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CONSULTING ENGINEERS

NACIP FEASIBILITY STUDY AND REMEDIAL DESIGN FINAL WORK PLAN PART A: TECHNICAL APPROACH

NAVAL ORDNANCE STATION INDIAN HEAD, MARYLAND

JUNE 1987

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JUNE 1987

PREPARED FOR

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CHESAPEAKE DIVISION
WASHINGTON, D.C.
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1.0 INTRODUCTION

This Work Plan is submitted in six parts with three appendices. Section 1.0 provides a summary of Indian Head Naval Ordnance Station (NOS) and its status within the Naval Assessment and Control of Installation Pollutants (NACIP) program, the proposed scope of the Feasibility Study/Remedial Design and E.C. Jordan's involvement in the program. Section 2.0 presents a summary of the findings from previous investigations, a summary of the site conditions and the technical program from the onset of the additional site characterization to the production of the final Feasibility Study/Remedial Design. Section 3.0 presents the project management and organization with descriptions of the responsibilities of key personnel. Section 4.0 presents the detailed schedule for the completion of the project, estimated to take approximately 38 weeks. Section 5.0 provides a list of referenced documents and Section 6.0 contains a list of acronyms used in the report.

Also appended to the Work Plan are the site-specific project Health and Safety Plan (HASP) (Appendix A), the Quality Assurance Project Plan (QAPP) (Appendix B) and Personnel Resumes (Appendix C). The overall HASP and QAPP for the NACIP projects have already been prepared and are included herein by reference only. Copies of these plans are available from ORNL and additional copies will be sent to Naval Facilities Engineering Command Chesapeake Division (CHESDIV) and NOS. Preparation of this Work Plan fulfills the requirements of Task 1 - Work Plan preparation. This Work Plan incorporates a Site Characterization Plan (Task 2.0) which includes detailed descriptions and quantitative information on sampling methodologies, investigative locations and field and laboratory procedures.

1.1 The NACIP Program and Indian Head Naval Ordnance Station

Indian Head Naval Ordnance Station (NOS) is included in the Naval Assessment and Control of Installation Pollutants (NACIP) program. The NACIP program was established to identify the presence of any suspected contamination at Navy and Marine Corps lands resulting from past operations and, if needed, to institute corrective remedial measures. The NACIP program is implemented in three parts:

1. Initial Assessment Study (IAS) The study consists of records searches and personnel interviews to collect and evaluate evidence supporting the existence of any potential contamination problems at NOS.

2. Confirmation Study The study consists of on-site investigations including physical and chemical analyses to confirm or deny the existence of contamination, to quantify the extent of the problem, and to recommend necessary corrective measures if contamination is present.

3. Remedial Measures The study identifies corrective actions to control and mitigate contamination.

The IAS was completed for NOS by Fred C. Hart Associates Inc. (FCH) and a report was submitted to the Navy in May 1983. The IAS contains background information on the chemicals which were known to have been stored or disposed of at NOS, or where such activity was suspected to have occurred. Thirty-eight sites were identified in the IAS report. The IAS provides a

ranking of these sites based on the available information and any potential hazard to human health and the environment. On the basis of this ranking, three sites were selected by the Navy for the Confirmation Study. The IAS was submitted to the Maryland Department of Health and Mental Hygiene (MDHMH) and the U.S. Environmental Protection Agency (USEPA).

The Confirmation Study was completed for NOS by CH2M Hill and a report was submitted to the Navy in September 1985. The Confirmation Study consisted of investigations at three sites at NOS. Based on the results of the Confirmation Study at these three sites and a review of the Confirmation Study report by MDHMH and USEPA, one site was selected for remedial measures under NACIP.

On February 23, 1987, E.C. Jordan Co. (Jordan) was authorized by the Department of the Navy through its contractor, Martin Marietta Energy Systems Inc, at Oak Ridge National Laboratory (ORNL), to conduct a feasibility study/remedial design at NOS. In addition, the Navy has contracted the U.S. Fish and Wildlife Service to conduct a 5-year biota study of Mattawoman Creek and the Potomac River in the area. As data from this study becomes available it will be evaluated as part of the feasibility study.

1.2 Purpose and Scope

Existing evidence suggests that mercury contamination from Site 8, the Nitroglycerin Plant Office Laboratory (Bldg. 766), may be migrating in the surface water and sediment of a small stream to a tidal pond downgradient of the laboratory and potentially into Mattawoman Creek and the Potomac River, thereby posing a potential threat to human health and the environment.

The purpose of this project is to complete the understanding of the physical environment and assess the distribution, migration and fate of mercury in sediment and surface water for use in conducting a feasibility study. Based on the results of these additional investigations and the previous data, an environmental evaluation of alternatives will be conducted and a Feasibility Study Report (FSR) and Remedial Design prepared.

This Work Plan describes the scope of work and methodology which will be employed by Jordan to conduct additional on-site investigations at Site 8 and to prepare the Feasibility Study. The scope of work for this project includes the following ten tasks:

Task 1	Work Plan Preparation
Task 2	Supplemental Site Characterization
Task 3A	Screen Control Measures
Task 3B	Develop Detailed Alternatives
Task 3C	Evaluate Detailed Alternatives
Task 4	Describe Selected Alternatives
Task 5	Prepare Environmental Evaluation of Alternatives
Task 6	Prepare Preliminary Draft Feasibility Study Report
Task 7	Prepare Draft Feasibility Study Report
Task 8	Prepare Final Feasibility Study Report
Task 9	Prepare Final Plans and Specifications
Task 10	Project Coordination and Management

It is intended that the work described in this Work Plan will be in compliance with CERCLA, SARA and RCRA regulations where applicable. The NACIP program parallels the CERCLA program conducted by the USEPA. Because of the impact of SARA on CERCLA, the USEPA guidance documents, Guidance on Remedial Investigations under CERCLA (EPA, 1985), shall be considered during the implementation of this Work Plan.

1.3 Project Logistics

This section describes the logistics of on-site field work to be carried out at NOS Indian Head. A meeting will be held at NOS prior to the start of on-site activities involving representatives from security, public works, engineering, safety, the station hospital and the fire department to discuss the logistics and requirements for conducting on-site investigations. A partial list of the items to be discussed at this logistics meeting include:

- security arrangements for access to the NOS in general and restricted areas where investigation is planned;
- communications while on base and major points of contact for daily progress reporting, scheduling and in case of emergency;
- procedures and personnel involved in the clearance of utilities at sediment sampling locations;
- location of a source of potable water, phone and electricity convenient to the site to be investigated; and
- the location and availability of base medical treatment facilities in case of an accident or personnel injury.

This logistics meeting will be held prior to any on-site investigative activities.

2.0 TECHNICAL APPROACH AND TASKS

This Work Plan has been developed based on Jordan's review of the Initial Assessment Study Report for NOS Indian Head; a review of the Confirmation Study Report; a review of the Statement of Work for the Feasibility Study Work Plan; a review of available background information; a site reconnaissance conducted by Jordan; and discussions with U.S. Navy officials and ORNL personnel.

2.1 Background Information

NOS Indian Head covers 3423 acres and is bounded by the Potomac River, Mattawoman Creek, Chicamuxen Creek, the town of Indian Head, and private property. It is situated in the northwestern section of Charles County, Maryland, 25 miles southwest of Washington, D.C. Figure 1 shows the location of the Naval Ordnance Station.

The mission of NOS is to provide material and technical support for assigned weapons systems, weapons, or components and to perform additional tasks as directed by the Naval Sea Systems Command. These tasks may include research, development, engineering, production, and quality surveillance for weapons systems, propulsion, unconventional explosives, cartridge-actuated and propellant-actuated devices, and chemicals. Disciplines represented at NOS include expertise in weapons systems, propulsion, explosives development, and propellant and explosives chemistry.

NOS hosts two major tenants: the Naval Explosive Ordnance Disposal Technology Center (NEODTC) and the Naval School, Explosive Ordnance Disposal (NSEOD). NEODTC was established to develop procedures for rendering safe conventional and special weapons, guided missiles, biological and chemical munitions, tools, and equipment. The mission of NSEOD is to train officers and enlisted personnel in methods and procedures for recovery, evaluation, rendering safe, and disposal of surface, underwater, conventional, and nuclear explosive ordnance.

Mercury is used as a catalyst at NOS to perform a purity analysis of nitroglycerin. The nitrate-ester analysis is conducted at a laboratory in the Nitroglycerin (NG) Plant Laboratory Office (Building 766). Accidentally, droplets of waste mercury were disposed of down the sink and floor drains in the laboratory which lead to a small stream. For over 20 years prior to 1981 small amounts of mercury used in laboratory tests in Building 766 had been discharged into a storm drainage manhole outside the building and then into the open stream in this manner. The floor drain has been sealed off and these practices have been discontinued. The stream flows across 0.75 miles of Navy property into a tidal pond and then into Mattawoman Creek. The drainage has a total relief of 36 feet and discharges into a tidally influenced area of Mattawoman Creek. This ditch and tidal pond comprise Site 8, the location of which is presented on Figure 2.

