to assess the conditions associated with dissolved oxygen demand.

Next step: Computer modeling is underway to assess river data to ascertain the causes of low dissolved oxygen.

B. Bottom Sediments

1. Sediment dynamics modeling

Develop requirements for improvements to a sediment dynamics model that would allow sediment scouring and deposition to be accurately predicted under a wide variety of flow conditions, and for alternative dredging scenarios.

A review and analysis of previous modeling on the Buffalo River was made and requirements for sediment model improvements were developed by a contractor for DEC.

Next step: Funding of the model improvements will be deferred as sediment dynamics modeling of the Buffalo River is being undertaken by the USEPA under the Assessment and Remediation of Contaminated Sediments (ARCS) program (See Appendix A).

2. Criteria Development

Develop methods for determining sediment criteria that have scientific validity.

The USEPA has been working for several years on developing and validating tests and associated acceptance criteria that would allow decisions to be made relative to the likely environmental impacts of contaminated sediments.

Next step: Once a criteria methodology has been developed by EPA, DEC will apply this methodology to the Buffalo River sediments.

C. Inactive Hazardous Waste Sites

1. Phase I Site Investigations

Conduct Phase I investigations involving existing data accumulation and assessment.

All Phase I studies for the Buffalo River basin have been completed by DEC (Appendix B, Tables B-1 and B-2).

Next step: The conduct of Phase II investigations, which include preliminary field studies to fill data gaps to complete the initial site assessment, can be scheduled.

2. Phase II Site Investigations

Conduct Phase II field investigations to fill data gaps to complete initial site assessments.

Phase II investigations were completed in 1992-93 at Stocks Pond, Dresser Industries, Clinton-Bailey and Tifft-Hopkins sites. (Appendix B, Tables B-1 and B-2).

Next step: Once Phase II site investigations are complete, the sites will be ranked and determinations of need for the conduct of Remedial Investigation/Feasibility Studies (RI/FS) will be made. Once an RI/FS is determined to be required, implementation action can be initiated under a DEC Consent Order by the responsible party or directly by DEC in the absence of a known responsible party.

3. Remedial Investigation/Feasibility Studies

Conduct Remedial Investigation/Feasibility Studies to define contaminant pathways and assess alternative remedial measures.

Remedial Investigation/Feasibility Studies are ongoing at the Niagara Transformer and ARO Corporation sites.

Next step: Once Remedial Investigation/ Feasibility Studies are complete, site remedial measures can be designed.

4. Remedial Design

Conduct Remedial Design

A remedial design was initiated for the Union Road and Buffalo Color sites during 1992-93.

Next step: Once remedial design is complete remedial construction can begin.

5. Remedial Action

Conduct Remedial Action

Remedial actions were ongoing during the 1992-93 at the Bern Metal (waste removal) and Madison Wire sites.

Next step: Once waste removal is completed at the Bern Metal site, an assessment will be made to determine if any further action is required.

D. Municipal and Industrial Wastewater Facilities

Discharge Permit Monitoring and Renewal

Continue discharge permit monitoring to achieve compliance with secondary treatment for municipal discharges and best available technology and best management practices for industrial discharges.

DEC has reviewed self-monitoring reports from dischargers, inspected facilities in operation and independently sampled effluent to check on the validity of self-monitoring data. General compliance with permit requirements has been maintained.

Next step: Each permit will be reassessed as part of the ongoing DEC water quality and technology evaluation process.

E. Combined Sewer Overflows

Combined Sewer System Modeling

Evaluate the combined sewer system model currently under development to assess its ability to reflect sewer system response to various storm events and system operation plans.

The Buffalo Sewer Authority (BSA) has undertaken an evaluation of initial model development and testing along with additional system monitoring to verify the modeled system response. Model adjustment and refinement has been completed. Selected simulations have been run to assess main interceptor system conditions and alternative operational schemes. Cost estimates of alternatives for overflow reduction/treatment have been developed.

Next step: Apply the combined sewer system model on a sub-basin basis to assess flow conveyance capability and the potential for enhanced in-system storage.

F. Fish and Wildlife Habitat

Habitat Improvement Potential

Develop plan to assess fish and wildlife habitat conditions and improvement potential.

A plan has been developed by DEC which specifically identifies work to be undertaken to assess existing habitat conditions, both aquatic and terrestrial, in the Buffalo River and to identify potentials for

habitat improvement. The work plan has been segmented into phases for accomplishment. Funding has been obtained and field work has been initiated by DEC to compile data on existing habitat conditions in the Area of Concern and the immediate upstream watershed.

Next step: Funds have also been provided through the USEPA for faculty and students of the New York State University College at Buffalo to conduct physical mapping, siltation rate evaluations and additional biological surveys relative to the Area of Concern in the Buffalo River.

TABLE 1
BUFFALO RIVER REMEDIAL ACTION PLAN
ACCOMPLISHMENTS THROUGH 1992-93

Objective	Target Completion Date	Responsible Agency	Status	Projected Completion Date
A. Stream Water Quality Monitoring				
1. Conduct high flow event sampling with flow activated sampling station	March 1993	DEC	Ongoing	September 1993
2. Conduct modeling of dissolved oxygen data	March 1993	DEC	Ongoing	March 1994
B. Bottom Sediments				
1. Conduct sediment dynamics modeling	March 1993	EPA (ARCS) 1/	Ongoing	March 1994
2. Develop methods for determining sediment criteria	?	EPA	Ongoing	?

1/ See Appendix A for this and other ARCS activities.

TABLE 1 (Continued)
BUFFALO RIVER REMEDIAL ACTION PLAN
ACCOMPLISHMENTS THROUGH 1992-93

Objective	Target Completion Date	Responsible Agency	Status	Projected Completion Date
C. Inactive Hazardous Waste Sites				
1. Conduct Phase II site investigations		DEC		
. Stocks Pond	October 1992		Complete	
. Dresser Industries	October 1992		Complete	
. Clinton-Bailey	October 1992		Complete	
. Tifft-Hopkins	October 1992		Complete	
2. Conduct Remedial Investigation/ Feasibility Studies		DEC		
. Niagara Transformer	March 1993		Ongoing	September 1993
. ARO Corporation	March 1994		Ongoing	March 1994
3. Conduct remedial action				
. Bern Metal	March 1993	EPA	Ongoing	September 1993
. Madison Wire	March 1994	DEC	Ongoing	March 1994

TABLE 1 (Continued)
BUFFALO RIVER REMEDIAL ACTION PLAN
ACCOMPLISHMENTS THROUGH 1992-93

Objective	Target Completion Date	Responsible Agency	Status	Projected Completion Date
D. Municipal and Industrial Wastewater Facilities				
Continue discharge permit monitoring	On-going	DEC	Ongoing	Ongoing
E. Combined Sewer Overflows				
Conduct initial sub-system assessment of conveyance capacity and enhanced in-system storage	March 1993	BSA	Ongoing	March 1994
F. Fish and Wildlife Habitat				
Conduct Phase I assessment of habitat conditions and improvement potential	March 1993	DEC	Ongoing	September 1993

CHAPTER 3
COMMITMENTS

The following is a description of 1993-94 commitments describing objectives, time for completion and responsible agency. An overview of agency commitments is shown in Table 2.

A. Stream Water Quality Monitoring

1. Flow Activated Sampling Station

Conduct high flow event sampling with a flow activated sampling station on the lower Buffalo River.

DEC has established a flow activated sampling station at Ohio Street for sample collection during high flow events. Event related sampling was continued into the 1992-93 year. Measurements were also made at a station at the upper end of the Area of Concern. The results will be compared to determine the loading of contaminants from both the upper basin and the Area of Concern.

Completion date - September 1993
Responsible agency - DEC

Next step: An analysis will indicate the amount of contaminants discharged from the Buffalo River. The loading of contaminants from both the upper basin and the Area of Concern will be determined.

2. Dissolved Oxygen Measurements

Conduct computer modeling to assess dissolved oxygen measurements on the Buffalo River.

Computer modeling to assess dissolved oxygen demand measurements is being undertaken. An assessment will be made of the benefits of supplemental water input from the Buffalo Harbor to the Buffalo River through the Buffalo River Improvement Corporation pumping and transmission system.

Completion date - March 1994
Responsible agency - DEC

Next step: Once the exact nature of the low dissolved oxygen is understood and the contributing causes are identified, remedial measures can be planned.

B. Bottom Sediments

1. Sediment dynamics modeling

Develop a sediment dynamics model that would allow sediment scouring and deposition to be accurately predicted under a wide variety of flow conditions, and for alternative dredging scenarios.

A sediment dynamics model of the Buffalo River has been developed by the USEPA under the Assessment and Remediation of Contaminated Sediments (ARCS) program (Appendix A). This model will allow predictions of sediment scour and deposition under a variety of flow conditions in the Area of Concern.

Completion date - March 1994
Responsible Agency - EPA

Next step: The ARCS program sediment dynamics model will provide information necessary for an assessment of the feasibility of remediation through sediment deposition and armoring.

2. Criteria Development

Develop methods for determining sediment criteria that have scientific validity.

