REMEDIAL DESIGN WORK PLAN
O'CONNOR COMPANY SUPERFUND SITE
AUGUSTA, MAINE

O'Connor Company Site
Augusta, Maine

Submitted by
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Project 94112
August 1, 1994
Revision 0
# TABLE OF CONTENTS

## LIST OF APPENDIX

### 1. INTRODUCTION

### 2. OVERVIEW OF REMEDY

2.1 Site Background  
2.2 Management of Migration (MOM)  
2.3 Source Control (SC)

### 3. DESIGN TEAM

### 4. WORK BREAKDOWN STRUCTURE AND SCHEDULE

4.1 Work Breakdown Structure  
4.2 Remedial Design Schedule

### 5. REMEDIAL DESIGN DELIVERABLES

5.1 30 Percent Design  
5.1.1 Management of Migration  
5.1.2 Source Control  
5.1.3 Evaluation of Separable Schedules  
5.1.4 Ground Water Sampling and Analysis Plan (SAP)  
5.1.5 Applicable or Relevant and Appropriate Requirements  
5.1.6 Project Delivery Strategy  
5.1.7 Independent Quality Assurance Review  
5.1.8 EPA and DEP Submittal and Review Requirements  
5.2 60 Percent Design  
5.2.1 Management of Migration  
5.2.2 Source Control
5.2.3 Project Plans, Reports, Studies and Evaluations 14
5.2.4 Remedial Action Contracting 15
5.2.5 EPA and DEP Submittal and Review Requirements 17
5.3 95 Percent Design 17
5.3.1 Management of Migration 17
5.3.2 Source Control 18
5.3.3 Project Plans, Reports, Studies and Evaluations 19
5.3.4 Applicable or Relevant and Appropriate Requirements 20
5.3.5 Final Bid Documents 20
5.3.6 Independent Quality Assurance Review 20
5.3.7 EPA and DEP Submittal and Review Requirements 20
5.4 100 Percent Design 21
5.4.1 Management of Migration 21
5.4.2 Source Control 21
5.4.3 EPA and DEP Submittal and Review Requirements 21

6. INDEPENDENT QUALITY ASSURANCE TEAM (IQAT) 22

TABLES
FIGURES
APPENDIX
LIST OF TABLES

1 - Design Deliverable Summary
2 - Draft Outline of Project Operations Plan
3 - Draft Outline of Operation and Maintenance Plan

LIST OF FIGURES

1 - Site Layout
2 - Organizational Chart - Remedial Design Team
3 - Work Breakdown Structure
4 - Schedule

LIST OF APPENDIX

A - Independent Quality Assurance Team Resumes
1. INTRODUCTION

This document provides the Remedial Design Work Plan (Work Plan) for the O'Connor Company Superfund Site (Site) in Augusta, Maine. This Work Plan is submitted by Central Maine Power Company (CMP) in accordance with the Explanation of Significant Differences (ESD) signed by U.S. Environmental Protection Agency (EPA) Regional Administrator John P. DeVillars on July 11, 1994 and Section I.4.b. of the O'Connor Company Site Revised Statement of Work (RSOW). The purpose of this Work Plan is to summarize Remedial Design activities including the scope of design deliverables and a proposed schedule. This document also summarizes the decisions reached at a technical information meeting held on May 23, 1994 between the EPA, the Maine Department of Environmental Protection (DEP), CMP and their consultants.
2. OVERVIEW OF REMEDY

2.1 Site Background

Previous salvage and transformer recycling activities by the F. O'Connor Company led to releases of polychlorinated biphenyl-(PCB-) contaminated oils at the Site. Principal features on the Site include a large barn that formerly housed scrap operations, an Upland Marsh, an adjacent "low area" of fill, two surface water impoundments (Upper and Lower Lagoons), three former outdoor transformer work areas (TWA I, TWA II, and TWA III) and a former scrap storage area. Site drainage is principally controlled by a natural slope extending downward from the transformer work areas toward Riggs Brook. Currently, the Upper and Lower Lagoons located on the slope serve as detention basins for surface water flow from the Upland Marsh (Figure 1).

2.2 Management of Migration (MOM)

The MOM remedy involves the extraction and treatment of ground water from beneath the Site containing target chemicals exceeding the following cleanup standards: PCBs (0.5 parts per billion (ppb)), 1,4-dichlorobenzene (27 ppb), and benzene (5 ppb). In the ROD, it is specified that extracted ground water will be pumped through a granular filter to remove particulates, suspended solids and oil droplets. The ground water will then be treated by use of granular activated carbon (GAC) to remove the organic contaminants. The treated ground water will be discharged into ground water injection wells. In addition to the ground water treatment system, environmental sampling of the sediment and biota within Riggs Brook and its associated nearby wetlands will be performed.

2.3 Source Control (SC)

Contaminated soil and sediment containing concentrations of PCBs and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) above cleanup standards are to be excavated and treated on-site using a solvent extraction process. Treated soil and sediment meeting the cleanup standards will be backfilled on-site. Treated soil and sediment failing to achieve the cleanup standards will require off-site disposal. Contaminated liquids produced during solvent extraction treatment that contain extracted PCBs and cPAHS will be destroyed off-site at a licensed Toxic Substances Control Act (TSCA) incinerator.

Cleanup standards for PCBs, cPAHs, and lead, in soil and sediment, were identified in the 1989 Record of Decision (ROD) to be 1 ppm, 1 ppm, and 248 ppm, respectively. Soil residues remaining after solvent extraction treatment that contain lead concentrations above the 248 parts
per million (ppm) 1989 ROD cleanup standard will be transported off-site for land disposal. If this lead-contaminated soil exceeds the toxicity characteristic concentration for lead (5 ppm), then the soil will undergo further treatment using a stabilization treatment technology prior to off-site land disposal.

An ESD dated July 11, 1994 modified the PCB and cPAH cleanup standards. As described in the ESD, soil and sediment above "target cleanup goals", will be excavated, treated with solvent extraction technology (if PCBs and cPAHs greater than 10 ppm) and placed in a Designated Area (Figure 1).

Target cleanup goals within the Designated Area are:

- total PCBs: 10 ppm
- total cPAHs: 10 ppm
- lead: 248 ppm

Target cleanup goals for all areas outside the Designated Area are:

- total PCBs: 1 ppm
- total cPAHs: 1 ppm
- lead: 248 ppm

In addition, the ESD requires that the Designated Area be covered with 12 inches of clean fill from off-site sources. Outside the Designated Area, excavated areas will also be backfilled with clean fill. The clean fill will include topsoil and will be re-vegetated. The clean fill/topsoil will contain less than or equal to 1 ppm PCBs, 1 ppm cPAHs, and 248 ppm lead.

If during full-scale implementation of the remedy, EPA determines that solvent extraction treatment is not feasible, then soil and sediment containing PCBs and cPAHs above the target cleanup goals will be transported off-site to Resource Conservation and Recovery Act (RCRA)/TSCA hazardous waste landfills, without treatment.

Site restoration will include restoration of on-site wetlands or establishing compensatory wetlands on-site that achieve an equivalent functional value of the wetlands not restored. The ROD also specifies decontamination, demolition and off-site disposal of the barn.
3. DESIGN TEAM

CMP will prepare Remedial Design through a Design Team consisting of two design firms, a remediation contractor, and CMP's Technical Services Department. Charles R. Nickerson, P.E. will serve as the Project Coordinator. As Project Coordinator, he will be the contact for EPA and DEP. Mr. Nickerson will be responsible for authorizing work by the Design Team and reviewing all criteria, plans, specifications, calculations, work plans, and reports prior to submittal to the EPA Remedial Project Manager and DEP Project Coordinator.

The organization of the Design Team is shown on Figure 2. Members of the Design Team include:

**GEI Consultants, Inc. (GEI) - Supervising Contractor and Design Firm**

GEI will continue in its role as Supervising Contractor for the O'Connor Company Site Remedial Design/Remedial Action (RD/RA). As the Supervising Contractor, GEI will be responsible for submitting all design deliverables. GEI will be responsible for determining compliance with regulations through a review of Applicable or Appropriate and Relevant Requirements (ARARs) and will develop the Remedial Action Project Operations Plan (POP) and Operation and Maintenance (O&M) Plans. GEI will also be responsible for design of soil treatment, site restoration, ground water extraction and treated ground water injection.

GEI is a full-service consulting and design engineering firm specializing in environmental remediation and geotechnical design. The firm was founded in 1970 and offers services across the country at six locations. GEI has provided investigation, design, and litigation support for over 2,500 environmental projects for industrial clients, utilities, hospitals, developers, lawyers, lenders, insurance companies, and government agencies. Many of these projects have involved the permitting or remediation of hazardous and solid waste disposal sites. Projects completed have included a number of sites on the U.S. EPA National Priorities List (NPL).