Sediment samples collected during the Confirmation Study from the stream just below the manhole contained mercury concentrations as high as 1,100 mg/kg. Lower concentrations were found in sediments as far as 2,500 feet down

N

SCALE IN MILES

0 25 50

LOCATION OF NOS INDIAN HEAD

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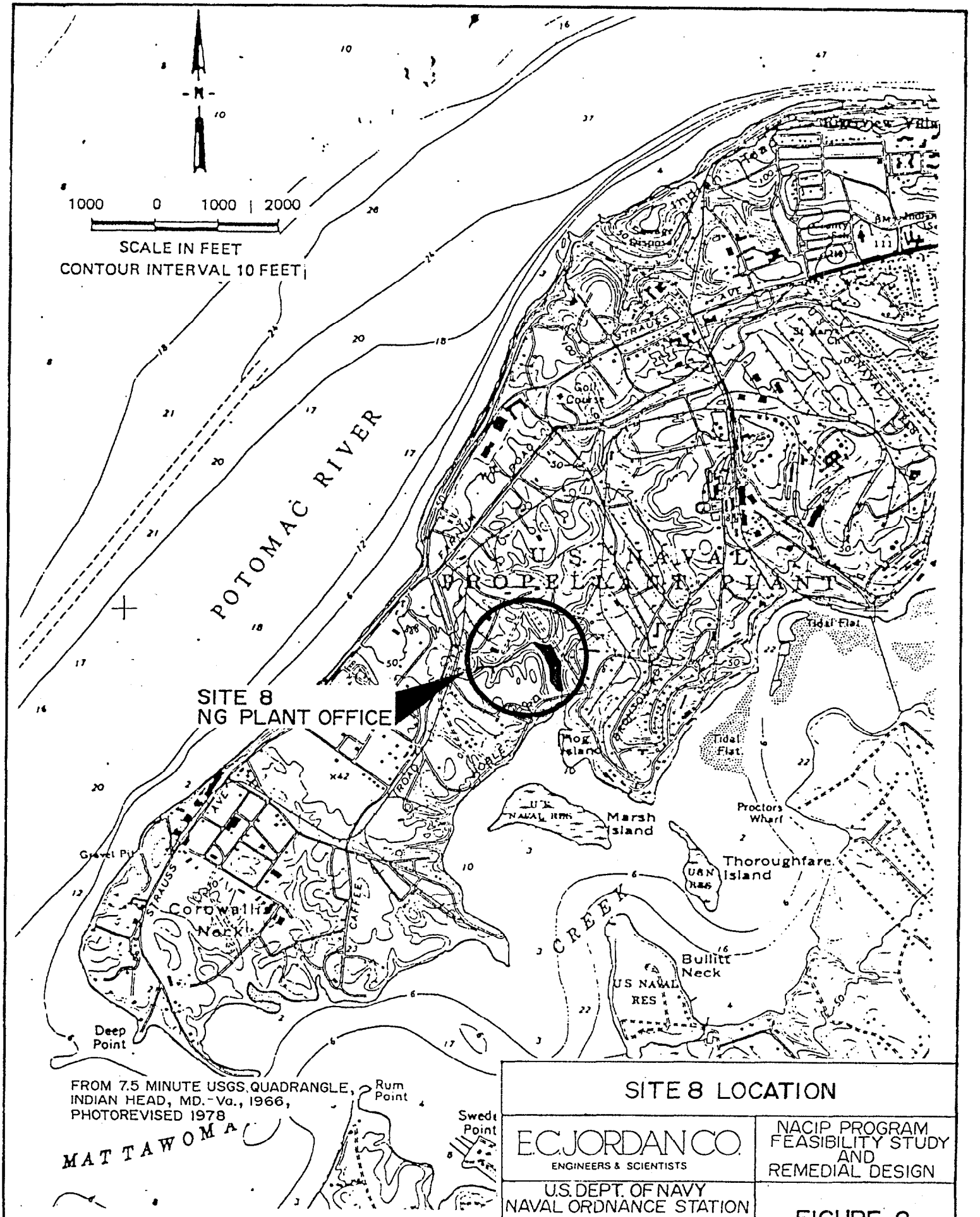
NACIP PROGRAM FEASIBILITY STUDY AND REMEDIAL DESIGN

U.S. DEPT. OF NAVY
NAVAL ORDNANCE STATION
INDIAN HEAD, MARYLAND

FIGURE 1



SITE 8 LOCATION

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NACIP PROGRAM
FEASIBILITY STUDY
AND
REMEDIAL DESIGN

U.S. DEPT. OF NAVY
NAVAL ORDNANCE STATION
INDIAN HEAD, MARYLAND

FIGURE 2

gradient from the NG Plant Laboratory Office. Concentrations in sediments at the outfall into Mattawoman Creek (3.5 mg/kg) were still above background levels (0.45-1.5 mg/kg). Seven water samples from within the creek also revealed elevated total mercury concentrations, up to 0.17 mg/l. Of the seven water samples collected in January 1984 the three from the stream exceeded the drinking water limit of 0.002 mg/l; the remaining four samples collected from tidal pond were below the drinking water limit. These water samples were all collected during cold water conditions (January 1984).

Estimates from the Confirmation Study suggest that 200 to 500 pounds of mercury may reside in the soils along the drainage area and in sediments of the stream and pond. The study also suggested that the pond probably traps much of the sediment from the drainage and that more than 95 percent of the mercury at Site 8 is located in the pond.

2.2 Task 1 - Work Plan Preparation

In response to Task Order Authorization No. X-09 and the Statement of Work, this Work Plan was developed. Based upon review of the IAS and the Confirmation Study, and after discussions at the initial meeting, E.C. Jordan has identified the need for additional site investigations to support the feasibility study preparation. The following sections of the Work Plan detail the supplemental site investigation activities with supporting technical rationale, and describe the feasibility study and remedial design process.

These supplemental investigations will include sediment and surface water sampling, a ground-penetrating radar survey, stream gauging, surveying and laboratory chemical analysis. The additional investigative activities are for the purposes of further assessing the distribution of mercury contamination in the stream and the tidal pond; estimating the volume of contaminated soil and sediment; determining the concentration and volume of dissolved mercury in the pond discharge into Mattawoman Creek; and obtaining physical, chemical and engineering data to support the description and evaluation of remedial alternatives.

The investigation Work Plan includes all specifications for sampling methods, analytical parameters, and analytical methods. The specifications of this Work Plan will comply with applicable federal, state, and local environmental regulations and include:

1. the number and types of samples to be collected;
2. proposed locations for sampling stations and sampling frequency;
3. sampling parameters and methods for collection of each sample type;
4. field data collection and data management plans; and
5. a schedule for completion of site investigation activities.

In addition, all sampling methods, sample storage/preservation procedures and laboratory handling protocol will comply with Sampling and chemical analysis Quality Assurance Guide for Navy Assessment and Control of Installation Pollutants (NACIP) Program, NEESA 20.2-047A June 1986.

In accordance with this guidance document, a laboratory Work Plan will be developed by Jordan and approved by the Naval Energy and Environmental Support Activity (NEESA) through ORNL's quality assurance coordinator, Mitzi Miller, prior to the initiation of the supplemental site investigation.