EPA is developing and validating tests and associated acceptance criteria that would allow decisions to be made relative to the likely environmental impacts of contaminated sediments. This work will be brought to a conclusion with a report on recommended tests and criteria.

Completion date - ?
Responsible agency - USEPA

Next step: Once a criteria methodology has been developed by EPA, DEC will apply this methodology to the Buffalo River sediments. Funds to support this could come from a demonstration project under the Clean Water Act, Section 118. It would include both the development of site specific criteria, and actual testing of the bottom sediments.

C. Inactive Hazardous Waste Sites

1. Phase II Site Investigations

Conduct Phase II field investigations to fill data gaps to complete initial site assessments.

A Phase II investigation is underway at one site, ENRX.

Completion date - March 1994
Responsible agency - DEC

Next step: Once Phase II site investigations are complete, the sites will be ranked and determinations of need for the conduct of Remedial Investigation/Feasibility Studies (RI/FS) will be made. Once an RI/FS is determined to be required, implementation action can be initiated under a DEC Consent Order by the responsible party or directly by DEC in the absence of a known responsible party.

2. Remedial Investigation/Feasibility Studies

Conduct Remedial Investigation/Feasibility Studies to define contaminant pathways and assess alternative remedial measures.

Remedial Investigation/Feasibility Studies are underway at two sites (Niagara Transformer and ARO).

Completion date - March 1994
Responsible agency - DEC

Next step: Once Remedial Investigation/ Feasibility Studies are complete, site remedial measures can be designed.

3. Remedial Design

Conduct Remedial Design

Remedial design is underway at two sites (Union Road and Buffalo Color)

Completion date - March 1994
Responsible agency - DEC

Next step: Once design is complete, remedial action can be implemented.

4. Remedial Action

Conduct Remedial Action

A remedial waste removal action is underway at the Bern Metal site and remedial construction action is underway at the Madison Wire site.

Completion date - March 1994
Responsible agency - DEC and EPA

Next step: Once construction is completed the sites will be monitored.

D. Municipal and Industrial Wastewater Facilities

Discharge Permit Monitoring and Renewal

Continue discharge permit monitoring to achieve compliance with secondary treatment for municipal discharges and best available technology and best management practices for industrial discharges.

DEC reviews self-monitoring reports from discharges, inspects facilities in operation and independently samples effluent to check on the validity of self-monitoring data. Significant violations of permit conditions trigger compliance or enforcement measures.

Completion date - Ongoing
Responsible agency - DEC

Next step: Each permit will be reassessed to meet water quality standards and the technology requirements applicable at the time of renewal. The requirement of pollution prevention measures will be initiated.

E. Combined Sewer Overflows

Combined Sewer System Modeling

Apply the combined sewer system model to assess sub-basin flow conveyance capacity and the potential for enhanced in-system storage.

Sub-basin system characteristics and flow data are being obtained for entry into the Buffalo Sewer Authority (BSA) combined sewer system model to assess system conditions and alternative operation schemes for the initial sub-basin.

Completion date - March 1994
Responsible agency - BSA

Next step: Once the exact nature of potential system modifications is defined, remedial measures including enhanced in-system storage can be planned.

F. Fish and Wildlife Habitat

Habitat Improvement Potential

Implement plan to assess fish and wildlife habitat conditions and improvement potential.

Habitat loss impairs beneficial uses such as fishing and observing wild birds and animals. The combination of dredging and bulkheading on the Buffalo River has substantially reduced fish habitat by eliminating many productive shallow waters and wetlands. A plan has been developed by DEC which specifically identifies the work to be undertaken to assess the existing habitat conditions.

A compilation of existing habitat conditions in the Area of Concern and the immediate upstream watershed is being undertaken by DEC. In addition, under funding provided by USEPA faculty and students from the New York State University College

at Buffalo will undertake physical mapping, siltation rate evaluations and additional biological surveys relative the Area of Concern.

Completion date - September 1993
Responsible agency - DEC and USEPA

Next step: Upon completion of Phase I of the assessment a determination of additional needs to develop a habitat improvement scheme will be prepared by the U.S. Fish and Wildlife Service under an agreement with Erie Couny and DEC which would lead to site acquisition to preserve habitat improvement potentials.

TABLE 2
BUFFALO RIVER REMEDIAL ACTION PLAN
1993-94 COMMITMENTS

Objective	Target Completion Date	Responsible Agency
A. Stream Water Quality Monitoring		
1. Conduct high flow event sampling with flow activated sampling station	September 1993	DEC
2. Conduct modeling of dissolved oxygen data	March 1994	DEC
B. Bottom Sediments		
1. Conduct sediment dynamics modeling	March 1994	EPA (ARCS) 1/
2. Develop methods for determining sediment criteria	?	EPA
C. Inactive Hazardous Waste Sites		
1. Conduct Phase II site investigations		DEC
. ENRX	March 1994	
2. Conduct Remedial Investigation/ Feasibility Studies		DEC
. Niagara Transformer	September 1993	
. ARO	March 1994	
3. Conduct Remedial Designs		DEC
. Union Road	March 1994	
. Buffalo Color	March 1994	

1/ See Appendix A for this and other ARCS activities.

TABLE 2 (Continued)
BUFFALO RIVER REMEDIAL ACTION PLAN
1993-94 COMMITMENTS

Objective	Target Completion Date	Responsible Agency
3. Conduct remedial actions		
. Bern Metal	September 1993	EPA
. Madison Wire	March 1994	DEC
D. Municipal and Industrial Wastewater Facilities		
Continue discharge permit monitoring	Ongoing	DEC
E. Combined Sewer Overflows		
Conduct initial sub-system assessment of conveyance capacity and enhanced in-system storage	March 1994	BSA
F. Fish and Wildlife Habitat		
Conduct Phase I assessment of habitat conditions and improvement potential	September 1993	DEC & EPA

APPENDIX

A. ASSESSMENT AND REMEDIATION OF CONTAMINATED SEDIMENTS (ARCS) WORK PLAN EXCERPTS

B. INACTIVE HAZARDOUS WASTE SITE REMEDIATION

ASSESSMENT AND REMEDIATION OF CONTAMINATED SEDIMENTS (ARCS) WORK PLAN EXCERPTS

Introduction

The 1987 amendments to the Clean Water Act, in Section 118(c)(3), authorize the U.S. Environmental Protection Agency's (EPA) Great Lakes National Program Office (GLNPO) to coordinate and conduct a 5-year study and demonstration project relating to the appropriate treatment of toxic pollutants in bottom sediments. Five areas were specified in the Act as requiring priority consideration in conducting demonstration projects: Saginaw Bay, Michigan; Sheboygan Harbor, Wisconsin; Grand Calumet River, Indiana; Ashtabula River, Ohio; and Buffalo River, New York (Figure 1). To fulfill the requirements of the Act, GLNPO initiated the Assessment and Remediation of Contaminated Sediments (ARCS) Program. In addition, the Great Lakes Critical Programs Act of 1990 amends the Section, now 118(c)(7), by extending the Program by one year and specifying completion dates for certain interim activities.

ARCS is an integrated program for the development and testing of assessment and remedial action alternatives for contaminated sediments. Information from ARCS program activities will be used to guide the development of Remedial Action Plans (RAPs) for the 43 Great Lakes Areas of Concern (AOCs, as identified by the United States and Canadian Governments), as well as Lakewide Management Plans.

Although GLNPO is responsible for administering the ARCS Program, it is a multi-organization endeavor. Other participants in ARCS include the U.S. Army Corps of Engineers (ACE), the U.S. Fish and Wildlife Service (FWS), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Department of Interior, EPA headquarters offices, EPA laboratories, EPA Regions II, III and V, Great Lakes State Agencies, numerous universities, and public interest groups.

The management framework for the ARCS Program is depicted in Figure 2. The Management Advisory Committee has provided advice on ARCS Program activities, and its membership includes representatives from the organizations noted above. Three technical Work Groups identify and prioritize specific tasks to meet the objectives of the Program. These are the Toxicity/Chemistry, Risk Assessment/Modeling, and Engineering/Technology Work Groups. A fourth Work Group, Communication/Liaison, oversees technology transfer, public information and public participation activities. Finally, the Activities Integration Committee coordinates the technical aspects of the work groups' activities.

Objectives

The overall objectives of the ARCS program are to:

- Assess the nature and extent of bottom sediment contamination at selected Great Lakes Areas of Concern,
- Demonstrate and evaluate the effectiveness of selected remedial options, including removal, immobilization and advanced treatment technologies, as well as the "no action" alternative, and
- Provide guidance on contaminated sediment problems and remedial alternatives in the Areas of Concern and other locations in the Great Lakes.

An important aim of the ARCS Program is that the procedures developed and demonstrated be scientifically sound, and technologically and economically practical. The intent is to provide the environmental manager with methods for making cost-effective, environmentally sound decisions. As a result, application of existing techniques is stressed over basic research into new ones. Some developmental work is, however, being undertaken.

To completely assess the causes and effects of contaminated sediments and to fully evaluate the remedial options available, a mass balance of each of the priority areas, including quantification of contaminant loadings from point and non-point sources, would be necessary. Unfortunately, such characterizations could cost several millions of dollars for each priority area. The ARCS Program is using available resources to develop a basic framework for site characterization.