Joanne O. Morin will continue in her role as Project Manager and GEI contact for the project. She will be supported by Alton Davis, P.E., Manager of GEI's Design Division.

**Woodard & Curran, Inc. (W&C) Design Firm**

W&C will be responsible for design of site preparation; soil and sediment excavation, barn decontamination and demolition, storm water and process water treatment, and the MOM ground water treatment system.
W&G is an environmental consulting firm of over 100 environmental engineers, scientists, regulatory specialists, and support personnel that concentrates in the six interrelated disciplines of industrial waste; hazardous waste; environmental studies and permitting; solid waste; municipal water and wastewater; and operation and maintenance. Founded in 1979, the firm is currently owned by seven partners, each of whom has between 14 and 25 years of experience in environmental engineering and who share a commitment to finding innovative, client-oriented solutions to environmental problems. With offices in Portland and Bangor, Maine, and Wellesley, Massachusetts, W&G serves industrial, commercial, and government clients throughout the Eastern United States.

Henri J. Vincent, P.E. will serve as the W&C Project Manager.

H.E. Sargent, Inc. (H.E. Sargent) Contractor Studies

H.E. Sargent will be responsible for performing the value engineering and constructability studies.

H.E. Sargent (Established in 1926) has seven decades of general contracting experience in New England, specializing in heavy civil projects including: site development, highways and bridges, sewer and water lines, environmental services including secure landfills and remediation, alternative energy facilities, and airports. They also provide process mechanical, piping and heavy structural construction services to many of Northern New England’s private and public construction buyers. Their expertise includes: water and wastewater treatment, concrete structures, mechanical and process, new construction and rehabilitation of bridges and hydro facilities.

David C. Jones will serve as the H.E. Sargent Project Manager.

CMP Technical Services Department

CMP Technical Services Department will be responsible for surveying, structural, electrical and mechanical design.

Central Maine Power Company’s Technical Services Department consists of a staff of 65 people which includes 27 Registered Professional Engineers. Department personnel have worked on a variety of projects ranging from research and development of innovative technologies to traditional civil, mechanical and electrical engineering work. Particular strengths of the Department applicable to the O’Connor Company Site include civil/structural engineering, mechanical/industrial engineering and electrical/power supply engineering. The Department provides multi-disciplined engineering services for a wide variety of projects.
The Technical Services Department has an extensive knowledge in the planning, design, project management, construction management and inspection of power plants, substations, transmission lines, and office facilities.

Daniel E. Spaulding, P.E. will serve as the CMP Technical Services Department and Project Manager.
4. WORK BREAKDOWN STRUCTURE AND SCHEDULE

The O’Connor Company Site Design Team has developed a Work Breakdown Structure to delineate and monitor the components of the Remedial Design to be completed by the various design team members. A description of the design team members and a summary of how the team is organized is provided in Section 3.0. Details of the various Remedial Design components is provided in Section 5.0. The Work Breakdown Structure is intended to be used along with the project schedule to keep track of which team member is completing a particular Remedial Design component, and when work on the component is scheduled to begin and end.

4.1 Work Breakdown Structure

A copy of the Work Breakdown Structure prepared for the O’Connor Company Site Design Team is provided in Figure 3. In its simplest form the Work Breakdown Structure identifies each of the individual technical tasks associated with the completion of the Remedial Design as they have been identified in the RSOW. These tasks have been organized in columns with headings or categories such as Management of Migration; Source Control; Reports, Studies, and Evaluations, etc. The tasks have been further arranged in rows to identify the specific components within each design submittal (i.e., 30 percent, 60 percent, 95 percent or 100 percent). The design submittals, as identified in the RSOW, are the conceptual (30 percent), intermediate (60 percent), final (95 percent), and revised final (100 percent) designs.

Each task has associated with it the team member responsible for its completion. While a single team member is identified for each task, this does not mean that the single member completes all of the task. Instead, input from the other team members will be provided before each of the tasks can be successfully completed. The identified team member is expected to ensure that the entire task is completed, and that it meets all the requirements as originally intended.

4.2 Remedial Design Schedule

A schedule has been developed for the completion of Remedial Design work at the O’Connor Company Site. This schedule is based upon the completion times identified in the RSOW and has been developed in a manner whereby the critical path for the completion of the work tasks has been determined. Each of the tasks identified in the Work Breakdown Structure has been accounted for in the Schedule, along with its relationship to the other tasks. Figure 4 provides the current Remedial Design Schedule with time in months. It assumes EPA review and approval times to be 30 days for the Work Plan, 60 days for the 60 percent design submittal, and 45 days for the 100 percent design submittal.
Since the EPA is not required to approve the 30 percent submittal prior to initiation of the 60 percent design, the 60 percent design will be submitted 90 days following the 30 percent submittal. The dates required for completion of the remaining portions of the design will be based upon the time required for EPA to review and approve the 60 percent submittal. Based upon the assumed times for review and approval, Remedial Design will take about 17 to 18 months.

The schedule submitted as a part of this Work Plan is intended to track only the Remedial Design components, and does not include the scheduling of any of the tasks associated with the implementation of the Remedial Action. According to the RSOW, a preliminary construction (or Remedial Action) schedule is to be included with the 60 percent design submittal, with a formalized Remedial Action schedule to be included in the Remedial Action Work Plan.
5. REMEDIAL DESIGN DELIVERABLES

The deliverables to be developed as a part of the Remedial Design preparation are intended to provide documentation that will meet the EPA requirements and will facilitate an effective and well orchestrated Remedial Action. The preparation of the Remedial Design is consistent with the O'Connor Company Site ROD, the ESD, RSOW, and Pre-Design phases, as well as with current EPA RD/RA guidance. The Remedial Design will be prepared in a series of four deliverables which are identified as: 30 percent or conceptual design, 60 percent or intermediate design, 95 percent or final design, and 100 percent or revised final design. These four stages of deliverables will be submitted to EPA based upon a pre-determined time schedule. A proposed schedule for the submittal of the deliverables is provided in Section 4.0 of this Work Plan. A description of the scope for each of these deliverables is provided in this section of the Work Plan; a summary of the Design Deliverable Components is provided in Table 1.

5.1 30 Percent Design

The intent of the 30 percent or conceptual design is to present a general picture of the MOM and SC remedial response actions. A separate design will be proposed for the MOM and SC components of the Remedial Design, but both will be submitted for review concurrently. Components of the 30 percent Design will consist of design criteria memorandum, conceptual design sketches, and an outline of technical specifications anticipated to be required. A description of the items to be included in the 30 percent MOM and SC Design submittals, along with the other required deliverables is provided below.

5.1.1 Management of Migration

The design submittals for MOM will consist of design criteria memorandums (DCMs), conceptual sketches, and an outline of technical specifications anticipated to be required. The purpose of the DCMs is to define the criteria by which the design calculations, design drawings and technical specifications will be based. For example, criteria used in the design of a ground water treatment system would include the identification of expected ground water extraction flow rate, expected contaminant level, water treatment components, standards to be followed in design and types of materials of construction. The design information presented in the 30 percent submittal would include the criteria to be used in the calculations but no sizing or detailed calculations will be submitted at this stage.

DCMs will be provided for each major feature of the MOM remedy and will include separate DCMs for ground water extraction, ground water treatment, reinjection of treated ground water, the treatment plant building, waste disposal, operation and maintenance testing, structural design, mechanical design, and electrical design. Also to be completed at this time would be tentative sizing of process equipment and treatment building.
Conceptual sketches to be completed for the MOM 30 percent Design submittal will include a site sketch, a ground water elevation contour map, a top of bedrock elevation contour map, a process flow diagram for ground water extraction, treatment and injection, and a preliminary treatment equipment arrangement. The ground water elevation contour map may be revised at 60, 95 or 100 percent design based on additional ground water elevation measurements to be taken as part of the quarterly ground water monitoring program. (See Section 5.1.4 below). Top of bedrock elevation contour map will not be revised in subsequent submittals unless additional information on the top of bedrock is collected.

5.1.2 Source Control

The design submittals for SC 30 percent Design will also consist of DCMs, conceptual sketches, and an outline of technical specifications anticipated to be required. SC DCMs will be prepared for site utilization, barn demolition, earthwork, soil treatment, storm water control, debris handling, site restoration, off-site disposal, support facilities, and a number of engineering items such as structural, mechanical and electrical general design criteria.