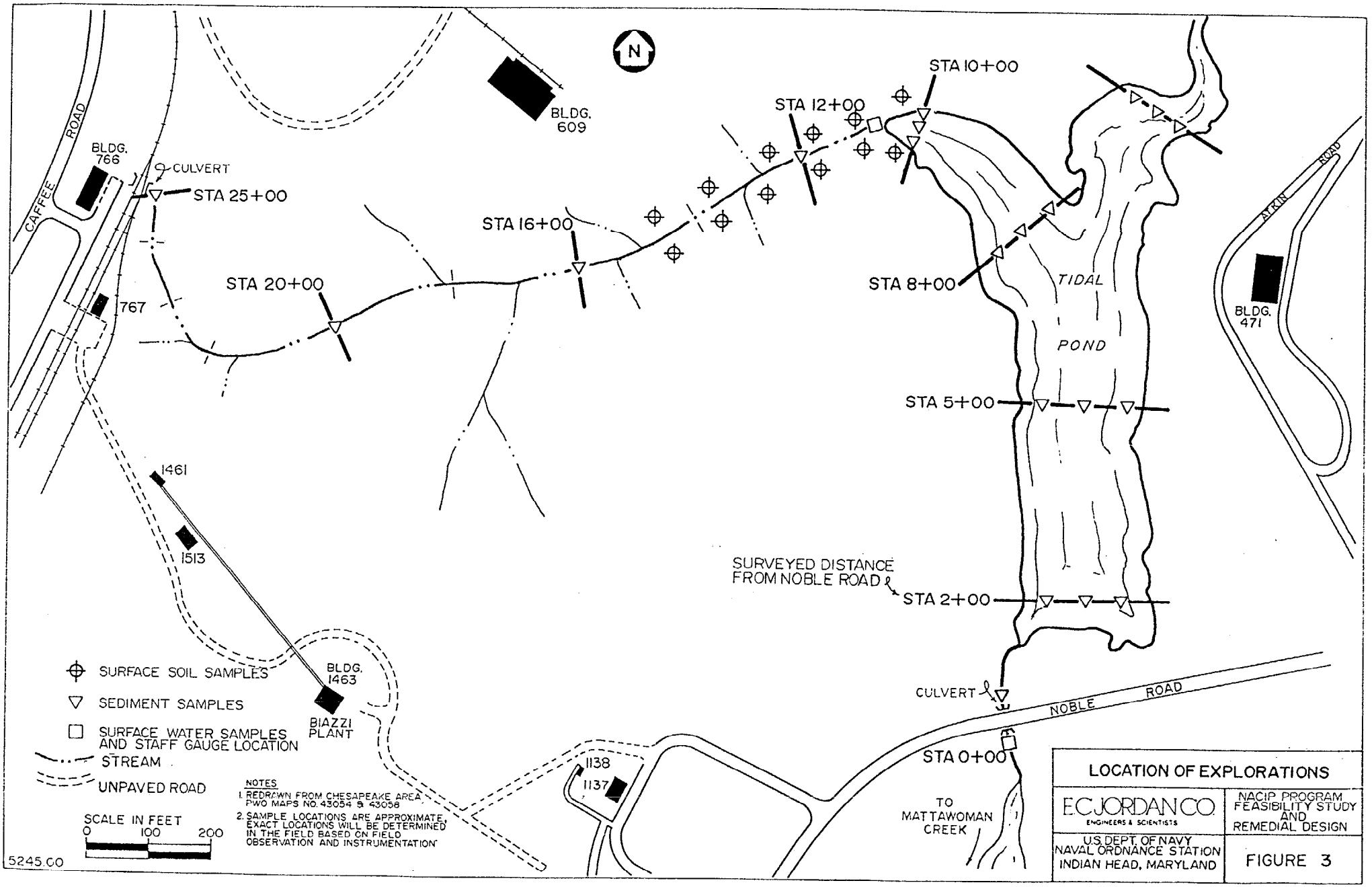
2.3 Task 2 - Supplemental Site Characterization

Figure 3 presents a vicinity map of the drainage and tidal pond downstream of Site No. 8. The pond receives drainage from another tributary stream and then discharges into Mattawoman Creek through a culvert under Noble Road. The pond is tidally influenced, but the culvert invert controls the lower limit of the pond elevation. There are two areas in which additional data are needed in order to adequately perform the feasibility study; hydrologic data about the drainage basin and the pond and additional chemical data on mercury "floodplain" concentration and distribution in floodplain surface soils, sediment and surface water. These data are required for the evaluation of water treatment; stream diversion; sediment removal; and in situ fixation remedial technologies as well as the no-action alternative. The investigation to gather the hydrologic data consists of the following work items:

- field investigations to determine widths and slopes of each section of the stream;
- assess water and sediment depth at several locations in the tidal pond and stream;
- monitor average and maximum flow rates through the culvert under Noble Road, on both rising and falling tides;
- establish staff gauges at the head of the tidal pond where inlets of the northwest and northeast tributaries drain into it and at the culvert under Noble Road;

The investigation to gather the additional chemical data consists of the following work items:

- collect two rounds of surface water samples at the three staff gauge locations mentioned above;
- collect 12 surface soil samples in the floodplain area adjacent to the stream;
- collect 90 sediment samples from the stream and tidal pond;
- measure field pH, oxidation and reduction potential (Eh), dissolved oxygen (DO), temperature and specific conductance of surface water at sampling points;
- analyze surface water samples for total and dissolved mercury concentration and total suspended solids;
- analyze surface soil and sediment samples for total mercury concentrations;
- analyze ten percent of the surface soil and sediment samples for EP Toxicity.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STA 10+00
STA 12+00
STA 16+00
STA 20+00
STA 25+00
CULVERT
BLDG. 766
CAFFEE ROAD
767
STA 8+00
TIDAL
POND
BLDG. 471
AIKIN ROAD
STA 5+00
1461
1513
SURVEYED DISTANCE FROM NOBLE ROAD
STA 2+00
BLDG. 1463
BIAZZI PLANT
CULVERT
NOBLE ROAD
STA 0+00
1138
1137
TO MATTAWOMAN CREEK
SURFACE SOIL SAMPLES
SEDIMENT SAMPLES
SURFACE WATER SAMPLES AND STAFF GAUGE LOCATION
STREAM
UNPAVED ROAD
SCALE IN FEET
0 100 200
NOTES
1. REDRAWN FROM CHESAPEAKE AREA PWO MAPS NO. 43054 & 43058
2. SAMPLE LOCATIONS ARE APPROXIMATE, EXACT LOCATIONS WILL BE DETERMINED IN THE FIELD BASED ON FIELD OBSERVATION AND INSTRUMENTATION
5245.00
LOCATION OF EXPLORATIONS
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NAVAL ORDNANCE STATION
INDIAN HEAD, MARYLAND
FIGURE 3

A detailed description of the methods and rationale for each work item is presented in the following sections for the hydrologic and chemical data gathering investigations.

Hydrologic Data. The rationale for the hydrologic data gathering is to determine the length, area, and volume of mercury-contaminated sediments and to determine variations in surface water discharge from the pond into Mattawoman Creek. The data are needed to adequately evaluate several remedial technologies including water treatment.

The vertical extent of the sediments in the pond will be determined first by means of a ground-penetrating radar (GPR) survey to delineate sediment thickness. In order for the GPR survey to be successful the sediments must have a conductivity of less than 8 mmhos/cm. The sediments will be measured for conductivity prior to any field investigation and if the conductivity measured in the sediments is higher than 8 mmhos/cm then the assessment of sediment thickness will be conducted by coring during sediment sampling. The thickness of sediments in the stream bottom will be measured by coring and direct measurement.

To provide horizontal and vertical control during the investigations the tidal pond and stream will be surveyed in 50 foot stations from the Noble Road culvert to building 766. This survey will aid in the calculation of the volume of sediments as well as the distribution of mercury in sediments. During this survey the widths and slopes of each 50 foot section of the stream will be measured.

Staff gauges will be place at the tributary inlets to the tidal pond and at the culvert beneath Noble Road in order to calculate flows into and out of the tidal pond. In addition, a V-notch weir will be placed in the culvert beneath Noble Road to measure average and maximum flow rates through the culvert on both rising and falling tides.

Chemical Data. The rationale for collecting additional chemical data is as follows:

- detect mercury contamination "hotspots" in sediment and floodplain surface soils and accurately calculate volumes of soils and sediments for evaluation of removal or in situ fixation remedial technologies.

- characterize presence and type (dissolved or absorbed onto suspended sediment) of mercury contamination in surface water to evaluate mercury migration and water treatment as a remedial alternative.

The distribution of mercury contamination will be accomplished by means of core samples collected at five additional locations in the stream and core samples collected at five cross sections in the pond. Figure 3 presents the sediment core sampling locations. Sediment sampling is planned in the tidal pond across five transects having three stations each. At each station, five 1-foot vertical sampling intervals to a depth of approximately 5 feet will be collected for a total of 75 samples. At five locations in the stream, samples

will be collected at 3 vertical intervals approximately 3 feet in depth, for a total of 15 samples. Additionally, one sediment sample at the northeast inlet stream of the tidal pond and 10 duplicate quality control samples will be collected for a total of 101 sediment samples. The sediment samples will be submitted for laboratory chemical analysis.

Each transect in the pond will be sampled at the midpoint of the pond and half way between the midpoint and the shore on each side. The sampling will be accomplished either by hand-coring tubes or, if needed, by use of a vibra-core device. The sediment cores will be composited in 1-foot increments and the maximum sample depth is anticipated to be 5 feet. Sediment samples will be collected in 4-ounce glass jars (I-CHEM) and preserved at 4 degrees centigrade from the time of sample collection to laboratory chemical analysis. Sampling documentation will include sample location report, analytical request form and chain-of-custody. This documentation will be completed in the field as samples are collected and will accompany the samples to the laboratory. Additionally, sampling and samples will be documented with photographs. For more detailed sample handling information refer to Jordan's QAPP (Appendix B).

Surface soil samples will be collected at 12 locations in the floodplain adjacent to the stream immediately upgradient from the tidal pond. Approximate locations of the soil samples are presented on Figure 3. The rationale for this sampling is as follows.

During the recent past, beavers dammed up the culvert beneath Noble Road and caused the tidal pond level to rise a few feet. This resulted in the area adjacent to the stream immediately upgradient of the pond to rise over its banks and flood the area. It is suspected that in this area mercury contaminated sediment may have been deposited by the high waters. The surface soil sampling is being conducted to characterize the presence and distribution of mercury in surface soils in the floodplain area.