It is important to stress at the outset that ARCS is not a cleanup program, and will not solve the contaminated sediment problems at the five priority consideration areas. The Program will, however, provide valuable experience, that can be used for other projects to actually solve the identified problems.

There are several important aspects of the management of contaminated sediments that will not be fully addressed by the ARCS Program because they were felt to be outside the main objectives of the study. Regulatory requirements and socioeconomic factors in decision-making are two such aspects that will be critical in the choice of a remedial alternative (or whether to remediate at all). While not addressing such issues in depth, the ARCS Program will identify the major issues that need to be resolved before decisions can be made.

Activities

Many complicated issues need to be addressed in order to accomplish the objectives of this Program. These include:

- Are the sediments contaminated with substances that are harmful to fish or other aquatic life, wildlife, or human health?
- Are the injuries inflicted of such magnitude or quality that remedial action is needed?
- What remedial action alternatives are available, what are their limitations and how effective are they likely to be?
- What are the possible adverse impacts of the remedial action itself?
- What are the costs of taking remedial action?

The three technical Work Groups are responsible for addressing these questions. The general responsibilities of the Work Groups are as follows:

Toxicity/Chemistry Work Group. To assess the current nature and extent of contaminated sediment problems by studying the chemical, physical and biological characteristics of contaminated sediments and their biotic communities; to demonstrate cost-effective assessment techniques at the priority consideration areas that can be used at other Great Lakes Areas of Concern; and to produce three dimensional maps showing the distribution of contaminated sediments in the priority areas.

Risk Assessment/Modeling Work Group. To assess the current and future hazards presented by the contaminated sediments to all biota (aquatic, terrestrial and human) under the "no action" and various remedial alternatives at the priority consideration areas, and to develop a ranking scheme for inter-site comparison.

Engineering/Technology Work Group. To evaluate and test available removal and remedial technologies for contaminated sediments, to select promising technologies for further testing, and to perform field demonstrations of as many of the promising technologies as possible.

Toxicity/Chemistry Work Group Work Plan

Introduction

The Toxicity/Chemistry Work Group has been responsible for developing and testing sediment assessment methods. This Work Group has been assessing the nature and extent of contaminated sediment problems by studying the chemical, physical and biological characteristics of contaminated sediments and their biotic communities. The Work Group has demonstrated assessment techniques for aquatic life at the priority consideration areas. The information obtained is being used to produce contamination maps of the areas.

Objectives

The primary objectives of the Toxicity/Chemistry Work Group are:

1. Assessment Survey Guidance. To develop guidance on the performance of assessment surveys of contaminated sediments through the development of a methodology for such surveys; and

2. Demonstration of Assessment Surveys. To demonstrate the assessment survey techniques at the priority consideration areas, and use results and lessons learned in developing guidance.

Activities

The tasks needed to accomplish these objectives have been:

1) General sampling, characterization, and mapping of sediment deposits;

2) Toxicity testing of sediment samples;

3) Chemical analysis of sediment;

4) Broader spectrum toxicity testing on a selected subset of sediment samples, to compare the relative sensitivities and selectivities of different assays;

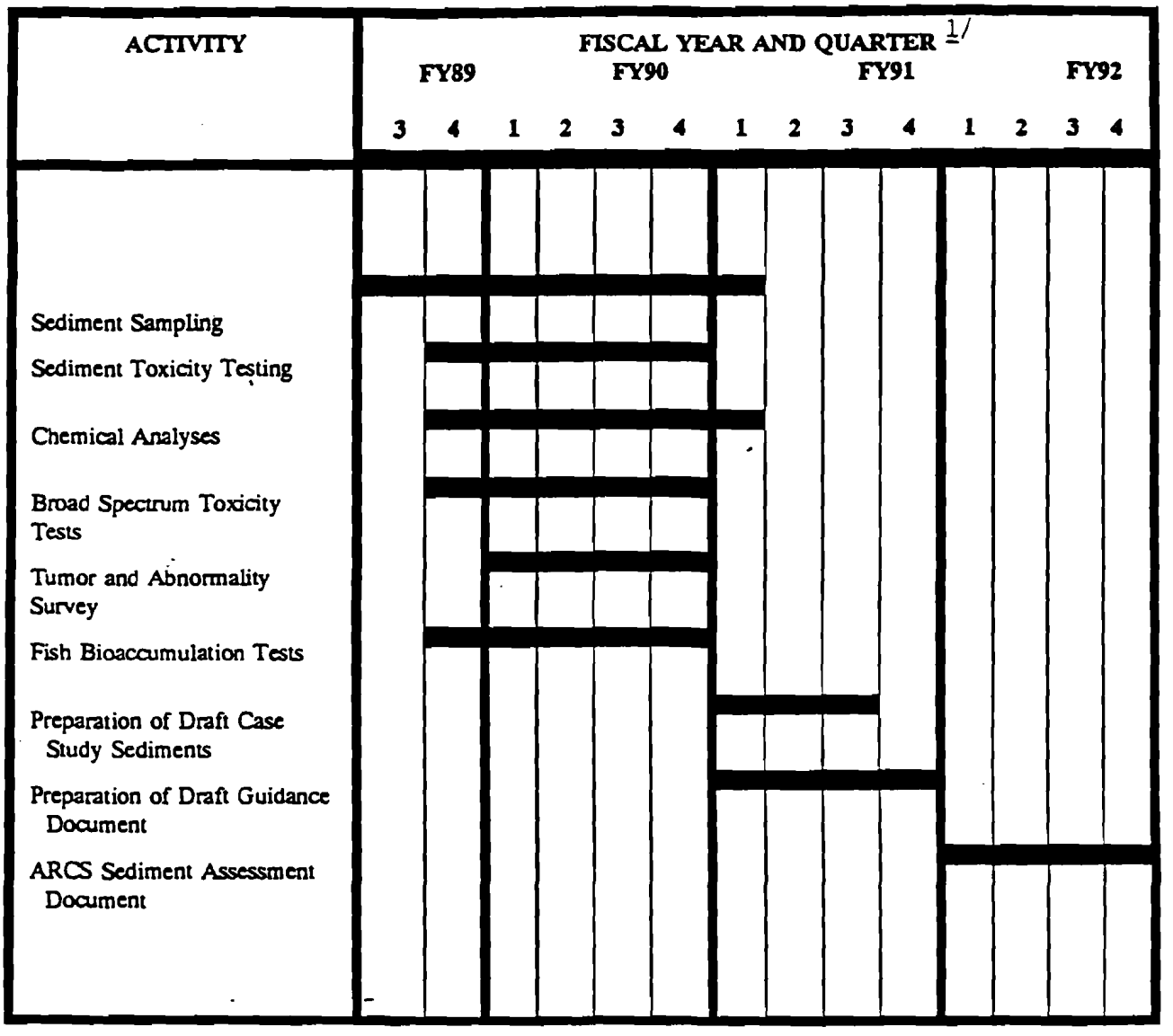
5) Fish tumor and abnormality surveys; and

6) Fish bioaccumulation assays.

Products

The products of the Toxicity/Chemistry Work Group will consist of the development of technical documents for each discrete work unit (e.g., chemical analysis of sediments, toxicity testing of sediments) and the maps of sediment deposits. In addition, the Toxicity/Chemistry Work Group will have a key role in the development of the Contaminated Sediments Assessment Guidance Document, and Volume III of the final ARCS guidance, which will recommend a much abbreviated, less expensive suite of tests that can be performed to evaluate contaminated sediment. Also, a report will be prepared comparing the chemical and toxicological roperties of the seidment with organisms living in these samples. The writing of these documents is being done by a small investigators that were involved in conducting these studies, coordinated by the Work Group Chairperson. GLNPO staff will oversee all phases of the document development.

Timeline - Toxicity/Chemistry Work Group



1/ Federal fiscal year extends from October 1 to September 30

Final report due December 1993.

Risk Assessment/Modeling Work Group Work Plan

Introduction

The Risk Assessment/Modeling Work Group is responsible for the evaluation of environmental and human health impacts resulting from contaminated sediments, and the development of techniques for assessing the environmental impacts resulting from the implementation of remedial alternatives. A mini-mass balance approach will be taken to provide the predictive capabilities necessary to determine such impact. The assessments will serve to identify and develop techniques and tools for performing sediment-related hazard evaluations. Assessments will consider the difficult task of separating the effects of sediments from those of the water column or other sources. A system for prioritizing sites with contaminated sediments will be developed to provide a comparative framework for assessing multiple sites that are potentially in need of remediation.

Objectives

The primary objectives of the Risk Assessment/Modeling Work Group are:

1. Hazard Evaluation: To evaluate exposures to, and impacts resulting from, contact with contaminated sediments and media contaminated by sediment contaminants, incurred by all receptors of concern under the "no action" alternative and other remedial alternatives. This evaluation will draw upon the development and integration of predictive tools to describe future hazards and risks.