Conceptual sketches to be completed in the SC 30 percent design can be subdivided into categories of civil, mechanical and process. Civil drawings will include a general site layout, temporary site grading and drainage, excavation and stockpile sequencing, on-site storm water collection layout, final site restoration, marsh/wetland reclamation, soil contaminant isopachs maps, and a ground water elevation contour map. Conceptual mechanical drawings would include storm water treatment equipment arrangement drawings, and storm water pump station equipment arrangements. Conceptual process drawings would include storm water/site water hydraulic profiles and process flow diagrams, and soil treatment process flow diagrams.

5.1.3 Evaluation of Separable Schedules

An evaluation of the feasibility of initiating remedial activities for distinct, separable remedial actions will be performed. Separable remedial actions would proceed in accordance with the RSOW but ahead of schedule for design activities for other elements of the remedy. This evaluation will be based primarily on the technical feasibility and practicability of separating the Remedial Action into independent elements.

Based on the pre-design studies, it seems that implementation of the Remedial Action will be controlled by the SC component. As currently envisioned, construction of the MOM extraction, treatment and injection system would not commence until the SC remedy is near complete. Though this allows the possibility to delay MOM design, CMP proposes to undertake SC and MOM remedial designs concurrently. It is believed that this will reduce the potential for conflicts between the two remedy designs and result in a more efficient and better coordinated Remedial Action.
5.1.4 Ground Water Sampling and Analysis Plan (SAP)

A ground water Sampling and Analysis Plan (SAP) will be prepared for quarterly monitoring. The ground water SAP is not part of the 30 percent design submittal but is included here for presentation purposes since it is a Remedial Design submittal. The ground water SAP is due within 30 days after receipt of notification of approval of EPA modification of the pre-design deliverables. The schedule for quarterly monitoring will be established in the SAP and will continue for at least three years after implementation of ground water treatment. The SAP will consist of a Field Sampling Plan (FSP) that will describe the procedures and methods necessary to perform the field work and a Quality Assurance Project Plan (QAPP) that will describe the organization, functional activities, and the quality assurance and quality control protocols necessary to meet the intended uses of the data.

5.1.5 Applicable or Relevant and Appropriate Requirements

A statement will be prepared detailing how all applicable or relevant and appropriate Federal and State public health and environmental requirements and standards will be met during the Remedial Action. How specific elements of the Remedial Action will meet the following statutes and associated regulations will be discussed:

- Resource Conservation and Recovery Act (RCRA),
- Clear Water Act (CWA),
- Safe Drinking Water Act (SDWA),
- Toxic Substances Control Act (TSCA),
- Wetland Regulations, and

5.1.6 Project Delivery Strategy

CMP plans to use a "Construction Management" project delivery system to complete remediation design. For the purpose of this work plan, the concept of Construction Management is defined as the maximum coordinated effort of the owner, designers, and remediation contractors working together; to develop the most cost efficient project, to enhance the quality of the project, to control remediation costs and schedule, as well as to reduce operating and maintenance costs. This approach was employed during the project pre-design phase with GEI as the prime manager. CMP also plans to use this approach during Remedial Action except that management services will be provided by a general construction firm or by CMP's Technical Services Department.

A general description of the items that will comprise the project delivery strategy, to be submitted as part of the 30 percent remediation design submittal, follows:

- detailed description of Remedial Action project delivery strategy;
• preliminary project organization chart indicating relationships between owner, remediation contractors and technical support services (i.e., quality assurance/quality control);

• preliminary segregation of remedy components for contracting purposes; and

• a summary of prequalified solvent extraction technology vendors.

5.1.7 Independent Quality Assurance Review

An Independent Quality Assurance Team will be selected to provide independent review of design deliverables. The team members selected and the purpose and scope of their review is detailed in Section 6.

5.1.8 EPA and DEP Submittal and Review Requirements

Since this is an interim submittal to EPA and DEP, only comments will be prepared by the regulators at this time, and progress of design work on the 60 percent submittal will continue. Following the submittal of the 30 percent deliverable to EPA, a technical informational review meeting between EPA, DEP, and the Design Team will be scheduled. The purpose of the meeting will be to answer questions and discuss comments received. Subsequent to this review meeting, the Design Team will document and submit responses to all EPA and DEP comments in a letter. In addition, comments received at this meeting will be incorporated into the 60 percent submittal.

5.2 60 Percent Design

The 60 percent or intermediate design will bring the design beyond the conceptual level that was completed in the 30 percent design, and will be the result of the preparation of more detailed design drawings and draft specifications. As with the 30 percent design submittal, a separate design will be established for the SC and MOM remedial response actions, and will be submitted for review concurrently. A description of the items to be included in the 60 percent MOM and SC design submittals, along with the other required reports, plans or evaluations is provided.

5.2.1 Management of Migration

Included with the MOM 60 percent design deliverable will be draft design calculations, additional design drawings and draft technical specifications. Preliminary calculations would include the preparation of those necessary for ground water extraction and injection, prefabricated building design, concrete footing and slab design, process design and site electrical requirements.

Draft design drawings will be prepared for geotechnical, civil, structural, process, mechanical, and electrical requirements. Examples of drawings to be prepared are:
Geotechnical - ground water extraction well and piping; and ground water injection well and piping designs.

Civil - updated site layout, and ground water elevation contour map.

Structural - ground water treatment building foundation layout.

Process - ground water extraction, treatment and injection hydraulic profile; ground water extraction, treatment and injection process flow diagram; and ground water treatment piping and instrumentation diagram.

Mechanical - treatment system equipment arrangement drawings

Electrical - Single line diagrams.

Draft technical specifications required for the MOM remedy will be prepared at this submittal. The finalization of these specifications will be completed as a part of 95 percent design submittal.

5.2.2 Source Control

Included with the SC 60 percent design deliverable will be draft design calculations, additional drawings and draft technical specifications. Draft calculations would include an evaluation of storm water generation and control, contaminated soil excavation quantities and staging, treated soil backfill quantities and staging, concrete footing and slab design, vehicle and debris washing stations, storm water treatment process design, soil treatment process design, on-site and perimeter storm water drainage systems, barn decontamination and removal, final site grading, and temporary and permanent sanitary treatment systems.

Draft SC 60 percent design drawings will be prepared for civil, structural, process, mechanical, and electrical requirements. Examples of drawings to be prepared are:

Civil - updated site layout; temporary site grading and drainage; soil contamination areas; contaminated soil excavations sequencing and stockpiling; on-site drainage collection system; updated ground water elevation contour map; wetlands, marsh and lagoon cleanup and restoration; barn demolition; final site grading and drainage design; and final (i.e., post remediation) ground water monitoring well schedule and details.

Structural - vehicle and debris washing area; sections and details; and storm water treatment facility foundation layout.

Process - storm water treatment hydraulic profile; storm water process flow diagrams; soil preparation, treatment and post-treatment process flow diagrams; and soil treatment mass balance diagram.
Mechanical - storm water treatment system equipment arrangement drawings; storm water pump station, section and details; and soil treatment system equipment arrangement drawings.

Electrical - site electrical design.

Draft technical specifications required for the SC remedy will be prepared at this submittal. The finalization of these specifications will be completed as a part of the 95 percent design submittal.

5.2.3 Project Plans, Reports, Studies and Evaluations

Draft Project Operations Plan (POP)

A Draft Final POP will be prepared describing all field operations in support of the Remedial Action. A draft outline of the POP is shown on Table 2. It will be comprised of the following:

- A Site Management Plan (SMP) describing site control and security; organization and communications between contractors; emergency procedures; waste disposal; and reporting to Federal, State and local agencies.

- A Community Relations Support Plan (CRSP) describing the activities CMP will take to support EPA and DEP's community relations efforts. These activities may include developing fact sheets or news releases, participating in public information meetings, and providing regular technical briefings to local officials and local citizens.

- A Sampling and Analysis Plan consisting of a Field Sampling Plan describing the field procedures and a Quality Assurance Project Plan describing the analytical quality assurance procedures necessary to obtain the data needed for the intended uses. The SAP will describe sampling procedures for various media for ensuring target cleanup goals are met, for excavated soil and sediment prior to treatment to obtain process information, and for sediments and biota within Riggs Brook and associated nearby wetlands.

- A site-specific Health and Safety Plan (HSP) to establish the procedures, personnel responsibilities, and training necessary to protect the health and safety of all on-site personnel during the Remedial Action.