Surface soil samples will be collected using a stainless steel auger and/or sampling spoons. The samples will be placed in 4-ounce glass jars (I-CHEM) and preserved at 4 degrees centigrade from the time of sample collection to laboratory chemical analysis. Sampling documentation will include a sample location report, analytical request form and chain-of-custody. This documentation will be completed in the field as samples are collected and will accompany the samples to the laboratory. Additionally, sampling and samples will be documented with photographs. For more detailed sample handling information refer to Jordan's Quality Assurance Project Plan (Appendix B).

Surface water data on total mercury concentrations have been gathered on a quarterly basis by NOS since November 1985 at 8 locations in the stream and tidal pond. This data in addition to that gathered during the NACIP Confirmation Study provides a data base adequate to preform a feasibility study. Additional surface water samples will be gathered from the two inlets to the tidal pond and the outlet culvert beneath Noble Road as presented on Figure 3. The purpose for these samples is to assess what portion of the mercury present in surface water is dissolve and what portion is present in the suspended sediments. Two rounds of surface water samples at these

locations will be conducted; one during a high flow period and one during a low flow period. The collection of both inflow and outflow samples will also indicate the amount of mercury concentration being contributed by sediments in the pond.

Surface water samples will be collected using a bottom-loading bailer to obtain a representative sample from the water column. Prior to taking a sample a Tri-Bar analyzer will be used to do pH, temperature and conductivity profiling to select the correct sampling depth in the water column. Surface water will be collected in 1-liter plastic bottles and preserved using nitric acid to lower the pH to less than 2.0. Surface water being analyzed for dissolved mercury instead of total mercury will be filtered to remove suspended sediment using a vacuum filtration unit and 0.45 um filter paper. Samples will then be stored at 4 degrees centigrade from sample collection to laboratory analysis. Sampling documentation will include sample location report, analytical request form and chain-of-custody. This documentation will be completed in the field as samples are collected and will accompany to samples the laboratory. Additionally, sampling will be documented with photographs. For more detailed sample handling information refer to Jordan's QAPP (Appendix B).

All sampling equipment used for surface water, sediment and surface soil sampling will be decontaminated between samples using soap and water, isopropyl alcohol and distilled water.

Laboratory chemical analysis will be conducted by CompuChem Laboratories Inc. in Research Triangle Park, North Carolina. Samples will be shipped by Federal Express. Sample handling procedures used by CompuChem are contained in the Laboratory Work Plan submitted by Jordan and CompuChem to ORNL and NEESA. A summary of chemical analysis is presented on Table 1 and laboratory analytical procedures and detection limits are present on Table 2.

At the completion of field investigations and laboratory chemical analyses, E.C. Jordan will submit 15 copies of a draft report containing a summary of the results of the Supplemental Site Characterization. This will be a letter-type report and will summarize the findings with an interpretation of their significance to the Feasibility Study/Remedial Design. Any comments received from CHESDIV or ORNL concerning the draft report will be addressed when this report is incorporated into the FSR as described below.

2.4 Task 3 - Screen, Develop, and Evaluate Control Measures

Within 8 weeks of delivery of the report detailing the results of Supplemental Site Investigation, E.C. Jordan will submit 15 copies of an interim Alternatives Evaluation Report which examines and compares remedial action options and makes recommendations on the most appropriate alternatives(s) for Site 8 at NOS. In preparing this report, Jordan will complete the following subtasks.

2.4.1 Task 3A Screen Control Measures

Feasible control measures, including management methods and technologies relevant to remediating the Site No. 8 problem identified in the Confirmation Study and Supplemental Site Characterization, will be screened on the basis of feasibility, cost, and environmental and public health impacts. This will reduce the number of control measures to be considered for the development and

TABLE 1

SUMMARY OF CHEMICAL ANALYSIS
NACIP FEASIBILITY STUDY/REMEDIAL DESIGN
NAVAL ORDNANCE STATION
INDIAN HEAD, MARYLAND

SAMPLE SOURCE	MEDIA	TOTAL Hg	DISSOLVED Hg	EPTOX(metals)	TSS[1]	DO[2]	pH	COND[3]	Eh[4]
SITE 8	SEDIMENT	91	—	10	—	—	—	—	—
	SURFACE SOIL	12	—	3	—	—	—	—	—
	SURFACE WATER	6	6	—	6	6	6	6	6
SUBTOTAL	SEDIMENT/SOIL	103	—	13	—	—	—	—	—
	SURFACE WATER	6	6	—	6	6	6	6	6
COMPUCHEM DUPLICATES	SEDIMENT/SOIL	11	—	2	—	—	—	—	—
	SURFACE WATER	1	1	—	1	1	1	1	1
SAMPLER BLANKS	SURFACE WATER	1	1	—	1	1	1	1	1
TRIP BLANKS	SURFACE WATER	1	1	—	1	1	1	1	1
TOTAL	SEDIMENT/SOIL	114	—	15	—	—	—	—	—
	SURFACE WATER	9	9	—	9	9	9	9	9

1. TSS - Total Suspended Solids
2. DO - Dissolved Oxygen
3. COND - Conductance
4. eH - Oxidation and Reduction Potential

TABLE 2

LABORATORY ANALYTICAL PROCEDURES
NAVAL ORDNANCE STATION
INDIAN HEAD, MARYLAND

MEDIA	PARAMETER	METHOD	REFERENCE	DETECTION LIMIT
SOIL/ SEDIMENT	TOTAL Hg	AA/COLD VAPOR	EPA METHOD 245.5	0.2 ug/g
	EPTOX (metals)	AA/GC	SW-846[1]	--
	Eh	PLATIMUM ELECTODE	--	--
SURFACE WATER	TOTAL/DISSOLVED Hg	AA/COLD VAPOR	EPA METHOD 245.1	0.2 ug/1
	TOTAL SUSPENDED SOLIDS	DRIED FILTRATE	STANDARDS METHOD 15TH EDITION-2090	--
	DISSOLVED OXYGEN	MEMBRANE ELECTRODE	EPA METHOD 360.1	--
	pH	POTENTIOMETRIC	EPA METHOD 150.1	--
	CONDUCTANCE	CONDUCTANCE	EPA METHOD 120.1	--
	Eh	PLATIMUM ELECTODE	--	--

1. Extraction by EPA Method 1310

review of detailed alternatives. Control methods will not be eliminated solely because of an inability to meet standards, because they may be used in conjunction with other control measures.

Because a screening of alternatives was completed as part of the Confirmation Study, Jordan will take full advantage of the work done previously to reduce duplication of effort. One alternative of particular interest to the Navy and State of Maryland for consideration at NOS is in situ treatment.

The initial screening of management methods and control technologies for Site 8 will focus on the four technical activities described in Section 2.4.3. The interim Alternatives Evaluation Report will identify control measures that passed the initial screening process as well as the rationale used for selecting or eliminating candidate control measures. If conditions warrant such actions, the report will also identify any control measures that should be immediately implemented through Emergency Response or Removal Procedures, pending completion of the FSR and final design.

Establish Cleanup Goals. Cleanup goals or response objectives will represent quantitative measurements of effectiveness for remedial action alternatives for Site 8. Applicable Federal and State ambient standards (such as Maximum Contaminant Levels for drinking water) will be identified to permit a comparison of projected environmental concentrations to appropriate standards or criteria. Target environmental concentrations (acceptable residual mercury levels) will be developed for sediments and waters on the site. The methodology for developing target environmental concentrations will be similar to that described on the USEPA Superfund Public Health Evaluation Manual (October 1986). It is not the objective of this Task to provide the scope and detail described in this manual for a formal and comprehensive public health evaluation.

The establishment of appropriate cleanup goals can be the most important decision made about an uncontrolled waste site. These goals will strongly influence the necessity for the cleanup, the scope and the cost of the selected remedial action, and the sequence and type of unit operations which should be considered. Attainment of these goals will indicate that acceptable environmental and health impacts have been achieved.

Identification of Applicable Control Measures. Remedial alternatives will be developed from specific technologies which are applicable to the conditions at the site. Potential remedial technologies will be divided into the following categories:

- waste removal actions (e.g., excavation);
- in situ treatment (e.g., solidification in place);
- waste containment actions (e.g., bottom sealing of the ditch and/or wetland, water treatment of culvert outflow, sediment detention basins);
- impact avoidance actions (e.g., posting and fencing);

- no action; and

- long-term monitoring.

For Site 8, remedial technologies from each of these categories may be applicable, either individually or in combination. This listing includes all the categories evaluated in the Confirmation Study. Other approaches may be considered as well.

Screening of Control Measures. The objective of initial screening is to reduce the number of technologies that will be involved in the development of alternatives. Cost, acceptability of engineering practices (feasibility and implementability), and environmental and public health impact will be considered in conducting the initial screening.

2.4.2 Task 3B - Develop Detailed Alternatives

Detailed alternatives will be developed from the control measures that passed the screening process. The "no action" alternative will be developed as well.