2. Prioritization System Development: To develop and apply a numerically-based system for use as a decision tool to aid in the prioritization of sites for remedial action;

3. Development of Guidance: To develop guidance on the analytical methods for assessing environmental and human health impacts of contaminated sediments, to support decision making.

Activities

The tasks needed to accomplish these objectives are:

1) Hazard Evaluation

- Mini-mass Balance Approach
  - Exposure Model Development
  - Field Surveys to Calibrate Models

- Risk/Hazard Assessments
  - Human
  - Aquatic Life
  - Wildlife

2) Site Prioritization

Tasks under section 3.1 address Objective 1; tasks under section 3.2 address Objective 2. Objective 3 will be accomplished by the implementation and interpretation of activities under Objectives 1 and 2, in overall ARCS guidance documents.

Hazard Evaluation

As used here, the phrase "hazard evaluation" refers to the overall evaluation of impacts to all receptors of concern resulting from exposure to sediment contaminants, and consists of several discrete assessments. The ultimate purpose of the hazard evaluation is to determine the existing and future health risks and effects (e.g., carcinogenic, reproductive or systemic effects, community structure impacts, etc.) presented to human and environmental receptors (aquatic, avian, mammalian) from direct or indirect contact with sediment contaminants under different remedial options. The hazard evaluation is comprised of 1) an exposure assessment, 2) a human health risk assessment, 3) an aquatic hazard assessment and 4) a wildlife hazard assessment. Strictly speaking, the exposure assessment is an integral part of the human health risk assessment and the aquatic and wildlife hazard assessments, and is not usually separated out as such. However, since the activities involved in performing the exposure assessment are different than those involved in performing a risk or hazard assessment, this work plan makes a distinction between them.

Two levels of evaluation are proposed in this work plan: baseline and comprehensive hazard evaluations (Table 3). Baseline human health hazard evaluations will be performed for all five priority demonstration areas, and will be developed from available site-specific information. The baseline hazard evaluations will describe the hazards to receptors under present site conditions. This baseline assessment will examine all potential pathways that humans may incur risk from exposure to sediments for a given location. Comprehensive hazard evaluations will be performed for the Buffalo River and Saginaw Bay areas. These evaluations will describe the hazards to receptors under different remedial alternatives. These two areas were chosen based upon anticipated impacts from sediments, lack of other on-going activities (such as Superfund remedial activities), and lack of complicating factors (such as complicated ground water/surface water interactions, multiple sources of contaminant inputs, etc.). Information will be obtained through modeling exercises and field studies (described below). A variety of remediation scenarios will be examined as part of the comprehensive evaluation. These will include examining selective removal or capping of hot spots, source control, or dredging of an entire river, among others. Additionally, the comprehensive risk assessment will examine the risk from all components of a remedial process. The Engineering/Technology Work Group will provide hypothetical mass losses of contaminants resulting from each step in a remedial action. The Risk Assessment/Modeling Work Group will then use these mass loadings to develop risk assessments based on losses to the environment.

Exposure Assessment

As a component of both the human health risk assessment and the aquatic and wildlife hazard assessments, the exposure assessment strives to describe or predict the receptor's exposure to sediment-related contaminants. The assessment of direct or indirect exposure to sediment contaminants by receptors of concern will vary with the type of receptor considered (human, aquatic, avian, mammalian), the exposure route (ingestion, inhalation, dermal uptake) and the exposure parameters (exposure magnitude, duration and frequency).

Probable human exposure routes which may need to be addressed in this assessment include 1) intake of sediment contaminants through the consumption of fish and avian wildlife into which sediment contaminants have bioaccumulated, 2) intake of sediment contaminants through ingestion of sediments (particularly in children between the ages of two to eight), and 3) dermal uptake of sediment contaminants resulting from recreational use of nearshore contaminated areas. Other exposure routes, such as inhalation of volatile contaminants in sediments or ingestion or inhalation of contaminants from drinking water supplies tainted by sediment contaminants may also be important, and may be considered if important on a site-specific basis.

Exposure assessments for aquatic biota will be evaluated in part by work being performed for the Toxicity/Chemistry Work Group. A suite of bioassays on the toxicological effects of sediment contaminants are planned by the Toxicity/Chemistry Work Group, including those to provide dose-response information. These data, along with existing information, will be the basis for the aquatic biota hazard assessment.

Exposure assessments for piscivorous avian and mammalian wildlife will focus mainly on the uptake of sediment contaminants through the consumption of biota into which sediment contaminants have bioaccumulated. Other routes of exposure may also be of importance, such as intake of contaminated suspended particles in whole water, or direct uptake of sediment contaminants dermally. The feasibility of analyzing these routes will be considered.

The input needed to perform the exposure assessments will be provided by existing information, information obtained from the Toxicity/Chemistry Work Group, through modeling and through the performance of selected field exposure studies.

Exposure Modeling

The purpose of exposure modeling is to provide a predictive tool to evaluate future exposures (and consequently hazards) if present conditions are maintained ("no action") or if cleanups are undertaken. The development and validation of models will proceed in two phases (Table 4). Phase I will focus on developing modeling tools using existing information.

Phase II will validate the approaches developed in Phase I by obtaining current synoptic information about the area via five to six sampling days on the river. Data will be collected on flows, contaminant loadings and concentrations in the water column of both the particulate and dissolved phases. This work was conducted in September and November, 1990 for the Buffalo River, and May and June, 1991, for the Saginaw River. To support the food chain model, fish species were also collected and are being analyzed. For the Buffalo River, the food chain model will concentrate on carp, while for the Saginaw River, the walleye fishery and other forage fish will be sampled and analyzed.

These data will then be used to calibrate the exposure models. Without calibration, there would be little confidence in the exposure model results.

Due to resource limitations, the Phase II field work to support the mini mass balance modeling studies will only be conducted at two priority consideration areas: Buffalo River and Saginaw Bay. The contaminants to be mass balanced for the Buffalo River include:

PCBs	lead
DDT	copper
dieldrin	benzo(a)anthracene
chlordane	benzo(b+k)fluoranthene
benzo(a)pyrene	chrysene

The contaminants to be modeled for the Saginaw River are:

PCBs
zinc
copper
lead

The above contaminants were chosen based on fish advisories, concerns cited in the respective Remedial Action Plans, and results obtained from Toxicity Identification Evaluation work. These are also the two areas where comprehensive hazard evaluations will be conducted. The primary objectives of these mass balance modeling studies include the demonstration of available mass balance techniques and how they may be used as an aid in addressing management questions concerning the remediation of contaminated sediments. The mass balance studies are designed to allow estimates of the effects of remedial alternatives, using information provided from other ARCS projects, in order to estimate the response of the AOCs to these alternative remedial actions in terms of toxicity and concentrations of contaminants in the water, sediments and biota. The mass balances being conducted for ARCS are called Level I or preliminary efforts, and some uncertainty is expected. Additional model verification will certainly be necessary in the future

In the mass balance approach, the law of conservation of mass is applied in the evaluation of the sources, transport, and fate of contaminants. The approach requires that the quantities of contaminants entering the system, less quantities stored, transformed, or degraded in the system, must equal the quantities leaving the system. Once a mass balance budget has been established for each pollutant of concern, the approach can be used to provide quantitative estimates of the effects of changes in that budget.

A mass balance model is the means by which the mass balance approach is applied to a natural system. The application of the mass balance method involves the

Table 4. Components of Phase I and Phase II Exposure Modeling Efforts

Phase I

1) Compilation, review and analysis of all pertinent environmental information.

2) Development of a sediment transport, deposition and resuspension model.

3) Use of Toxicity Identification Evaluation (TIE) approach where the cause(s) of toxicity (e.g., the particular chemicals) have not been identified.

4) Development of load/response relationships for the chemicals of concern based on existing information about loadings to the system.

Phase II

1) Measures contaminant loadings to the system, such as:

   - Upstream loadings
   - Tributary loadings
   - Combined sewer overflows
   - Hazardous waste site discharges.

2) Sample fish.

3) Measure flow characteristics of river.

4) Measure conventional parameters.

5) Characterize sediment deposits.

6) Perform a Toxicity Identification Evaluation (TIE) on selected Samples.

quantification of the sources, transport, and fate of contaminants. The specific components of the exposure modeling study are described below.

1) Hydrodynamic Model Application: The complex interaction of flows in the Great Lakes (due to upstream inflows and changes in lake elevation) requires that a hydrodynamic model be applied in order to estimate flows. For the systems of concern in the ARCS modeling studies, the model will be multidimensional in order to provide resolution of lateral as well as possibly vertical gradients in addition to longitudinal gradients in transport characteristics.

2) Sediment Transport Model: A model of cohesive sediment transport will be applied in order to predict the interactions between transport, deposition and resuspension processes under various meteorological and hydrological conditions. This model will provide predictions for use in the transport of sorbed contaminants and resuspension of toxic sediments. The model will aid in assessing the no-action alternative by providing estimates of burial rates and the effects of dredging on the system by providing estimates of sediment transport and times required to refill dredged areas. The application of a sediment transport model is of particular importance in these studies due to lack of historical sediment data.