Draft Operation and Maintenance Plans (O&M)

A Draft Final Operation and Maintenance (O&M) Plan will be developed to ensure the long-term, continued effectiveness of the SC and MOM components of the Remedial Action. An outline of the O&M Plan is shown on Table 3. The O&M Plan will
include cost estimates for post-closure; post-closure care monitoring and inspection schedules; and procedures for fulfilling the five-year review requirements of the Comprehensive Environmental Response and Compensation Liability Act (CERCLA).

Preliminary Construction Schedules and Costs

A preliminary construction schedule and cost estimate will be completed and submitted with the 60 percent submittal. The cost estimate will be a revision of the cost estimate prepared as part of the pre-design studies, and will be based upon the new information gained during the conceptual and preliminary design. A tentative construction schedule will be developed at this stage to begin the planning stages for Remedial Action.

Value Engineering Study

Consistent with the RSOW and EPA’s guidance for Remedial Design activities, the O’Connor Design Team has incorporated into the design phase a Value Engineering Study. The purpose of the value engineering is to provide an early review of the design concept and to provide a cost justification of design decisions. Incorporation of this review at various stages of design development will result in a design that is cost-effective.

The O’Connor Design Team’s approach for the incorporation of Value Engineering into the Remedial Design is to include a remediation contractor as part of the team. During the entire Remedial Design process, H.E. Sargent, Inc., will provide review of the design. H.E. Sargent’s purpose will be to review the project and to assess the various options available to complete a given operation. Criteria by which the design will be reviewed include whether the task selected is the most cost effective option available. This Value Engineering review will take place beginning at the submittal of the 30 percent design and will continue through 60 percent design.

5.2.4 Remedial Action Contracting

Preliminary Bid Documents

A general description of the items that will comprise the remedial action contracting deliverables, to be submitted as part of the 60 percent remediation design submittal, follows:

- project organization charts for each remedy component indicating the primary contracting packages and major subcontracting packages;
- preliminary contract documents (i.e., commercial terms and conditions);
- a summary of short-listed solvent extraction technology vendors; and
• a summary of prequalified remediation contractors.

Currently it is anticipated that at the completion of 60 percent design a formal quotation will be solicited from the short-listed solvent extraction vendors and a preliminary quotation will be solicited from the prequalified remediation contractors. Meetings to be held in advance of soliciting these quotations will be scheduled to allow EPA and DEP to attend and participate in the pre-bid discussions.

Contractor Qualifications

Potential vendors and contractors for the Remedial Action will be evaluated based on qualifications and then short-listed for possible retention prior to soliciting price quotations. Preliminary quotations will be obtained from the short-listed companies for budgeting purposes followed by formal quotations for retention negotiations. Final proposals will be obtained from select contractors based on addenda prepared in response to EPA and DEP review and comment on the approved 100 percent design submittal. The anticipated sequence of Remedial Action contracting by remedy component, is as follows:

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<th>REMEDIAL ACTION CONTRACTOR RETENTION SEQUENCE</th>
<th>Primary Remedy Component</th>
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<td>Remediation Design Submittals</td>
<td>Solvent Extraction</td>
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<td>Source Control</td>
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<td>Management of Migration</td>
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Final Proposal
To allow the solicitation of competitive proposals for the costliest part of the site remedy (i.e., soil treatment), the solvent extraction vendors will be prequalified early in the design schedule. This will enable the vendors and project design team members to incorporate the technical requirements of the short-listed vendors’ technologies so as not to preclude them from making a competitive final proposal for the soil cleanup contract.

5.2.5 EPA and DEP Submittal and Review Requirements

The 60 percent submittal is a major submittal requiring EPA review and approval prior to the initiation of the 95 percent design. Following the submittal of the 60 percent deliverable, a technical presentation meeting between EPA, DEP, and the design team will be scheduled. The purpose of the meeting will be to present the 60 percent design and answer immediate questions related to its content. Following the submittal of the 60 percent design, the progress of the design work will be halted until approval of the 60 percent submittal is provided by the EPA. Scheduling of the preparation of the 95 percent design submittal will be contingent upon the receipt of the formal EPA approval of the 60 percent submittal.

5.3 95 Percent Design

The 95 percent or final design will incorporate additional detail to the design submitted at the intermediate or 60 percent level. Included with this deliverable will be final design calculations, and the detailed design drawings and plans. The final version of the technical specifications will be incorporated, and the preparation of the Final Bid Documents will be completed. The design drawings and plans at this stage in the design will include the final versions of the documents prepared at the 60 percent level, with additional detail drawings necessary to allow construction and operation of all remedial measures, and to satisfy the requirements of the EPA and DEP.

A description of the items to be included in the 95 percent MOM and SC Design submittals, along with the other required reports, plans or evaluations is provided.

5.3.1 Management of Migration

The design submittals for MOM will consist of final design calculations, detailed design drawings and a final version of the technical specifications. Final design calculations will be completed for structural, process, mechanical and electrical details that were not previously completed in the 60 percent design submittal.

Final versions of the MOM design drawings will be prepared for geotechnical, civil, structural, process, mechanical, and electrical requirements. Many of these will be the final versions of the plans prepared during the 60 percent design. However, drawings showing a greater level of detail (especially for mechanical and electrical designs) will be prepared for this submittal. Examples of final design drawings to be submitted are:
Remedial Design Work Plan  
Revision 0  
Date August 1, 1994  
Page 18

Geotechnical - ground water extraction well and piping; ground water injection well and piping designs; and well piping profiles, sections and details.

Civil - updated site layout, and ground water elevation contour map.
Structural - ground water treatment building structural and foundation layout and section details; and drainage sump, sections and details.

Process - ground water extraction, treatment and injection hydraulic profile; ground water extraction, treatment and injection process flow diagram; and ground water treatment piping, and instrumentation diagram.

Mechanical - treatment system equipment arrangement drawings; piping arrangement and detail drawings; plumbing and sanitary piping; HVAC diagram and arrangement; and fire protection diagram and arrangement.

Electrical - grounding layout; lighting layout; power layout; one line diagram; control panel arrangement and wiring diagram; fire alarm panel; instrument and electrical equipment installation details; conduit layout; motor control center interconnection diagram; and layout of field instruments and control devices.

A final version of the technical specifications for the MOM 95 percent design, will be prepared at this submittal. This final version of the technical specifications will be complete for bidding purposes.

5.3.2 Source Control

As with the MOM 95 percent submittal, the design deliverables for SC 95 percent design will consist of final design calculations, detailed design drawings and a final version of the technical specifications. Final design calculations will be completed for structural, process, mechanical and electrical details that were not previously completed in the 60 percent design submittal.

Final versions of the SC design drawings will be prepared for geotechnical, civil, structural, process, mechanical, and electrical requirements. Many of these will be the final versions of the drawings prepared during the 60 percent design. As with the MOM Design, the SC drawings showing a greater level of detail (especially for mechanical and electrical designs) will be prepared for this submittal. Examples of SC Final Design drawings to be submitted are:

Civil - updated site layouts; site security; temporary site grading and drainage; access road layout, profiles, and sections; soil contamination areas; contaminated soil excavations sequencing and stockpiling; on-site drainage collection system; updated ground water elevation contour map; wetlands, marsh and lagoon cleanup and restoration
design; barn demolition; final site grading and drainage; and final (i.e., post remediation) ground water monitoring well schedule and details.

Structural - vehicle and debris washing area layout, sections and details; storm water treatment facility foundation layout; paving drawings for raw soil, feed stock, stabilized soil storage areas; and temporary foundation pad and paving drawings for soil treatment unit, and soil stabilization unit.

Process - storm water treatment hydraulic profile; storm water process flow diagrams; soil preparation, treatment, post-treatment process flow diagrams; soil treatment mass balance diagram; and piping and instrumentation diagrams for storm water treatment, soil preparation, soil treatment and soil post treatment.

Mechanical - storm water treatment system equipment arrangement drawings; storm water pump station, section and details; soil treatment system equipment arrangement drawings; storm water piping arrangement and detail drawings; compressed air piping diagram; plumbing and sanitary piping; HVAC arrangement and detail; and fire protection systems arrangement.

Electrical - site electrical layout; grounding layout; lighting layout; power layout; one line diagram; control panel arrangement and wiring diagram; fire alarm panel; instrument and electrical equipment installation details; conduit layout; motor control center interconnection diagram; and layout of field instruments and control devices.

As with the MOM 95 percent submittal, a final version of the technical specifications for the SC 95 percent design, will be prepared at this time and will be submitted. This final version of the specifications will be complete for bidding purposes.

5.3.3 Project Plans, Reports, Studies and Evaluations

Revised Final Project Operation Plan (POP)

The Project Operation Plan (POP) will be revised to reflect changes in design from the 60 percent to the 95 percent design submittals. These changes will be the result of finalizing the remedial design and comments received from EPA and DEP on the Draft Final POP.