Detailed alternatives will be developed by integration and sequencing of the selected control technologies screened as part of Task 3A. It will be necessary to develop preliminary design data and operational requirements for each alternative in sufficient site-specific detail to allow comparative evaluation based on the evaluation criteria identified in Task 3C. The presentation of each alternative for consideration will include the following:

- description of the alternative in terms of the technology or combination of technologies utilized;

- summary of additional data requirements, if needed;

- cost data, including estimates of capital cost and operation and maintenance (O&M) costs, and results from a present-worth analysis; (where appropriate, Jordan will also provide sensitivity analysis for costs);

- measures needed to ensure worker safety during implementation; and

- identification of management processes incorporated into the control measures, such as land use controls, personnel training and supervision, and coordination with Federal, State, and local agencies.

The description of technologies incorporated in each alternative will include the following:

- key design assumptions that will affect performance, implementability, environmental impact, or cost;

- a narrative summary of the alternative which will describe the chemical and physical processes involved as well as the general advantages and disadvantages of the technology.

The "no action" alternative will also be included on the developed list of alternatives. If additional technology performance, installation requirements, or other information is required during the alternatives development process, ORNL will be notified and will assist in evaluating the needs of the project. For example, pilot testing is assumed to be unnecessary at this time. Should such testing later prove to be necessary, schedules and budgets will be re-evaluated with ORNL and CHESDIV.

2.4.3 Task 3C - Evaluate Detailed Alternatives

The objective of this task is to evaluate and determine the cost-effectiveness of the limited number of remedial alternatives identified in Task 3B. A record of the evaluation process will be generated in the form of an annotated tabular summary which presents the major conclusions of these evaluations. The evaluation process will be carried out and presented in three main steps.

Description of Evaluation Criteria. Definitions of the evaluation parameters are presented in Table 1.

Effectiveness Analysis. An effectiveness analysis will consist of a qualitative evaluation of site applicability using the non-cost factors described in Sections A, C, D, and E in Table 3. This analysis, based on the field data, will describe the transport of mercury, especially at the Noble Road culvert, and will also, where appropriate, be a component part of the environmental assessment conducted in Task 5.

Under a "no action" scenario, the effectiveness analysis will describe the level, duration, and significance of impacts on receptors if the site were to remain in its present condition. The effectiveness of remedial alternatives in reducing concentration levels at receptors can be estimated by inputting relevant source and concentration data for the remedial alternatives into the model. This information will be complemented with estimates of the value of uses of land, air, water, and biotic resources likely to be contaminated so as to complete the determination of acceptability of the "no action" response.

Cost Evaluation. The detailed cost estimate of each alternative will include construction and operating costs. These costs will be expressed as a total cost of implementation and the present worth of operating costs over the period that the alternative must be operated. In addition to interest and inflation rate variations, the cost assessment will include an analysis of the sensitivity of cost to the degree or level of implementation of an alternative. For example, the cost of excavating 50 percent of the contaminated soils at the site will be compared to the cost of excavating 90 or 100 percent of the contaminants. Due to variances in contaminant concentrations, the cost is generally not directly proportional to the degree of implementation. For example, 50 percent of the contaminants may be removed in 3,000 cubic yards of sediment, but the next 40 percent of the contaminants may be diluted in 5,000 cubic yards of sediment. Cost estimates will be prepared using data from Jordan's project files, EPA technical reports, quotations from equipment vendors, and Jordan's estimators. Major uncertainties in costs will be discussed and recommendations for corrective measures, will be made if possible.

TABLE 3
DEFINITION OF EVALUATION CRITERIA
NOS INDIAN HEAD

PARAMETER	DESCRIPTION
A. Engineering Feasibility	
Performance:	ability to meet intended function and applicability to site conditions.
Reliability:	complexity and frequency of maintenance; demonstrated field use and ability to prevent future problems associated with waste disposal.
Implementability:	complexity of construction and operation for conditions at site; time to install and operate.
B. Cost Analysis	
Cost Types:	capital costs; operational and maintenance (O&M) costs.
Analysis:	best estimates of present worth as a function of interest rate and inflation rate variations and the cost of critical operating components.
C. Public Health Analysis	
Short-term Impacts:	assess potential short-term health effects of the remedial alternatives to the surrounding community and environment to determine appropriate management practices during and following implementation of the remedial action.
Long-term Impacts:	assess long-term potential impacts associated with the selected alternatives and the predicted environmental concentrations that would result from their implementation.
Worker Health Impacts	potential risks to workers and public resulting from site activities and transport of waste.
	(The public health analysis will be done using the U.S. Environmental Protection Agency Superfund Public Health Evaluation Manual as a guide).
D. Environmental Assessment	
Each Detailed Alternative	determination of the value of present and future uses of land, air and biotic resources (e.g., evaluation of the land, air or biotic resources which would no longer be suitable for its current or future use); identification and quantification of environmental impacts; assessment assessment of impact.
E. Regulatory Requirements	
Permitting:	number of permits required; additional information and study requirements; time. Action in wetlands especially sensitive.
Compliance:	ability to comply with regulatory requirements established on the local, state, or federal level such as RCRA, HSWA, CERCLA, or SARA.

Presentation of Results. The interim Evaluation of Alternatives Report will discuss the relative technical advantages and disadvantages of each alternative, as well as a summary of the cost analysis. This report will also include a recommended remedial action alternative (or a combination of alternatives) which is most-favored for the site. This alternative will be the one which is considered to be the most effective; that is, one which is technically acceptable, adequately protects public health and the environment, and meets regulatory requirements at the lower cost. Fifteen copies of this report will be provided to the ORNL Project Manager. A project meeting for the purpose of reviewing the Task 3C Report and obtaining concurrence of the Navy, ORNL, and regulatory agencies on the recommended remedial action will be held at NOS 2 weeks after delivery of the report.

2.5 Task 4 - Describe Selected Alternative

Once a remedial action has been selected for implementation at the site, a narrative description with appropriate illustrations and drawings will be developed for presentation. The selected alternative will be described in sufficient detail to provide the rationale for the selected alternative, including the following information:

- Engineering Description:
  - conceptual design criteria and rationale;
  - operational description of process units or other facilities;
  - description of operation and maintenance requirements;
  - types of equipment required, including approximate capacity, size, and construction materials;
  - list of additional engineering data required to proceed with design;
  - preliminary project schedule; and
  - conceptual map showing general locations for project actions and facilities.
- Cost Analysis:
  - best estimates of present worth;
  - capital cost estimates; and
  - operation and maintenance cost estimates (including replacement costs) and duration of operation expenses.
- Regulatory Compliance:
  - construction and operational permit requirements;
  - description of technical requirements for environmental mitigation measures (e.g., identification and description of processes reviewed to alleviate unacceptable impact);
  - operating permit requirements; and
  - right-of-way and other access-related requirements.

The description will be sufficiently detailed to be used as a baseline (35 percent design) document for design and construction of the selected remedial alternative. The descriptions will be submitted as Task Report No. 4 These descriptions and the Task Evaluation will be incorporated into the Preliminary Draft FSR, which is due 4 weeks after the alternative selection.

2.6 Task 5 - Prepare Environmental Evaluation of Alternatives

The Environmental Evaluation of Alternatives will be done concurrently with Task 4 - Description of Selected Alternatives. The Environmental Evaluation of Alternatives will be presented in the Preliminary Draft FSR and will include:

- summary descriptions of detailed alternatives considered in Task 3C;
- environmental impact analyses of each alternative;
- references for all data cited in the studies or the actual data which supports the analyses; and
- descriptions of mitigating measures appropriate for each detailed alternative.

Particular attention will be given to the tidal areas on and near the site. Much of the data used in this assessment will be derived from the effectiveness analysis for each alternative described in Task 3C. The Preliminary Draft FSR, however, will provide a more formal and comprehensive presentation of this assessment.

The U.S. Fish and Wildlife Service is monitoring the nearby Mattawoman Creek biota for mercury. To the extent that information becomes available from this five-year monitoring program, which began recently, it will be included in this Environmental Evaluation. The primary value of this information will be in assessing present, or "no action", conditions.

2.7 Task 6 - Prepare Preliminary Draft Feasibility Study Report

Subsequent to the development and evaluation of alternatives, a Preliminary Draft FSR will be prepared. This report will include an introduction and reports from Tasks 2, 3, 4 and 5. A recommendation for the most appropriate remedial action(s) for the site and a detailed rationale for this decision will be prepared.

2.8 Task 7 - Prepare Draft Feasibility Study Report

The Draft FSR will include any revisions to the Preliminary FSR from ORNL. Such revisions are not expected to be extensive given the close coordination and frequent reviews up to this point in the project. The purpose of this draft is to prepare the necessary documentation for regulatory agencies. This report will be distributed to the regulatory agencies by CHESDIV. Within 4 weeks of delivery of this report, Jordan will attend a 1-day meeting at NOS to present the FSR and discuss regulatory comments.

2.9 Task 8 - Prepare Final Feasiblity Study Report

Following the presentation meeting, the Final FSR will be prepared and will include documentation of modifications to the Final Draft FSR in response to the regulatory agencies' comments. These revisions will be made after conferring with CHESDIV and ORNL.