3) Contaminant Exposure Model: Time variable exposure models will be applied in order to predict the effects of water and sediment transport, as well as the effects of sorption and kinetic processes such as volatilization and degradation, on the concentrations of certain critical contaminants. Modeling studies will be conducted concurrently of the riverine portions of the systems, and affected bays or lakes. The contaminant exposure model will assess the effects of loadings and various remedial alternatives on the system. The models will be applied to estimate load/response/uncertainty relationships, which will aid in addressing the study objectives. The models will also provide information that will be used by the Food Chain Model to estimate the contaminant body burdens in fish species due to varying exposure concentrations in water and sediment.

4) Food Chain Model: A model of the food chain will be utilized to estimate the response of varying exposure concentrations on contaminant concentrations in the biota. The model will use data collected as part of the study in order to construct a simple food chain model as well as evaluate certain hypothetical food chains (due to reintroduction of some species) using information obtained from the other studies.

The study will utilize existing models and methods. The model which will be used as a framework for the study is Water Quality Analysis Program, WASP4 (Ambrose et al. 1988). This model will be used to integrate predictions from other models (e.g. hydrodynamic and sediment transport) in order to estimate contaminant concentrations in the water sediment and biota. The WASP4 model provides a consistent modeling framework for eutrophication, toxics transformation and transport, bioaccumulation, and food chain effects. It is maintained and distributed by the Center for Exposure Assessment Modeling, located at EPA's Environmental Research Laboratory in Athens, Georgia, and has been widely distributed around the world. It is presently the framework used for modeling studies in Green Bay, Lake Michigan, as well as studies on Lake Ontario and elsewhere on the Great Lakes.

Synoptic Surveys

Field sampling programs were designed to provide information required for the application of mass balance models. Synoptic surveys were performed for six sampling days for the lower Buffalo and Saginaw Rivers. The sampling stations were selected to allow estimates of pollutant influxes to, and effluxes from, the AOCs. Samples were integrated over the width of the system. The data collected during the synoptic surveys included flows, loading and concentration data for solids and chemicals in both water and suspended solids. Samples for selected conventional parameters were collected at a greater frequency in order to aid in calibration of the hydrodynamic and sediment transport model, and in order to aid in estimating yearly loadings. Data on sediment contamination is being collected as part of studies of other ARCS Work Groups. The types of data to be obtained are briefly described below.

1) Hydrodynamic Data: Data for the calibration of the hydrodynamic model includes historical data as well as data collected as part of the field studies. Historical data are available on flows, water surface elevations at the mouth of the Buffalo and Saginaw Rivers, meteorological data, and concentrations of some conventional constituents such as temperature, conductivity, etc. The above data were also obtained concurrently with field studies. In addition, water surface elevation data, velocity and discharge measurements, and wind velocity and direction data were obtained.

2) Sediment Transport Data: Data for the calibration of the sediment transport model also relies on historical data, such as U.S. ACE dredging records. Information on sediment characteristics (e.g. grain size, water content, etc.) was determined during the sediment surveys. Also, bathymetry surveys were conducted to estimate changes in the system's morphometry. Data on suspended solids were collected concurrently with the river sampling, and suspended solids data were collected either during high flow events (Buffalo River) or hourly during certain periods (Saginaw) in order to support the sediment transport model. Finally, "shaker" studies will be conducted to estimate the resuspension characteristics of the sediments.

3) Contaminant Exposure Data: Ambient water, sediment, loading, and food chain data for the calibration of the exposure model will use, whenever possible, historical data. In addition, surveys were conducted to identify spatial variability in the system during varying flow conditions in 1990. Further studies will be conducted to identify pollutant loadings and ambient pollutant concentrations in water and sediments, and biota.

a. Pollutant Loadings: Pollutant loadings are being estimated and/or measured from point and non-point sources. Historical data are being assessed to estimate loadings from point sources as well as measurements acquired concurrently with the ambient water quality studies. Loadings from Combined Sewer Overflows (CSOs) are being estimated based on a limited field sampling program (24 samples at 10 CSOs) and storm water modeling in the Buffalo River study (CSOs were not identified as significant sources and were not sampled in Saginaw). Loadings for contaminants and suspended solids from upstream tributaries are based on 6 daily averaged measurements taken during the fall of 1990. Historical contaminant, suspended solids and flow data, as well as data from the suspended solids survey, are being used to extrapolate these measurements to annual loading rates. An analysis of the uncertainty of these estimates is also being performed.

b. Ambient Water Concentrations: Ambient data for particulate and dissolved contaminants as well as conventional parameters were obtained over six sampling days during the fall of 1990.

c. Sediment Data: Data for sediment concentrations were collected as part of separate sampling studies in 1990.

4) Food Chain Data: Data have been collected for carp in the Buffalo River and their stomach contents analyzed in order to establish a relationship between carp contaminant concentrations and their benthic forage. Carp were selected for analyses for two reasons. First, there are presently advisories in effect for consumption of carp in the Buffalo River. Second, the available resources limit the possibility of collection data to support an evaluation of fish species with a more complex food chain. Carp samples were collected and divided into three age classes for analysis. Sampling in the Saginaw River concentrated on walleye and its food chain due to the importance of the walleye fishery in this area.

The final phase of this approach will be to verify and calibrate the models in Phase I using the site-specific data collected in Phase II.

Risk and Hazard Assessments

The activities involved in the preparation of the individual Risk and Hazard Assessments vary depending upon the area evaluated, the receptors and the endpoints considered. It is primarily a paper exercise, combining information on exposure to, and toxicity of, sediment contaminants. The experience gained from performing these assessments

at the five ARCS AOCs will provide more refined tools to be used at the other AOCs than were previously available. The Baseline Assessments use existing data, while the Comprehensive Assessments use the results obtained from the exposure modeling work to predict future risk.

Human Health Risk Assessment

Cancer risks and non-cancer hazards potentially incurred resulting from direct and indirect exposure to sediment contaminants, will be considered. Risks and hazards will be calculated using methods recommended by the U.S. EPA Risk Assessment Guidelines of 1986 and other generally recognized risk assessment procedures. Uncertainties in the risk assessment will be stated, as will the assumptions, and discussion on the overall meaning of the risk assessment will be developed. Toxicological information required to calculate risks or hazards may not be available for all chemicals found in the demonstration areas. Therefore, the baseline risk assessment will identify information which is required for the evaluation but not available, and such needs will be recommended to the Activities Integration Committee for resolution. As part of the comprehensive evaluations planned for the Buffalo River and Saginaw Bay, target sediment concentrations (i.e., chemical concentrations below that associated with unacceptable risks and hazards) will be calculated for chemicals identified as responsible for the majority of the risk or hazard.

One of the more potentially important impacts of some chlorinated organic compounds, such as PCBs, is their potential for adverse developmental effects upon infants and children. Recent epidemiological evidence exists that suggests developmental effects have occurred in young children whose mothers were heavy consumers of Great Lakes fish. Given the relationship between sediment and fish contamination, this toxicological endpoint should be assessed in the ARCS program. However, this endpoint is not easily assessed in a quantitative fashion using the existing risk assessment methodology commonly employed by the U.S. EPA. This arises from the hypothesis that the contaminants, to which the infant or child is exposed through placental transfer and breast-feeding, is a result of the mother's body burden of the chemical. This maternal body burden is the result of her lifetime of contaminant intake, not only that occurring during pregnancy. Assessment would require complex pharmacokinetic modeling, an approach which is not well developed in the environmental assessment field.

Given the difficulties which exist in quantifying this hazard, it is beyond the scope of the ARCS program to address this issue in any great depth. However, ARCS would be remiss if it did not address the issue at all. Therefore, the Risk Assessment/Modeling Work Group is pursuing the option to develop an issue or problem identification paper on the subject. It is envisioned that the paper would summarize the existing epidemiological information, discuss the relationship between sediments, fish consumption, human body burden, and human-to-human chemical transfer, and discuss the inadequacies of present assessment techniques to describe the problem.

Aquatic Life Hazard Assessment

Aquatic life hazard assessment is an emerging discipline which differs fundamentally from assessments of human health effects. Current approaches for assessing the hazards to aquatic life (such as endangerment of health and viability of populations and communities) focus on existing ecological toxicity, as determined by field or laboratory studies. This type of information will be available from the Toxicity/Chemistry Work Group. Other types of descriptors of toxicity, based on chemical, physical and biological factors, such as the Equilibrium Partitioning Approach to calculating numerical sediment criteria from water quality criteria, the Apparent Effects Threshold and the Sediment Quality Triad, will also be part of the Toxicity/Chemistry Work Group output, and will be used to express and estimate future exposures and effects under the various remedial alternatives. To predict impacts on aquatic life under various remedial alternatives, toxicological information describing dose-response relationships will be used. A baseline aquatic life hazard evaluation is being performed for the Buffalo River. This approach can be made available for application to other sites.