Revised Final Operation and Maintenance Plan (O&M)

The Operation and Maintenance (O&M) Plan will be revised to reflect changes in design from the 60 percent to the 95 percent design submittals. These changes will be the result of finalizing the remedial design and comments received from EPA and DEP on the Draft Final O&M Plan.
Constructability Report

Consistent with the RSOW and EPA’s guidance for Remedial Design activities, the O’Connor Design Team has incorporated into the design process an evaluation of the constructability of the Remedial Design. The O’Connor Design Team’s approach for the incorporation of a evaluation of constructability into the Remedial Design is to include a remedial contractor as part of the team. During the entire Remedial Design process, H.E. Sargent, Inc. will provide review of the design. H.E. Sargent’s role will be to review each component of the design to evaluate whether it is constructable and biddable. This constructability review will take place beginning at the submittal of the 60 percent design and will continue through 95 percent.

5.3.4 Applicable or Relevant and Appropriate Requirements

A statement will be prepared of all assumptions and all drawings and specifications necessary to support the analysis of compliance with Applicable or Relevant and Appropriate Federal and State public health and environmental Requirements (ARARs) provided in the 30 percent design submittal. The specific elements of the remedial design that will ensure compliance with ARARs will be identified.

5.3.5 Final Bid Documents

A general description of the items that will comprise the remedial action contracting deliverables, to be submitted as part of the 95 percent remediation design submittal, follows:

- detailed Remedial Action organization chart and suborganization charts for each remedy component with alternate short-listed or selected companies identified; and
- final contract documents for each major remedy component.

5.3.6 Independent Quality Assurance Review

An Independent Quality Assurance Team (IQAT) will be selected to provide independent review of design deliverables. The team members selected and the purpose and scope of their review is detailed in Section 6.

5.3.7 EPA and DEP Submittal and Review Requirements

This is to be a interim submittal similar to the 30 percent submittal where only comments will be prepared by EPA and DEP at this time, and progress of design work on the 100 percent submittal will continue. Following the submittal of the 95 percent deliverable
to EPA, a technical informational review meeting between EPA, DEP, and the Design Team will be scheduled. The purpose of the meeting will be to answer questions and discuss comments received. Subsequent to this review meeting, the Design Team will document and submit responses to all EPA and DEP comments in a written letter. In addition, comments received at this meeting will be incorporated into the 100 percent submittal.

5.4 100 Percent Design

The 100 percent revised final design will incorporate comments received and any additional detail required by the EPA comments to the design that was submitted at the final or 95 percent level.

5.4.1 Management of Migration

Included with this 100 percent MOM deliverable will be final design calculations, the detailed design drawings and the final version of the technical specifications. The design drawings at this stage in the design will include the final versions of the documents prepared at the 95 percent level, with inclusion of the response to comments of the 95 percent submittal received from EPA and DEP.

5.4.2 Source Control

As with the MOM 100 percent design, the SC 100 percent Design will include the final design calculations, the detailed design drawings, and the final version of the technical specifications. The design drawings at this stage in the design will include the final versions of the documents prepared at the 95 percent level, with inclusion of the response to comments of the 95 percent submittal received from EPA and DEP.

5.4.3 EPA and DEP Submittal and Review Requirements

The 100 percent design submittal is a major submittal requiring EPA review and approval prior to the initiation of Remedial Action. Following the submittal of the 100 percent deliverable a technical presentation meeting between EPA, DEP, and the Design Team will be scheduled. The purpose of the meeting will be to formally present the 100 percent design and answer immediate questions related to its content. Following the submittal of the 100 percent design, the initiation of the Remedial Action Work Plan will be delayed until approval of the 100 percent submittal is provided by the EPA.
6. INDEPENDENT QUALITY ASSURANCE TEAM (IQAT)

As required in Section I.2.b. of the RSOW, CMP has selected an IQAT to provide independent review of design deliverables. The IQAT will consist of an individual from GEI and W&C and a specialist in hazardous waste health and safety. IQAT members will be independent of all other Remedial Design activities. The RSOW specifies that the IQAT review design criteria, plans, and specifications for clarity and completeness. This review will be performed at the completion of 30 percent and 95 percent design.

The results of the IQAT review will be summarized in a memorandum and submitted to EPA and DEP three weeks after the appropriate design submittal. The Design Team will provide written response within four weeks of receiving the IQAT review.

The IQAT members are described below. Their resumes are provided in Appendix A.

Deborah R. Roy, MPH, RN COHN, CET

As President and Principal of Safe Tech Consultants, Inc. of South Portland, Maine, Ms. Roy provides consulting services in State and Federal regulatory compliance audits, investigation of toxic exposure complaints, toxicological research, hazardous waste and emergency response training, site safety plan development and technical review, training program and material development, ergonomic evaluation and work station redesign, policy development and professional education. She also provides statistical analysis and interpretation of medical surveillance data and she also develops health and safety policy and procedure manuals for manufacturers, municipalities, and health care facilities.

Previously as project manager and corporate training manager for Groundwater Technology, Inc. of Portland, Maine, she designed, implemented and managed training programs for U.S. employees in compliance with OSHA requirements for Hazardous Waste Operations and Emergency Response, Respiratory Protection, Hearing Conservation and Hazard Communication. She supervised seven trainers and provided technical assistance and direction for the corporate health and safety program.

Marco D. Boscardin, P.E., Ph.D.

Dr. Boscardin is a Senior Project Manager in the Environmental Division of GEI Consultants, Inc. specializing in the application of geotechnical engineering to site remediation design and construction. His experience includes MCP Phase I and Phase II investigations; design and construction oversight of short-term measure response actions; landfill liner and cap design and evaluation; contaminated soil and ground water management plans, and techniques to minimize excavation and dewatering during utility construction through contaminated areas. He has also worked on a wide range of other projects during his career including: tunneling, trenchless...
construction, site exploration, excavation support systems, dewatering, grouting, embankment and slope stability, building foundations, and instrumentation to monitor performance. These experiences provide an added dimension that Dr. Boscardin brings to the project.

Prior to joining GEI, Dr. Boscardin was an Assistant Professor of Civil Engineering at the University of Massachusetts and at the University of Illinois, where he taught courses and performed research in the areas of tunneling, rock engineering, foundations, soil mechanics and civil engineering materials.

Franklin E. Woodard, P.E., Ph.D.

As President of W&C Dr. Woodard is responsible for technical supervision of the firm’s environmental engineering design and research projects. Dr. Woodard has over 25 years of experience in the design of wastewater systems for municipal and industrial clients. He is well known for innovative solutions to problems regarding industrial waste treatment and pretreatment, air pollution, wastewater pollution, hazardous waste, and water supply. He also has extensive experience in working with State and Federal agencies in helping municipal and industrial clients with permitting and compliance issues with EPA and many State environmental agencies. Dr. Woodard has conducted extensive research and authored numerous publications on a variety of topics associated with waste treatment and air quality and recently wrote a definitive textbook on "Industrial Wastewater Treatment, by Woodard & Curran". He is a registered Professional Engineer in Maine.
# TABLE 1 - DESIGN DELIVERABLE SUMMARY