2.10 Task 9 - Prepare Final Plans and Specifications

Jordan will provide Plans and Specifications in such form as to enable the Navy to procure a construction contract that will implement the selected remedy. Because that specific remedy is presently not known, we cannot be certain that a 4 week time period will be adequate or that the design package will be entirely suitable for Navy procurement practice without allowing for a comment phase. Jordan proposes to use its best efforts to provide the design documents as specified. The Plans and Specifications will include at a minimum the following:

- a narrative description of the work being specified;
- type and amount of equipment and materials needed;
- bid provisions for any differences between expected and actual material, equipment, or labor quantities;
- engineering drawings;
- amount and disposition of earth, sediments, or other materials moved during construction;
- permit requirements;
- health and safety requirements;
- location and disposition of excavated materials,
- project schedules; and
- format for bidder's cost proposals.

2.11 Task 10 - Project Coordination and Management

Project Coordination includes specific activities designated in the SOW. They are as follows:

- Monthly progress reports to the ORNL Project Manager, containing the following items:

  - summary of accomplishments;
  - significant findings;
  - problems encountered and steps taken to address problems;
  - estimated degree of completion of Tasks, Subtasks, and the Task Order;
  - manhours expended versus manhours scheduled to date for each Task
  - cost summary information; and
  - any changes in scope and their effect on cost and schedule.

  The monthly progress report will be compiled by the Task Order Manager on the basis of input from the Task Leaders and the Jordan accounting department. The two attachments to the RFP will be filled out monthly and accompany the progress reports.

- Documentation and distribution to the ORNL Project Manager of all significant meetings/interactions/telephone calls with personnel external to Jordan pertaining to the work at NOS;

  Generation and distribution of minutes of coordination/management/technical meetings to which Jordan is a party within 10 calendar days of the meeting; and

- Participation in a project initiation meeting at the NOS within 15 calendar days of "notice to proceed". This meeting will discuss logistical arrangements for completing the proposed work and the necessary technical, regulatory administrative or communication requirements for completion of field work and preparation of the FSR.

3.0 PROJECT MANAGEMENT

3.1 Management Approach

In undertaking the Indian Head NOS Feasibility Study/Remedial Design Task Order, Jordan will be responsible for management of the NACIP technical program with senior Jordan personnel filling the key roles of Corporate Officer, Program Manager, Task Order Manager, contracts/administration, quality assurance, and health and safety. The quality review board will be staffed by three senior Jordan staff members. For the purposes of technical management, the various tasks and subtasks of the NOS Task Order have been consolidated in two activities with each activity area assigned a technical leader. The technical leader for site characterization will be Tony Allen while Jay Johnson will supply the technical lead for Feasibility Study/Remedial Design.

Jordan will take a holistic approach to problem-solving at NOS. None of the tasks/subtasks are "stand alone" activities; instead, they are interrelated. Consequently, the results of one work assignment have the potential to affect other work elements. As such, the activity leaders will work closely with the Task Order Manager and each other to create an appropriate level of synergism.

3.2 Personnel

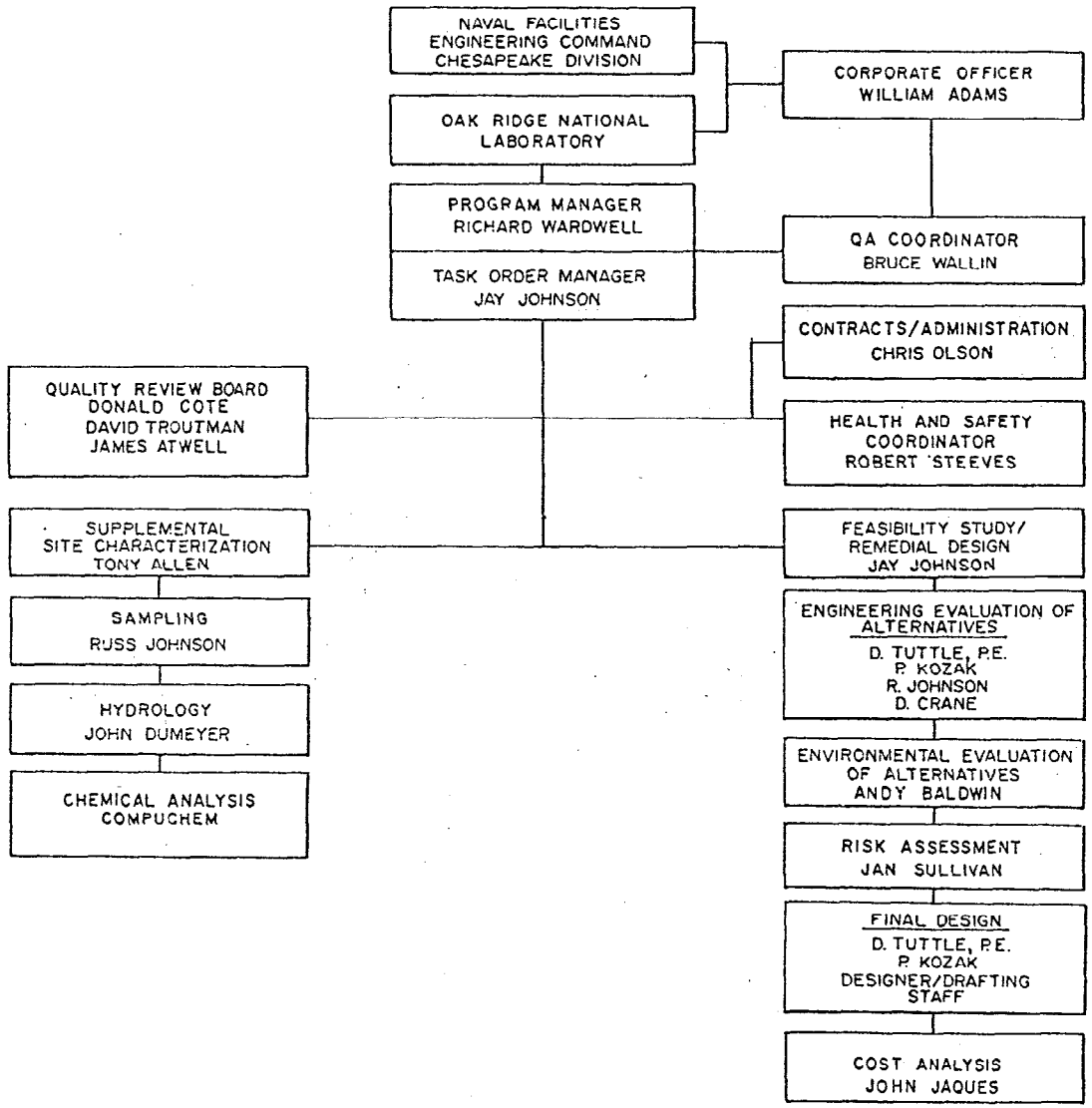
3.2.1 Key Personnel

The designated roles for the NACIP work at NOS are given below. The Task Order organization is shown on Figure 4.

- Corporate Officer. The Corporate Officer is William R. Adams, Jr., P.E., a vice president of Jordan. He is responsible for committing the corporate resources necessary to conduct the program work activities, for supplying corporate-level input for problem resolution, and for assisting the Program Manager and Task Order Manager as needed in project implementation.

- Program Manager. The Program Manager, Ritch Wardwell, is responsible for oversight and management of the overall multi-installation Navy NACIP program for the Northeast Region. In this position, Mr. Wardwell is able to perceive overall program needs, to promote technology and other information transfer between various NACIP projects, and to direct resources as appropriate for effective and timely completion of program activities.

- Task Order Manager. The Task Order Manager for Indian Head NOS Task Order will be Jay Johnson. He is responsible for evaluating the appropriateness and adequacy of the technical or engineering services provided for the NOS Task Order and in developing the technical approach and level of effort required to address each of the work plan tasks. He is also responsible for the day-to-day conduct of the work, including the integration of the input of supporting disciplines and subcontractors (i.e., field investigation and laboratory subcontractors). Mr. Johnson



E.C. JORDAN CO. ENGINEERS & SCIENTISTS	PROJECT ORGANIZATION CHART FEASIBILITY STUDY/REMEDIAL DESIGN
NACIP PROGRAM NAVAL ORDNANCE STATION INDIAN HEAD, MARYLAND	FIGURE 4

will be reviewing the ongoing quality control during performance of the work, and the technical integrity of conclusions and recommendations, and the clarity and usefulness of all project work products.