Wildlife Hazard Assessment

Hazards to piscivorous avian and mammalian species are of primary concern for areas within the Great Lakes System. Adverse health effects, such as reproductive impairment and structural deformities, resulting from intake of contaminants in food, have been documented. Description of such effects are generally an outcome of field studies; prospective hazard assessments are not commonly performed. However, since the primary route of contaminant intake is through the consumption of contaminated food (fish), a rough prospective hazard evaluation can be performed in a manner similar to human food chain concerns. As above, the baseline hazard assessment is being based on existing information on impacts upon wildlife in the area, with an emphasis on the degree of hazard attributable to contaminated sediment, as compared with other "sources" of contaminants to wildlife. For the comprehensive assessment, future impacts will be based upon modeled exposures. Limitations of performing such an assessment will be discussed. Baseline and comprehensive wildlife hazard evaluations will be performed at two of the priority consideration areas (Buffalo River and Saginaw Bay). This approach can be made available for application at other sites where wildlife impacts from contaminated sediment are of concern.

Site Prioritization for Remedial Action and Development of Decision Support Tools

A numerically-based ranking system which synthesizes assessment variables and produces objective priorities will be designed to allow remedial priorities to be set for each of the Great Lakes Areas of Concern. Development of numerically-based ranking will provide a method for integrating hazard and risk assessments within and between individual

Areas of Concern. The result will be a prioritization procedure that can be used in a comprehensive strategy for the management of contaminated sediments.

The following are tasks anticipated for this activity to provide site ranking and integration of information about individual sites or areas of concern:

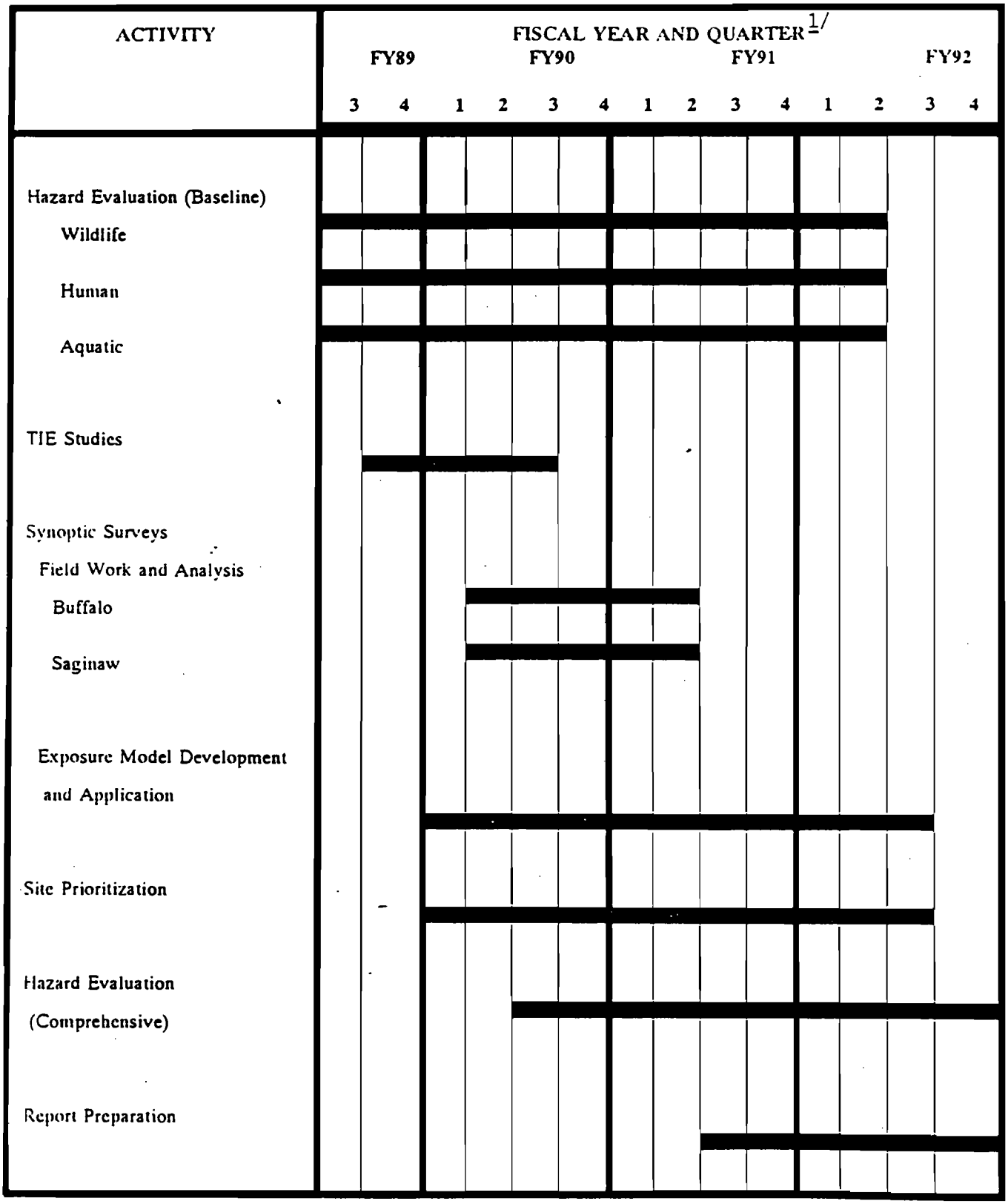
- Investigate methods of ranking and decision support analysis to determine what other approaches should be incorporated for the ARCS program;
- Develop a ranking method to integrate measures of hazard, risk and cost;
- Develop a method of ranking sites which can be applied to the Great Lakes Region, by State and Provincial jurisdictions, or smaller sub-regions (i.e., individual lake watersheds);
- Calibrate test the ranking procedure and integration procedure on the five priority consideration areas being investigated during the ARCS Program.

This work will be closely coordinated with the data collection and assessment activities of the Toxicity/Chemistry Work Group.

Products

The products of the Risk Assessment/Modeling Work Group will consist of technical documents for each discrete work unit (e.g., the baseline and comprehensive hazard evaluations). In addition, much of the work performed for this Work Group will be an integral part of the Risk Assessment/Modeling Guidance Document and the Contaminated Sediments Remediation Guidance Document, discussed in Part I, and members will have direct input into the development of these guidance documents.

Timeline - Risk Assessment/Modeling Work Group



1/ Federal fiscal year extends from October 1 to September 30

Final report due December 1993.

Engineering/Technology Work Group Work Plan

Introduction

The primary responsibilities of the Engineering/Technology Work Group are to evaluate and test available remedial technologies for contaminated sediments, to select promising new technologies for further testing, to demonstrate alternatives at priority consideration areas, and to estimate contaminant losses during remediation. The Engineering/Technology Work Group will seek technologies that are available, implementable, and economically feasible. Both removal and *in situ* alternatives will be considered.

Objectives

The primary objectives of the Engineering/Technology Work Group are:

1. Evaluation of existing technologies: To evaluate the effectiveness, technical feasibility and cost of existing technologies to remediate contaminated sediments and estimate contaminant losses during remediation;

2. Demonstration of effectiveness: To demonstrate the effectiveness of sediment remedial technologies through the performance of bench-scale tests, and pilot-scale demonstration projects at selected priority consideration areas;

3. Options Development: To develop options for the remediation of contaminated sediments at the five priority consideration areas; and

4. Development of Remediation Guidance: To develop guidance on the selection and implementation of contaminated sediment remedial alternatives.

Activities

The tasks needed to accomplish the Work Group objectives have been:

1) Perform a review of technical literature;

2) Evaluate the applicability of technologies for bench-scale studies;

3) Estimate contaminant losses during remediation;

4) Collect sediments for bench-scale testing;

5) Sediment storage and analysis;

6) Convene a workshop on bioremediation technologies;

7) Evaluate solidification/stabilization technologies;

Tasks currently being performed include:

8) Evaluate treatment technologies for inorganic contaminants;

9) Conduct bench-scale tests of selected treatment technologies;

10) Conduct pilot-scale demonstrations; and

11) Develop options for priority consideration areas.

Products

The products of the Engineering/Technology Work Group will consist of the development of technical documents for each discrete work unit (e.g., bench-scale testing, pilot-scale testing). One key product of this Work Group is a matrix of monetary costs versus contaminant losses from the technologies tested. This information will be provided to the Risk Assessment/Modeling Work Group for use in evaluating the impacts of alternative remedial options. Table 5 summarizes the match-up of technologies and locations planned for the ARCS demonstrations. The table also includes technology demonstrations that have been or are being done under other programs, including the U.S. Army Corps of Engineers, Superfund PRPs and Canada. The Engineering/Technology Work Group will make use of the results of these other demonstrations along with the ones being done specifically for ARCS.

In addition, much of the work performed for this Work Group will be an integral part of the Contaminated Sediments Remediation Guidance Document, discussed in Part I, and members will have direct input into the development of this guidance document.

Summaries of Treatment Technologies

The following are short descriptions of each of the technologies listed in Table 5:

- Solidification/Stabilization: The addition of binding materials to produce a more stable solid material that is more resistant to the leaching of contaminants. Typical binding material used include portland cement, fly ash, kiln dust, blast furnace slag, and proprietary additives.

- Inorganic Treatment/Recovery: The physical or chemical separation of sediments into different fractions that may be more or less contaminated. Since sediment contaminants usually associate themselves with fine-grained particles like silts and clays, their separation from the bulk of the sediments could significantly reduce the volume of material requiring advanced treatment.