Remedial Design Work Plan  
O'Connor Company Site  
Augusta, Maine

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>CONCEPTUAL DESIGN (30%) SUBMITTAL</th>
<th>INTERMEDIATE DESIGN (60%) SUBMITTAL</th>
<th>FINAL DESIGN (95%) SUBMITTAL</th>
<th>REVISED FINAL DESIGN (100%) SUBMITTAL</th>
</tr>
</thead>
</table>
| Detailed Design Documents | • Design Criteria Memorandums  
• Preliminary Sketches | • Draft Design Calculations  
• Draft Design Drawings  
  Civil  
  Structural  
  Mechanical  
  Process  
  Electrical  
  Value Engineering Study  
  Incorporation of Comments on 30% Design | • Final Design Calculations  
• Final Detail Design Drawings  
  Civil  
  Structural  
  Mechanical  
  Process  
  Electrical  
  Constructability Review | • Revised Final Design Calculations  
• Revised Final Detail Design Drawings  
• Incorporation of Comments on 95% Design |
| Technical Specifications | • List and Status of Specifications | • Outline of Specifications | • Final Design Specifications | • Revised Final Design Specifications |
| Schedules & Bid Documents | • Evaluation of Separable Schedules  
• Approaches to Remedial Action Contracting | • Draft Construction Schedule  
• Draft Construction Costs  
• Draft Bid Documents  
• Qualifications of Potential Supervising Construction Contractors | • Final Bid Documents | • Revised Final Bid Documents, as needed |
<p>| Project Operation Plan (POP) | • Draft Final POP: Health and Safety, Community Relations Support, Sampling and Analysis, and Site Management Plans | | • Revised Final POP: Health and Safety, Community Relations Support, Sampling and Analysis, and Site Management Plans | |
| Operation &amp; Maintenance (O&amp;M) Plan | • Draft Final O&amp;M Plan | | • Revised Final O&amp;M Plan | |</p>
<table>
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<tr>
<th>COMPONENT</th>
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<th>FINAL DESIGN (95%) SUBMITTAL</th>
<th>REVISED FINAL DESIGN (100%) SUBMITTAL</th>
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</thead>
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<tr>
<td>ARARs Evaluation</td>
<td>• Detailed Statement of How ARARs Will be Met</td>
<td></td>
<td>• Detailed Statement With All Assumptions, Drawings And Specifications Necessary To Support ARARs Compliance</td>
<td></td>
</tr>
<tr>
<td>EPA Review Status</td>
<td>• Review and Comment Only</td>
<td>• Review and Approval</td>
<td>• Review and Comment Only</td>
<td>• Review and Approval</td>
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<td>EPA, DEP, &amp; CMP Technical</td>
<td>• Technical Informational Review meeting to Discuss Submittal and Receive EPA and DEP Comments</td>
<td>• Technical Presentation Meeting EPA Approval Will Be Formally Received</td>
<td>• Technical Informational Review meeting to Discuss Submittal and Receive EPA and DEP Comments</td>
<td>• Technical Presentation Meeting EPA Approval Will Be Formally Received</td>
</tr>
</tbody>
</table>
1. INTRODUCTION
   • Site Description and Background
   • Summary of Remedy

2. SITE MANAGEMENT PLAN
   • Site Security and Access
   • Communications and Key Personnel
   • Emergency Response and Contingency Plan
   • Air Monitoring
   • Waste Disposal
   • Data Management
   • Reporting

3. COMMUNITY RELATIONS SUPPORT PLAN
   • Previous Community Relations Activities
   • Community Relations Objectives
   • Anticipated Community Relations Support Activities

4. FIELD SAMPLING PLAN
   4.1 Sampling and Data Quality Objectives
   4.2 Sampling Locations and Frequency
      • Soil Sampling
         - Horizontal and vertical extent of excavation limits
         - Soil and sediment prior to treatment
         - Confirmatory sampling of soil and sediment left in-place outside the limits of excavation
         - Treatment Residues
         - Physical Testing
      • Sediment and Biota Sampling
      • Surface Water Sampling
      • Barn Materials Sampling
      • Debris Sampling
      • Treatment System Sampling
      • Investigative-Derived Waste
   4.3 Sampling Equipment and Procedures
TABLE 2 - DRAFT OUTLINE OF PROJECT OPERATIONS PLAN
O'Connor Company Site
Augusta, Maine

4.4 Sampling Handling and Analysis
- Chain of Custody
- Sample Labelling/Documentation
- Sample Shipments

4.5 Decontamination Procedures

4.6 Management of Investigation-Derived Wastes

5. QUALITY ASSURANCE PROJECT PLAN
- Quality Assurance Objectives for Measurement
- Sampling Procedures
- Sample Control and Custody Procedures
- Equipment Calibration Procedures
- Analytical Methods
- Data Validation, Reduction and Reporting
- Data Assessment Procedures
- Internal Quality Control Procedures
- Performance and System Audits
- Preventive Maintenance Procedures and Schedules
- Corrective Action/Quality Assurance Reporting

APPENDIX A Field Logs and Checklists

APPENDIX B Site-Specific Health and Safety Plan
TABLE 3 - DRAFT OUTLINE OF OPERATIONS AND MAINTENANCE PLAN
O'Connor Company Site
Augusta, Maine

1. INTRODUCTION
   1.1 Inspection Schedules

2. POST CLOSURE MONITORING
   2.1 Wetlands Restoration
   2.2 Storm Water Controls
   2.3 Environmental Monitoring

3. EQUIPMENT OPERATION AND MAINTENANCE
   3.1 Ground Water Extraction System
   3.2 Ground Water Treatment System
   3.3 Ground Water Injection System
   3.4 Ground Water Monitoring

4. FIVE-YEAR REVIEWS

APPENDIX A Equipment Manuals and Warranties
APPENDIX B Cost Estimates for Post-Closure Care
APPENDIX C Financial Assurance Documentation

GEI Consultants, Inc.                        Project 94112
                                          August 1, 1994
EPA AUTHORIZES R.D.

REMEDIAL DESIGN WORK PLAN

TECH. INFO. MEETING

EPA REVIEW AND APPROVAL

MONTHLY SAP DUE TO EPA

30% DESIGN

TECH. INFO. MEETING

60% DESIGN

DESIGN/PRE-CONST. CONFERENCE

EPA REVIEW AND APPROVAL

90% DESIGN

TECH. INFO. MEETING

100% DESIGN

EPA REVIEW AND APPROVAL

Note: ed = elapsed days

Central Maine Power Company
Augusta, Maine

Remedial Design Work Plan
F. O'Connor Site
Augusta, Maine

REMEDIAL DESIGN SCHEDULE

GEI Consultants, Inc.

Project 94112

August 1994

Fig. 4
APPENDIX A

Independent Quality Assurance Team

Resumes
DEBORAH R. ROY  
President  
Senior Consultant

EDUCATION

MPH in Occupational Health and Safety, University of North Carolina, 1988
MBA Coursework (Part time), Northeastern University, 1985-1986
BSN (Cum Laude), Northeastern University, 1982

PROFESSIONAL

AFFILIATIONS

American Association of Occupational Health Nurses
Maine Safety Council - Board of Directors, Treasurer
Maine Safety and Health Conference Committee
National Environmental Training Association
Downeast Industrial Hygiene Association- Program Committee

PROFESSIONAL EXPERIENCE

1990-present  President and Principal - SafeTech Consultants, Inc., South Portland, ME (self-employed part-time, August 1987 - May 1990). Assists client companies by providing consultation in state and federal regulatory compliance audits, investigation of toxic exposure complaints, toxicological research, hazardous waste and emergency response training, site safety plan development and technical review, training program and material development, ergonomic evaluation and work station redesign, policy development and professional education. Provides statistical analysis and interpretation of medical surveillance data. Develops health and safety policy and procedure manuals for manufacturers, municipalities, and health care facilities. Writes training programs and materials as mandated by OSHA standards. Supervised and/or delivered approximately 1,500 hours of training in the last year.


Developed proposals, managed project budgets and personnel, and presented reports to clients.
1985-1987  Group Manager, Occupational Medical Services - Center for Health Promotion, Portland, ME. Developed and implemented new occupational medical service including injury/illness management clinic, medical surveillance, periodic and pre-placement exams, safety training and consulting services. Supervised a staff of three and served 100 client companies with an employee base of 15,000.

1982-1985  Manager, Occupational Health and Safety - Sprague Electric Company, Division Headquarters, Sanford, ME. Developed and implemented comprehensive health and safety service including administration of Worker's Compensation, loss control, hazard evaluation, illness and injury management, pre-placement and periodic physical assessments, hearing conservation, health and safety training, and counseling and crisis intervention. Coordinated a two-year study on Ergonomics and Cumulative Trauma Disorders with Boston University Medical Center. Provided training in machine redesign for corporate management, design engineering staff, and production supervision.

SPECIAL ACCOMPLISHMENTS
Board-certified by the National Environmental Training Association in Health and Safety (CET), 1990 - present.
Board-certified by the American Board for Occupational Health Nurses (COHN), 1988 - present.

SELECTED PRESENTATIONS
(Partial List)
MARCO D. BOSCARDIN, Ph.D., P.E.
PROJECT MANAGER

EDUCATION
Ph.D., Geotechnical Engineering, University of Illinois - 1980
M.S., Geotechnical Engineering, University of Illinois - 1975
B.S., Civil Engineering, Massachusetts Institute of Technology - 1973

Trenchless Technology, by ASCE, Boston, MA, November 1992
Environmental Law for Engineers and Scientists, by ACEC/NE,
    Newton Centre, Jan/Feb 1992 and Feb/March 1993
Earth Retention Seminar by Pti, ASFE, and ADSC, Boston, MA, October 1992
New England Seismic Design, Fall Lecture Series, by BSCES Structural Group,
    Cambridge, MA, Fall 1991
Drilled Foundation Workshop, by ADSC, Fort Collins, CO, July 1987

REGISTRATION
Illinois and Massachusetts

GENERAL
Dr. Boscardin is a project manager in the Environmental Division of GEI specializing
in the application of geotechnical engineering to site remediation design and
construction. His experience includes MCP Phase I and Phase II investigations; design
and construction oversight of Short Term Measure response actions; landfill liner and
cap design and evaluation; contamination soil and groundwater management plans, and
techniques to minimize excavation and dewater during utility construction through
contaminated areas. He has also worked on a wide range of other projects during his
career including; tunneling, trenchless construction, site exploration, excavation support
systems, dewatering, grouting, embankment and slope stability, building foundations, and
instrumentation to monitor performance. These experiences provide an added dimension
that Dr. Boscardin brings to successfully attack environmental problems.