Some specific responsibilities of this role include:

- o overall technical responsibility for the project;
- o initiating project activities;
- o participating in the work plan preparation and staff assignments;
- o identifying and fulfilling equipment and other resource requirements;
- o monitoring task activities to ensure compliance with established budgets, schedules, and the scope of work; and
- o regularly interacting with the NACIP Management Team, the Corporate Officer and others, as appropriate, on the status of the project.

o Contracts and Administrative Manager. The staff-level position of Contracts and Administrative Manager is established because of the importance of day-to-day scope, schedule and budget monitoring for the NOS Task Order both within Jordan and between Jordan and the NACIP Management Team. It is expected that program decisions will be occurring frequently. Therefore, it is necessary to anticipate and immediately implement the administrative actions (initiate internal work orders, follow-up on support needs, amend subcontracts, track cost-charges) to carry out the program plans. To achieve maximum efficiency and insure timeliness of response, Chris Olson will also be responsible for these areas to Jordan through the Task Order Manager and will be the principal communication link to the client for these areas. Three specific task for which Mr.Olson will be responsible are the following:

- o established and overseeing all subcontracts for support services;
- o preparing monthly technical/management/cost progress reports; and
- o ensuring that appropriate financial record and reporting requirements are met.

o Quality Review Board. A Quality Review Board, made up of senior technical staff from the Jordan team, will assist the Task Order Manager by providing review of the technical aspects of the project to assure that the services reflect the accumulated experience of the firms, that they are produced in accordance with corporate policy, and meet the intended needs of the NACIP Management Team. The primary function of this board is to assure the application of technically sound methodologies and the development of litigation defensible data, interpretations and conclusions.

James S. Atwell, P.E., David E. Troutman and Donald R. Cote, P.E. will comprise the Jordan company members of the Quality Review Team and will take a very active involvement in all phases of the project, primarily the technical quality and appropriateness of the conclusions and recommendations of the Feasibility Study Report.

- Quality Assurance and Health and Safety Coordinator. The Task Order Manger is supported by a Quality Assurance Coordinator and a Health and Safety Coordinator. These staff-level positions will report to the Corporate Officer and the Task Order Manager, respectively. The Quality Assurance Coordinator will assure that appropriate NACIP,NEESA and EPA protocols are followed on the NOS Task Order and will be responsible for the development of the quality assurance plan. The coordinator also works with the Program Manager/Task Order Manager to assure that established quality control procedures are implemented. The Health and Safety Coordinator is responsible for assuring that NOS project team complies with the company's Health and Safety Plan when conducting site visits. He is responsible for seeing that the Health and Safety Plan is developed for the implementation of the selected alternative.

  Bruce Wallin of Jordan will serve as the QA Coordinator and Robert Steeves will serve as Health and Safety Coordinator for the Program respectively. On-site conformance with safety protocols will be insured by periodic site visits by Mr. Steeves and through day-to-day supervision by NOS Site Characterization Task Leaders.

3.2.2 Team Members

Other key line positions in the NOS Task Order are the technical activity leaders, i.e., senior and/or most-experienced individual in each technical area of the project. These technical activity leaders as shown on the Project Organization Chart are as follows:

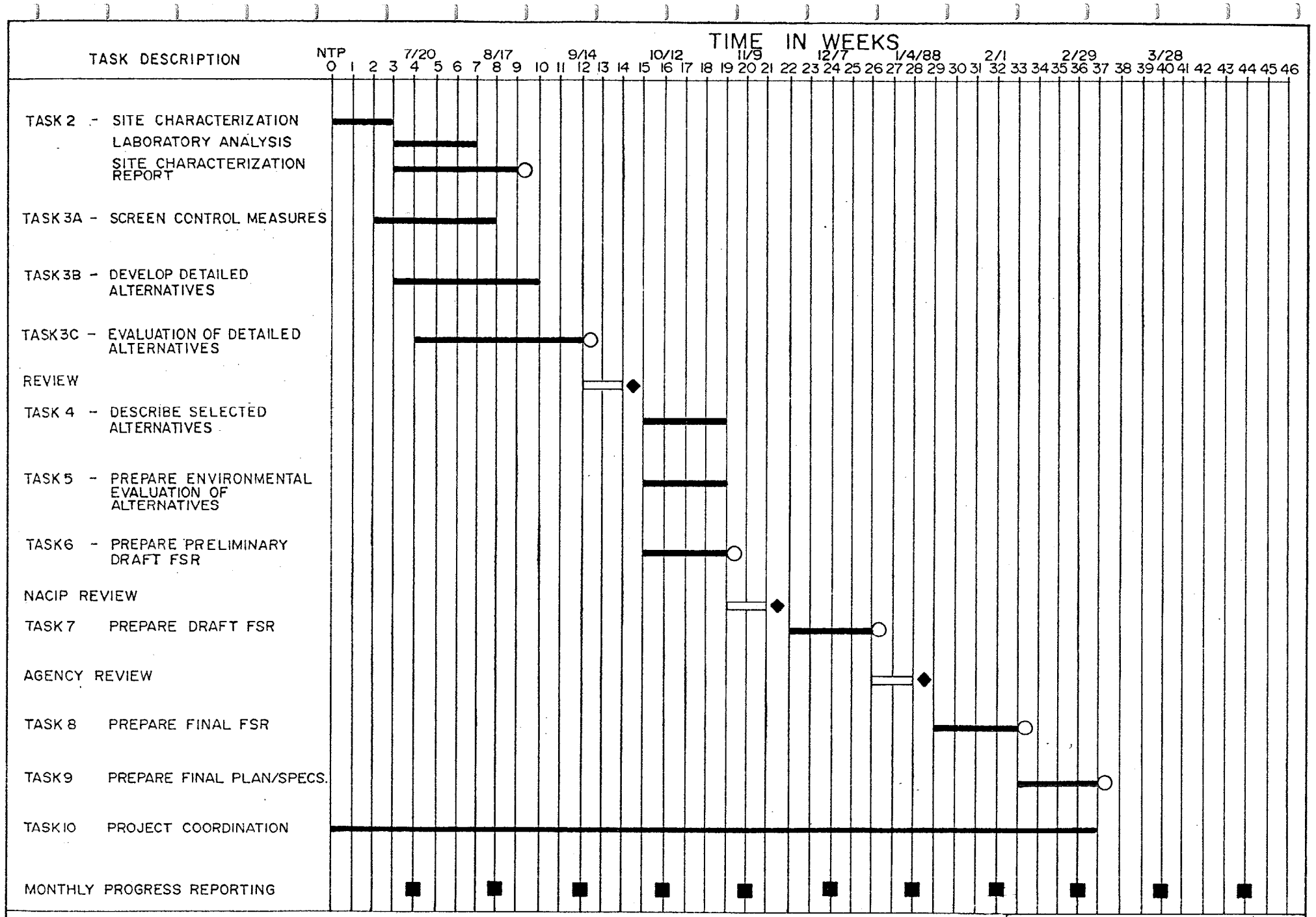
- Site Characterization. Tony Allen, Soil Chemist, will be the technical leader for all supplemental site characterization studies described in Task 2. As part of this, he will be responsible for the development of the Task 2 work plan.

- Feasibility Study/Remedial Design. Jay Johnson will also be responsible for all feasibility study/remedial design activities.

Other personnel for each major task are presented in Figure 4. Resumes of each individual listed, which are included in Appendix C, discuss their hazardous waste and feasibility study/remedial design-related qualifications and experience.

4.0 PROJECT SCHEDULE

The schedule for the NACIP additional site characterization and feasibility study at NOS as described herein as shown in Figure 5. The schedule is given in terms of duration rather than for specific dates pending establishment of a specific date for work plan approval and initiation. The proposed schedule shows an estimated 38 weeks for project completion. The actual project duration may be shorter or longer depending on review turn around.



DURATION OF TASK
DELIVERABLES DUE DATE
MEETING
MONTHLY PROGRESS REPORT DUE DATE
REVIEW PERIOD
NTP NOTICE TO PROCEED 6/22/87

FEASIBILITY STUDY SCHEDULE

E.C. JORDAN CO
ENGINEERS & SCIENTISTS

NACIP PROGRAM
FEASIBILITY STUDY AND REMEDIAL DESIGN

U.S. DEPT. OF NAVY
NAVAL ORDINANCE STATION
INDIAN HEAD, MARYLAND

FIGURE 5

5.0 REFERENCES

1. Fred C. Hart Associates Inc., Initial Assessment Study of Naval Ordnance Station, Indian Head, Maryland, Final Report, May 1983.

2. CH2M Hill, NACIP Confirmation Study Naval Ordnance Station, Indian Head, Maryland, Final Report, September 1985.

3. United States Environmental Protection Agency, Ambient Water Quality Criteria for Mercury - 1984, EPA 440/5-84-026, January 1985.

4. Statement of Work for Feasibility Study at Site 8, Nitroglycerin Plant Office, Naval Ordnance Station, Indian Head, Maryland, Submitted to: Naval Facilities Engineering Command, Cehsapeake Division, February 1987.