- Bioremediation: The use of microorganisms such as bacteria to reduce the toxicity of sediment contaminants by degrading them through biological action. Used in the treatment of waste waters and contaminated soils.

- Based Catalyzed Decomposition (BCD) (Process formerly called KPEG Nucleophilic Substitution): A chemical process that reduces the toxicity of chlorinated hydrocarbons (such as PCBs) by removing chlorine atoms and replacing them with alkali metals (such as potassium).

- Basic Extraction Sludge Technology (BEST) Extraction Process: Separates contaminated sediments into three fractions: a solid fraction that contains the inorganic contaminants (such as heavy metals); an oil fraction that contains the organic contaminants (such as PCBs); and a water fraction that may contain residual amounts of the original sediment contaminants. By itself, BEST does not destroy any contaminants, but may significantly reduce the volume of material requiring advanced treatment.

- Low Temperature Thermal Stripping: Removes volatile organic contaminants (such as polynuclear aromatic hydrocarbons, or PAHs) by heating the sediments to temperatures lower than those used in the destructive incineration process. Not intended to permanently destroy contaminants, but may result in a sediment that can be more easily disposed of.

- Wet Air Oxidation: Organic contaminants are destroyed by exposing them to elevated temperatures and pressures. This process was developed over 30 years ago and has been successfully used to treat municipal sewage sludge.

- Low Energy Extraction: Separates contaminated sediments into fractions as described for the BEST process. Uses a combination of solvents to remove PCBs and other organic contaminants from the sediment.

- Eco-Logic Destruction Process: A thermochemical process that uses high temperatures and hydrogen gas to destroy organic contaminants.

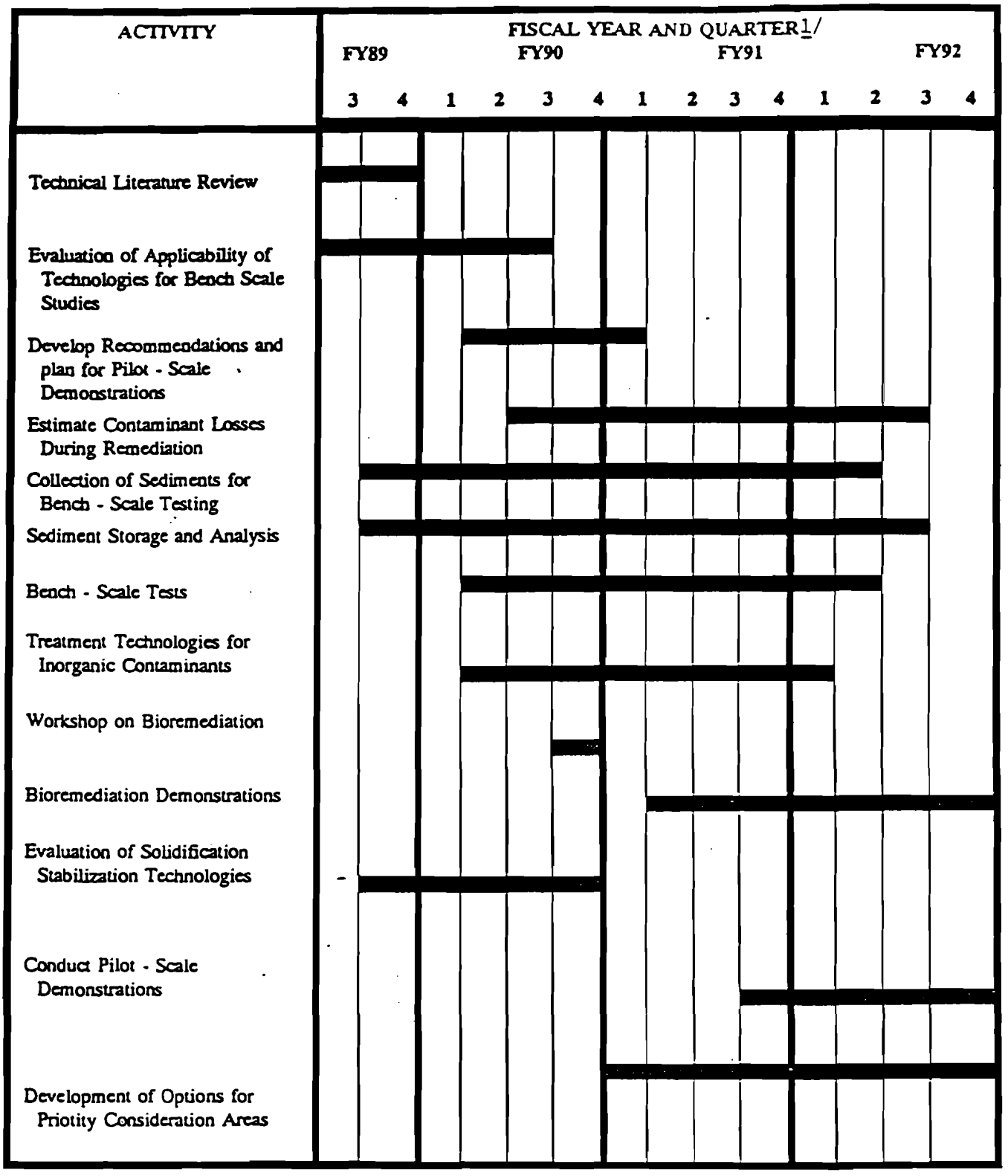
- In-Situ Stabilization: The covering or armoring of sediment deposits with geotextiles, plastic liners, or graded stone. Prevents the disturbance and resuspension of contaminated sediments, which could lead to a release of sediment contaminants back into the water column.

- Acetone Extraction (Rem-Tech): Acetone is used as a solvent to extract PCBs from contaminated sediments.

- Aqueous Surfactant Extraction: Similar to the Low Energy Extraction process. Instead of applying acetone, however, this process uses aqueous surfactant to remove PCBs. Ultrasonics may be employed to improve extraction efficiencies.

- Sediment Dewatering Methods: Techniques to remove the water from contaminated sediments, such as air drying, consolidation, and filter presses. May be necessary prior to the application of a treatment technology that works inefficiently in the presence of water.

Timeline - Engineering/Technology Work Group



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INACTIVE HAZARDOUS WASTE SITE REMEDIATION

At the time of preparation of the Remedial Action Plan thirty-two sites were identified in the Buffalo River basin where hazardous wastes may have been deposited. New information obtained as a result of work undertaken during 1992-93 is summarized and underlined in Table B-1. Site investigation and remediation program progress in the Buffalo River basin is shown in Table B-2.

Six new sites were identified in the Buffalo River basin since the completion of the RAP. These sites have been added to the above listings.

TABLE B-1
REMEDIATION STATUS
HAZARDOUS WASTE SITES
BUFFALO RIVER WATERSHED

NUMBER	SITE NAME	SITE CODE	REMEDIATION STATUS	CONTAMINANT MIGRATION CONCERNS
CAYUGA CREEK				
915093	Town of Marilla	D	Phase I Investigation completed. Phase II Investigation completed. Delisted December 1992	No hazardous waste confirmed at this site.
915069	Lancaster Reclamation	D	Phase I Investigation completed. Phase II Investigation completed. Delisted February 1991	Analyses of groundwater indicate the site is impacting groundwater quality. Surface water results do not indicate a significant contamination condition exists.
915082	Stocks Pond	2A	Phase I Investigation completed Phase II Investigation completed.	Proximity of this site to Cayuga Creek and slightly elevated levels of metals and phenols at site indicate a potential for contaminant movement to the creek.
915064	Dresser Industries	2A	Phase I Investigation completed. Phase II Investigation completed.	Potential for contaminant migration is considered to to be unlikely due to extremely low levels of contaminants found at site.
915105	Village of Depew Borden Road	D	Phase I Investigation completed. Supplemental sampling completed. Delisted October 1990	The site contains foundry sands with phenolic based binders. A portion of the site has been excavated. Investigations indicate no hazardous waste present on site.

TABLE B-1 (Continued)

NUMBER	SITE NAME	SITE CODE	REMEDIATION STATUS	CONTAMINANT MIGRATION CONCERNS
915070	Land Reclamation	3	Phase I Investigation complete. Phase II Investigation completed.	Data indicates presence of contaminants in groundwater and surface water. Contaminant migration confirmed.
915129	Old Land Reclamation	2A	Phase I Investigation complete. Phase II Investigation completed.	Soil and leachate sampling indicates the presence of inorganic and organic contaminants. Proximity of this site to Cayuga Creek indicates a potential for contaminant movement to the Creek.
915128	Union Road	2	Phase I Investigation completed. RI/FS completed. Record of Decision issued. Remedial design underway.	Site contains sludges and tar. Data indicates the presence of elevated levels of heavy metals in tar. Surface water and sediment sampling confirm the migration of lead from the site.
BUFFALO CREEK				
915088	Northern Demolition	D	Phase I Investigation completed. Site delisted in 1989.	Data does not indicate hazardous waste present on site.
CAZENOVIA CREEK				
915062	CID (Chaffee Landfill)	4	Leachate collection system installed.	Data available indicates no contaminant migration.
915130	Hi View Terrace	D	Phase I Investigation completed. USEPA removal action performed.	Data indicates presence of total cyanides in waste material. Site remediated.