Prior to joining GEI, Dr. Boscardin was an Assistant Professor of Civil Engineering at
the University of Massachusetts and at the University of Illinois, where he taught
courses and performed research in the areas of tunneling, rock engineering, foundations,
soil mechanics and civil engineering materials. In addition, he consulted on numerous
projects.

EXPERIENCE
• MCP Phase II Investigation at a Priority Disposal Site, Stow, Massachusetts.
  Project Manager for Phase II comprehensive assessment and remedial evaluation at a
  commercial site located in drinking water resource area. Issues at this site included
  DNAPL migration and hydrologic regime at the site.

• MCP Short Term Measure Response Actions at Priority Disposal Site, Everett,
  Massachusetts. Assistant Project Manager responsible for the design and construction
  of containment and recovery system for coal gas residues which were migrating into an
  intertidal zone and surface water.
• New Neponset Valley Sewer, Massachusetts Developed geotechnical design and construction recommendations and prepared specifications for microtunnelling and conventional pipejacking for installation of a sewer force main under roads and railroad tracks and through an area of potentially contaminated soils. Considerations included evaluation of the types of trenched and trenchless technologies, and contaminated soils and groundwater management approaches compatible with soil conditions and the environmental and space constraints of the site. Also performed review of contractor submittals.

• Central Artery, DO14C and D017A Design Sections, Boston, Massachusetts Task Manager for subsurface investigation, laboratory testing, data analyses, and data and engineering report preparation. Subsurface investigations included standard penetration test borings, thin-walled tube sampling, rock coring, cross-hole seismic tests, water level and pressure monitoring, and borehole permeability testing (packer, constant head, and variable head methods). Also directed in situ testing, including pressuremeter, dilatometer, and field vane tests, for the Central Area. Laboratory testing included sample radiography, standard index tests, triaxial strength testing (compression, extension, and $K_c$), direct simple shear tests, consolidation tests, and dynamic triaxial tests. Data analyses were performed to develop subsurface profiles, to estimate soil properties, and to provide soil and rock parameters and geotechnical design and construction recommendations for use by the Section Design Consultants. Geotechnical design issues included soil and rock excavation, slurry walls for excavation support, pipejacking and tunnelling for utility line relocations, water control during construction, seismic loads, and effects of construction on adjacent structures, utilities, and tunnels.

• Central Artery, Tiedown Test Element Program, Boston, Massachusetts Task Manager for design of tiedown element test program, developing contract documents, evaluating bids for tiedown element drilling, installation, and testing, monitoring instrumentation and field testing by the contractor, evaluation of test data, and preparation of a report describing the tests, the results and design recommendation for tiedowns in soil and rock to resist tunnel uplift. Instrumentation includes vibrating wire strain gages, electronic load cells, optical surveying, hydraulic pressure gages, and data acquisition.

• Prebid Evaluations Performed analyses and developed construction and value engineering design alternatives for contractors during the bidding phases of projects involving tunnel and open-cut excavations in soil and rock. Included evaluation of compatibility of proposed construction methods and equipment with the expected ground conditions, effect of excavation-induced ground movements on adjacent structures and utilities, and recommendation of measures to minimize potential adverse response. Projects were located in Canada, Puerto Rico, Washington, D.C., Milwaukee, Chicago, Phoenix, Washington, and Florida.

• Providence Harbor Crossing, RI Performed a post-construction review and evaluation of the design and construction of a 3300-foot-long segment of an 18-inch-diameter natural gas pipeline crossing that passed through fill, organic silt, glacial outwash and till, and shale and sandstone bedrock. Review and evaluation considered
pre-construction information and decisions, contract specifications and conditions, compatibility of construction methods and equipment with ground conditions, and construction control.

- **Water Treatment Facility, Lincoln, New Hampshire** Project Manager in charge of geotechnical investigations and foundation design for the Town of Lincoln water treatment facilities.

- **Rochester Pump Station Excavation, Rochester, New Hampshire** Project Manager in charge of design of sheet pile braced excavation system and dewatering system for pump station excavation in soft, sensitive clays.

- **Castalia Pump Station, Castalia, Ohio** Analyzed base heave of pump station excavation and prepared remedial construction and excavation bracing design recommendations to permit completion of excavation and construction.

- **Storm Water Overflow Holding Basin, Bowling Green, Ohio** Evaluation of structural capacity of holding basin base slabs to hydraulic uplift.

- **Pump Storage Facility, Point Pleasant, Pennsylvania** Prepared design recommendations for excavation support and blasting associated with construction of a pump storage project. Both soil and rock excavation were evaluated, including subaqueous excavation. Blasting recommendations included drilling and loading patterns to minimize deleterious vibrations at adjacent structures.

- **Washington, D.C. Metro** Evaluation of soil movements and resulting building responses associated with excavation and for various braced excavation and tunnels in soil and rock. Work included design, installation, and monitoring of instrumented test sections, evaluations of construction methods and equipment compatibility with ground condition methods and equipment to improve ground response and productivity.

- **Underground Storage Caverns, Fort Saskatchewan, Canada** Finite element analyses and design recommendations for deep caverns in salt for storage of natural gas. Caverns were constructed using solution mining techniques and were approximately 250 feet in diameter and 6,000 feet deep. Included consideration of creep behavior.

- **Steam Chambers, Kern County, California** Laboratory testing and geotechnical design for oil sand steam extraction caverns. The extraction system included horizontal drilling to install pipes for injection of steam and extraction of oils.

- **Coal Mine Subsidence, Illinois** Evaluation of impacts and design recommendations for remedial measures in regions of coal mine subsidence for the Abandoned Mined Lands Reclamation Council. Project work included borehole photography; design, installation, and monitoring of instrumentation to provide data on settlement and horizontal movement of the ground and affected structures and utilities.
• **Cerrillos Dam, Puerto Rico** Evaluated construction implications of rock excavation and support conditions for river diversion structures and dam foundation preparation. Evaluations included grouting to control seepage, and excavation and support requirements for diversion tunnel and abutment excavations.

• **Four-Mile Fork Drainage Basin Tunnel, West Virginia** Reviewed and made recommendations regarding the design and specifications for excavation, instrumentation, and support of an unreinforced concrete-lined tunnel in sandstone and shale.

• **Rocky Hill Quarry, Eliot, Maine** Project manager in charge of geotechnical investigations and design recommendations for a proposed 300-acre quarry. Scope of work included subsurface explorations, field reconnaissance, materials evaluations, investigation of design rock slope conditions, geohydrologic investigations and blasting program, evaluation of impact of blast-induced vibrations on adjacent structures. Work included instrumentation and data monitoring for a seven-day pump test. Instrumentation included flow meters, pressure transducers, water level indicators, and automatic data acquisition systems.

• **Kaiser Aluminum and Chemical, Gramercy, Louisiana** Instrumented, performed and analyzed pile load tests, and developed foundation design recommendations for the coal conversion facilities of a chemical plant. Instrumentation included electronic load cells, hydraulic pressure gages on rams, dial indicators, wire-mirror systems, telltales, and optical surveying to monitor the load and movement for test piles and reaction systems during compression, tension, and lateral pile load testing.

• **Route 106/Loudon Road Improvements, Concord, New Hampshire** Project Manager in charge of geotechnical construction observation services and geotechnical design recommendations for widening highways feeding into a regional mall. Construction included compaction control of embankment fills, subgrade and pavement structure compaction control, soil and rock slope improvements.

• **Power Plant Diffuser System, Wiscasset, Maine** Installed and monitored instrumentation associated with twin 9-foot diameter fiberglass pipes. Instrumentation included pneumatic total pressure cells and resistance strain gages. Also performed geotechnical construction observation and testing during pipe installation. Work included rock excavation, dike and embankment construction, subaqueous construction, and pipe bedding and backfilling.