TABLE B-1 (Continued)

NUMBER	SITE NAME	SITE CODE	REMEDIATION STATUS	CONTAMINANT MIGRATION CONCERNS
BUFFALO RIVER				
915039	West Seneca Transfer Station	D	Phase I Investigation completed. Phase II Investigation completed. Delisted December 1992	Data does not indicate hazardous waste present on site.
915036	Madison Wire Indian Church Road	2	Phase I & II Investigations completed. RI/FS completed in 1989. Removal action for drums and liquids completed by EPA. Design of remedial alternative completed. Remedial action underway.	Soil, sediment and surface water samples show the presence of heavy metals and organics. Potential for contaminant migration is indicated.
915059	Houghton Park	3	Phase I Investigation completed. Buffalo Urban Renewal Agency investigated site in 1983.	Analytical data shows contamination of soil and groundwater with heavy metals and phenols. However no significant contaminant migration indicated.
915021	Erie Lackawanna Railroad	D	Phase I Investigation completed. Site was delisted in 1989.	Investigation indicated no hazardous waste disposed on site.
915040	Mobil Oil Corporation	3	Phase I Investigation completed. Phase II Investigation completed.	Investigation indicates no significant contaminant migration. On-site bioremediation demonstration progressing.
915037	Houdaille-Manzel	2	Negotiations for remediation Consent Order failed. State funded Remedial Investigation/Feasibility Study completed.	Data does not indicate hazardous waste present on site.

TABLE B-1 (Continued)

NUMBER	SITE NAME	SITE CODE	REMEDIATION STATUS	CONTAMINANT MIGRATION CONCERNS
915017	Donner Hanna Coke	3	Phase I Investigation completed. Phase II Investigation completed.	Groundwater and surface water is being contaminated with organic compounds and heavy metals.
915012 (A,B)	Buffalo Color	2	RI/FS completed. Record of Decision issued. Remedial design underway.	Site contains organic and inorganic contaminants. Migration of contaminants to Buffalo River is confirmed.
915012C	Buffalo Color	D	Deep well has been properly closed out. Site delisted in 1989.	
915004	Allied Chemical Industrial Chemical Division	D	Phase II Investigation completed. RCRA closure underway. Delisted February 1993.	Investigations did not indicate the presence of hazardous waste on site.
915071	Lehigh Valley Railroad	2	Phase II Investigation is completed. Supplemental sampling program underway.	Groundwater and soil are contaminated with organics and metals. There is a limited potential for contaminant migration. Tanks which were source of contamination have been removed.
915034	MacNaughton-Brooks	D	Phase II Investigation completed. Delisted March 1991.	Investigations did not indicate the presence of hazardous waste on site.
915041	Mollenberg-Betz	D	Phase I Investigation completed. Supplemental sampling completed. Delisted May 1991.	Investigations did not indicate the presence of hazardous waste on site.

TABLE B-1 (Continued)

NUMBER	SITE NAME	SITE CODE	REMEDIATION STATUS	CONTAMINANT MIGRATION CONCERNS
915072	Tifft Farm Nature Preserve	2A	Phase II Investigation completed. Supplemental sampling program completed.	Low level organic and metal contamination.
915115	Bengart & Memel	4	Site has been remediated under Consent Order.	PCB contaminated soils have been remediated.
915126	Clinton-Bailey	2A	Phase I Investigation completed. Phase II Investigation completed.	Data indicates the presence of heavy metals (arsenic) and organic compounds in soil samples at site. Potential for contaminant migration indeterminable. Drum removal completed in 1991.
915113	U.S. Steel - Eastern Div.	2A	Phase I Investigation complete. Supplemental sampling program completed.	Investigations did not indicate the presence of hazardous waste on site.
915131	Tifft-Hopkins Street	2A	Phase I Investigation is completed. Phase II Investigation completed.	Potential for contaminant migration has not been determined yet.
915133	Ameron	4	Investigation by Ameron has been completed and remedial system is in operation. Reclassified March 1991.	Data does not indicate potential for contaminant migration.
ADJACENT TO MOUTH OF BUFFALO RIVER				
915080	Times Beach	D	Phase I Investigation complete. Corps of Engineers had undertaken sampling of surface and groundwater, sediment, flora and fauna. Delisted September 1991.	Potential for contaminant movement to Outer Harbor exists.

TABLE B-1 (Continued)

NUMBER	SITE NAME	SITE CODE	REMEDIATION STATUS	CONTAMINANT MIGRATION CONCERNS
SITES IDENTIFIED SUBSEQUENT TO RAP COMPLETION				
915146	Niagara Transformer (4)	2	Interim Remedial Measures completed. Remedial Investigation/ Feasibility Study underway.	PCBs in soil/sediments/surface water found in storm water ditch. Potential for contaminant migration to Buffalo River exists.
915135	Bern Metal Corporation (4)	2	Phase I Investigation complete. USEPA Emergency Removal Action underway.	Heavy metals known to be present in soils. Potential for contaminant migration unknown.
915147	ARO Corporation (1)	2	Remedial Investigation/Feasibility Study underway.	Groundwater contamination confirmed.
915149	Scott Aviation (1)	2	Remedial Investigation/Feasibility Study planned.	Groundwater contamination confirmed.
915150	ENRX (4)	2A	EPA removal action completed. DEC to conduct Phase II Investigation.	Potential for contaminant migration unknown.
915157	Mr. C's Cleaners (3)	2	Phase II Investigation completed in 1992. Remedial Investigation/ Feasibility Study planned.	Groundwater contamination exists. Potential for contaminant migration confirmed.

WATER BODY

(1) Cayuga Creek
(2) Buffalo Creek
(3) Cazenovia Creek
(4) Buffalo River

TABLE B-1

SITE CODES

Classification 1 - causing or presenting an imminent danger of causing irreversible or irreparable damage to the public health or environment -- immediate action required;

Classification 2 - significant threat to the public health or environment -- action required;

Classification 2a - temporary classification assigned to sites for which there is inadequate data to assign them to the other classifications;

Classification 3 - does not present a significant threat to the public health or environment -- action may be deferred;

Classification 4 - site properly closed -- requires continued management;

Classification 5 - site properly closed, no evidence of present or potential adverse impact -- no further action required;

Classification D - site delisted, no hazardous waste present on site.

TABLE B-2
INACTIVE HAZARDOUS WASTE SITE
REMEDIATION PROGRAM PROGRESS
BUFFALO RIVER BASIN

	Phase I	Phase II	Remedial Invest. Feasibil. Study	Remedial Design	Remedial Constr.	Remediation Complete or Not Required
CAYUGA CREEK						
Town of Marilla	———	———	———	———	———	———
Lancaster Reclamation	———	———	———	———	———	———
Stocks Pond	———	———				
Dresser Industries	———	———				
Village of Depew-Borden Road	———	———	———	———	———	———
Land Reclamation	———	———				
Old Land Reclamation	———	———				
Union Road	———	———	———	———		
BUFFALO CREEK						
Northern Demolition	———	———	———	———	———	———
CAZENOVIA CREEK						
CID	———	———	———	———	———	———
HiView Terrace	———	———	———	———	———	———
BUFFALO RIVER						
W. Seneca Transfer Station	———	———	———	———	———	———
Madison Wire	———	———	———	———	———	
Houghton Park	———					
Erie Lackawanna RR	———	———	———	———	———	———
Mobil Oil Corp.	———	———	———	———	———	———
Houdaille-Manzel	———	———	———			
Donner Hanna Coke	———	———				

TABLE B-2 (Continued)
INACTIVE HAZARDOUS WASTE SITE
REMEDIATION PROGRAM PROGRESS
BUFFALO RIVER BASIN

	Phase I	Phase II	Remedial Invest. Feasibil. Study	Remedial Design	Remedial Constr.	Remediation Complete or Not Required
BUFFALO RIVER						
Buffalo Color (2)	———	———	———	——>		
Buffalo Color - Deep Well	———	———	———	———	———	———>
Allied Chemical	———	———	———	———	———	———>
Lehigh Valley RR	———	———>				
Mac Naughton Brooks	———	———	———	———	———	———>
Mollenberg-Betz	———	———	———	———	———	———>
Tifft Farm	———	———>				
Bengart & Memel	———	———	———	———	———	———>
Clinton-Bailey	———	———>				
U.S. Steel	———>					
Tifft-Hopkins	———	———>				
Ameron	———	———	———	———	———	———>
ADJACENT TO MOUTH OF BUFFALO RIVER						
Times Beach	———	———	———	———	———	———>
SITES IDENTIFIED SUBSEQUENT TO RAP COMPLETION						
Niagara Transformer	———	———	——>			
Bern Metal	———>					
ARO	———	———	——>			
Scott Aviation	———	———>				
ENRX	———>					
Mr. C's Cleaners	———	———>				