• **I-95 Extension and I-395 Viaduct, Baltimore, Maryland** Instrumented, performed and analyzed pile load tests to develop value engineering design recommendations for I-95 and I-395 interchanges. Instrumentation included electronic load cells, hydraulic pressure gages on rams, dial indicators, wire-mirror systems, telltales and optical surveying to monitor the load and movement of the test piles and reaction systems during compression and tension pile load testing.
• Allied Hospital, Wilkes Barre, Pennsylvania  Geotechnical investigation and foundation design for a four-story rehabilitation facility sited on strip mine spoil over four levels of abandoned coal mines. A test embankment to investigate potential deep-seated settlements was designed and monitored as part of the project.

• Perry's Victory National Park, Ohio  Evaluation of alternative design submittals for a seawall foundation in rock. Included concrete key and caisson alternatives to resist horizontal loadings.

• Larson Quarry, Dekalb, Illinois  Design recommendations for underground expansion of Larson Rock Quarry. Included design of an open-cut and a room-and-pillar mine in limestone and shale.

PUBLICATIONS


Professional Profile

As President of Woodard & Curran, Dr. Woodard is responsible for technical supervision of the firm's environmental engineering design and research projects. Dr. Woodard has over 25 years of experience in the design of wastewater systems for municipal and industrial clients. He is well known for innovative solutions to problems regarding industrial waste treatment and pretreatment, air pollution, wastewater pollution, hazardous waste, and water supply. He also has extensive experience in working with state and federal agencies in helping municipal and industrial clients with permitting and compliance issues with EPA and many state environmental agencies. Dr. Woodard has conducted extensive research and authored numerous publications on a variety of topics associated with waste treatment and air quality and is currently writing a definitive textbook on "Industrial Wastewater Treatment, by Woodard & Curran", for publication in 1993. He is a registered Professional Engineer in Maine.

Education

B.S., Civil Engineering, University of Maine, 1961
M.S., Civil Engineering, University of Maine, 1963
Ph.D., Sanitary Engineering, Purdue University, 1965

Professional Associations

Water Environment Federation
American Water Works Association
American Society of Civil Engineers
Maine Water Utilities Association
Air Pollution Control Association
Associated Industries of Maine and of Massachusetts
Technical Association of the Pulp and Paper Industry
The Societies of Sigma Xi, Chi Epsilon
The Society of Phi Kappa Phi

Related Experience

President, Woodard & Curran Inc., Portland, ME 1979-present

- Dr. Woodard as lead technical expert and Principal-in-Charge, was retained to study, and determine, using information generated by others, the historical aspects of contamination of groundwater with 1,1,1 Trichloroethylene (TCE) at a Superfund site in EPA Region 10. Transport of the TCE and its ultimate fate were also included in the study. The study included a thorough review of the industrial standard of practice over the past 40 years, as well as thorough consideration of the hydrogeologic characteristics of the site, and a thorough review (and comment) of mathematical modeling that was performed by others.
Superfund site in Region 1. Dr. Woodard, with technical back-up from the hydrogeotechnical and industrial wastes groups within Woodard & Curran, was retained to examine and evaluate work done by others at an industrial manufacturing site listed under the Superfund Program within Region 1. The problem that prompted the study was contamination of the groundwater with several organic solvents, including perchloroethylene, 1,1,1, TCE and Freon. The work completed by Woodard & Curran involved evaluation of the groundwater modeling, and estimating the extent of contamination of the groundwater at a certain point downgradient that would likely have been contributed by the subject industrial facility.

Conducted a process capability analysis for improving the performance of an existing PACT treatment system treating 40 MGD of hazardous waste from a chemical plant. Pollutants of concern were heavy metals, salts, and organics.

Woodard & Curran assisted the Central Foundry Division of GMC, Massena Plant in its efforts to resolve problems with the handling, on-site processing, and disposal of oily hazardous sludge waste from a process water treatment and recycle system. Engineering services include an evaluation of the present situation, definition of the problem itself, on-site pilot testing, and comparison of alternatives and their costs. Dr. Woodard participated in the design of pilot studies, interpretation of data, negotiations with state and federal agencies, conduct of the work and provided technical oversight to the sludge chemical conditioning process.

Woodard & Curran evaluated existing sequencing batch chrome removal and neutralization pretreatment facilities at Nashua Corporation’s Merrimack facility to assure compliance with the Town of Merrimack’s industrial wastewater pretreatment ordinances. Recommended system modifications to achieve compliance included changing reagents used in the chrome reduction and pH adjustment steps of the chrome removal process, segregation of wastewater streams going to the chrome treatment and neutralization facility and design of a batch reactor facility for biochemical waste reduction and sludge dewatering. Dr. Woodard provided technical oversight throughout this project. He assisted with design related studies and provided input to the final detailed design of system modifications.

Project Director for a study of the St. John River and technical arguments that allowed the Fraser Paper Mill in Madawaska, ME, to increase its NPDES permit discharge limits to categorical standards.

Dr. Woodard has worked as a consultant to a very large chemical manufacturing company in Ontario, Canada. His work, which is presently being followed up by the Industrial Wastes Group at Woodard & Curran, involved working out strategies to obtain agreement from Canadian regulatory authorities concerning discharge permit modifications.

Dr. Woodard has worked as a consultant to a Canadian Consulting firm, ADI Limited. His duties involved assisting in the design of wastewater treatment for a large food processor.
**Previous Work Experience**

*University of Maine, Orono, ME (1967 - 1979)*

For ten years prior to joining Woodard & Curran in 1979, Dr. Woodard was a professor of Civil Engineering, teaching graduate and undergraduate courses in Environmental Engineering and conducting an exceptionally active research program. He served as major professor for 28 Master of Science degree candidates and three Ph.D. candidates. Dr. Woodard also conducted a very active private consulting business. As a consultant he became well known for innovative solutions to problems regarding industrial waste treatment and hazardous waste handling and disposal. His clientele included over 20 industries, the Maine Department of Environmental Protection, and EPA Region I. Four representative projects were as follows:

- **Potomac Electric Power Co, Washington, D.C.** Provided advice concerning protection of receiving water (the Potomac River) from potential harmful effects from a proposed new nuclear power generating station. Helped to select sampling locations and sampling methods for an existing condition river quality study, as well as for a water quality mathematical modeling study.

- **Region I, USEPA.** Directed a two-year study to establish the quality of ambient air in the State of Maine. The results of this study were used to write the first Air Discharge permits in Maine.

- **Penobscot Poultry Co.** Designed the first dissolved air flotation treatment system in the U.S. to treat wastewater from a poultry processing plant. This type of system became the industry standard within two years. It is now used at virtually all poultry processing facilities in the country, with little modification from Dr. Woodard's first design.

- **State of Maine DEP.** Dr. Woodard was appointed a member of a team that developed the first solid wastes disposal and ground water protection act promulgated by the State of Maine. This law has been amended several times since its initial passage, but remains in its basic form.

**Publications**


Woodard, F.E., and Etzel, J.E., "Coacervation and Chemical Coagulation of Lignin From Pulp Mill Black Liquor", Journal of the Water Pollution Control Federation, 37, 7, 990 (1965).


Woodard, F.E. and Sproul, O.J., "An Air Pollutant Emissions Inventory and Ambient Air Quality Estimate for Selected Municipalities in Maine", Department of Industrial Cooperation, University of Maine, Orono, Maine, January (1971).

Woodard, F.E. and Sproul, O.J., "An Air Pollutant Emissions Inventory and Ambient Air Quality Estimate for Selected Municipalities in Maine, Addendum I and II", Department of Industrial Cooperation, University of Maine, Orono, Maine, June (1972).


Berry, L.S., Lafayette, P.F., Reed, S.W. and Woodard F.E., "Laboratory Studies into the Reduction of Pollution from Poultry Processing by In-Plant Recycle", Proceedings 29th Purdue Industrial Waste Conference, Purdue University, Lafayette, Indiana (1974).


Frost, R.E. and Woodard, F.E., "Analysis of the Effects of Wastewater Treatment Costs on the Feasibility of Major Processing Changes Including In-Plant Reuse of Wastewater in a Poultry Processing Plant", Proceedings, 30th Purdue Industrial Waste Conference, Purdue University, Lafayette, Indiana (1975).
Reed, S.W. and Woodard, F.E., "Dissolved Air Flotation of Chiller Water Leading to In-Plant Recycle at a Poultry Processing Plant", Journal of the Water Pollution Control Federation, 48, 1, 107 (1976).


Woodard, F.E. and Marston, K.R., "99+% BOD$_5$ Removal from Rendering Plant Wastewater", Presented at the 37th Annual Purdue Industrial Waste Conference, Purdue University Lafayette, Indiana (May, 1982)