5. USEPA Superfund Public Health Evaluation Manual, October, 1986.

6.0 LIST OF ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Superfund)
CHESDIV	Chesapeake Division, Naval Facilities Engineering Command
DOD	Department of Defense
FCH	Fred C. Hart Associates Inc.
FSR	Feasibility Study/Remedial Design
GPR	Ground-Penetrating Radar
HASP	Health and Safety Plan
HSL	Hazardous Substance List
HSWA	Hazardous and Solid Waste Amendments of 1984
IAS	Initial Assessment Study
MDHMH	Maryland Department of Health and Mental Hygiene
NACIP	Naval Assessment and Control of Installation Pollutants
NCLP-CIP	National Contract Laboratory Program-Caucus Inorganic Protocol
NEODTC	Naval Assessment Study
NG	Nitroglycerin
NOS	Naval Ordnance Station
NSEOD	Naval School Explosive Ordnance Disposal Technology Center
ORNL	Oak Ridge National Laboratory
QAPP	Quality Assurance Program Plan
RCRA	Resource Conservation and Recovery Act of 1976
RFP	Request for Proposal
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act of 1986
SOW	Statement of Work
TSCA	Toxic Substance Control Act
USEPA	U.S. Environmental Protection Agency

APPENDIX A

SITE SPECIFIC HEALTH AND SAFETY PLAN

E.C. JORDAN CO.
SITE SPECIFIC HEALTH AND SAFETY PLAN

A. GENERAL INFORMATION

SITE: Indian Head Naval Ordnance Station-Site 8

SITE OWNER/CONTACT: U.S. Navy / Thomas Woo (Dept. of Safety)

LOCATION: Indian Head, Md, 25 miles SW of Washington, D.C.

PLAN PREPARED BY Karen L. Busen DATE: 04/02/87

APPROVED BY: Tony Allen DATE: 4/21/87

OBJECTIVE(S): To maintain health and safety while collecting sediment and water samples.

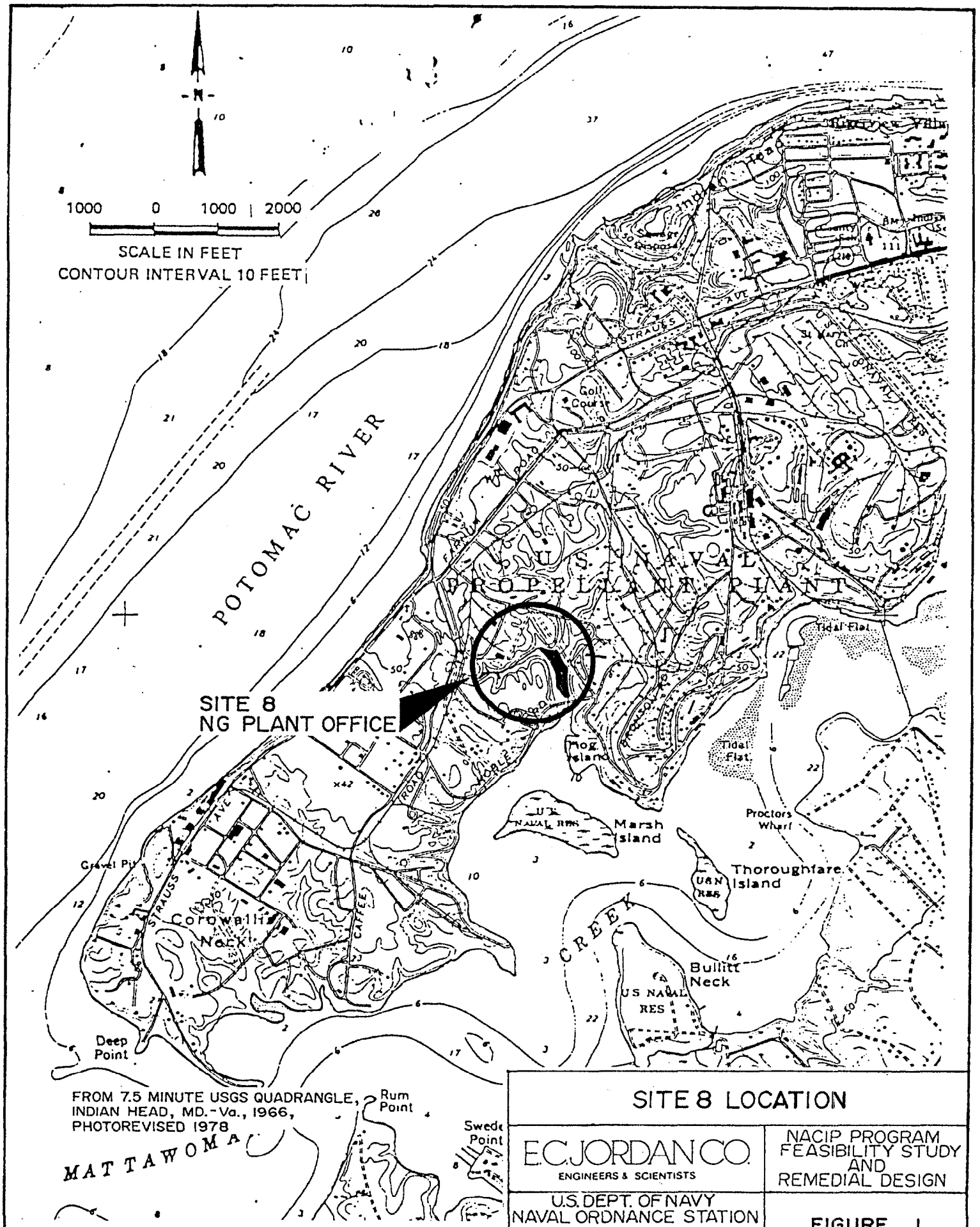
PROPOSED DATE(S) OF INVESTIGATION: June 1987

BACKGROUND REVIEW: Complete: X Preliminary: _____

OVERALL HAZARD: Serious: _____ Moderate: X Low: _____ Unknown: _____

B. SITE/WASTE CHARACTERISTICS

SITE DESCRIPTION: NOS Indian Head covers 3,423 acres and is bounded by the Potomac River, Mattawoman Creek, Chicamuxen Creek, the Town of Indian Head, and private property. It is situated in the northwestern section of Charles County, Maryland, 25 miles southwest of Washington, D.C. Figure 1 shows a portion of the Naval Ordnance Station and the location of Site 8.



SITE 8 LOCATION

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FEASIBILITY STUDY
AND
REMEDIAL DESIGN

U.S. DEPT. OF NAVY
NAVAL ORDNANCE STATION
INDIAN HEAD, MARYLAND

FIGURE 1

WASTE TYPES: Liquid X Solid ____ Sludge ____ Gas ____

CHARACTERISTICS: Corrosive ____ Ignitable ____ Radioactive ____

Volatile X Toxic X Reactive ____ Unknown ____

Principal Disposal Method (type and location): The Nitroglycerin Plant Office Laboratory (Building 766) used mercury in the nitrate-ester analysis of Nitroglycerin (NG). Small amounts of mercury from the labs were rinsed down the lab sinks and floor drain into a manhole outside the building, and subsequently into Mattawoman Creek via a small stream and tidal pond.

Status: (active, inactive, unknown): Active Station

History: (Worker or non-worker injury; complaints from public; previous agency action): Sampling by CH2M Hill in 1984 and 1985 showed mercury contamination downgradient of the manhole and drainage ditch in water of 0.17 mg/1 and in sediments of 1,100 mg/kg. They estimated that there were 200 + pounds of mercury in the sediments downgradient of Building 766. Using a mercury vapor analyzer, CH2M Hill found readings of 0.3 to 0.9 mg/m^3 near the outfall of Building 766 into the drainage stream. NOS Hygiene has not.

C. HAZARD EVALUATION

Mercury is a cellular poison and precipitates protein. It has a high vapor pressure and high atmospheric concentrations can occur high from negligible contamination. Inhalation is the prime route of exposure although dermal contact should be avoided. /(Air saturated with Hg vapor at 25 degrees Celsius contains 19.5 mg/m^3). Eighty percent of that inhaled by humans is absorbed in the blood.

Acute poisoning from Hg vapor produces metallic taste, nausea, abdominal pain, vomiting, diarrhea, and headache. After a few days, salivary glands swell, gingivits develops, teeth may loosen and ulcers may form on lips and gums and death may result. The brain is the target organ for chronic damage from inhaled Hg vapor. Table 1 presents some additional physical and toxicological charactertistics of mercury.

The TLV for mercury vapor is 0.05 mg/m^3. The August 1984 sampling trip experienced Hg vapor levels in excess of the TLV; if the readings on the Jerome mercury vapor analyzer were correct. Interferences for the Jerome analyzer are H_2 and acid gases and there are aboveground nitric and sulfuric acid storage tanks within 500 feet of the stream which may produce acid gases through venting.

TABLE 1
CONTAMINANTS OF CONCERN

Chemical	Approximate Odor Threshold (ppm)	TLV (ppm)	Physical Characteristics	Dermal Toxicity	Remarks
Mercury (Solid)	--	50 mg/m3	Silvery-white heavy liquid	Skin irritant	Cumulative neurotoxin
Mercury (Vapor)	--	0.05 mg/m3	High vapor pressure	Skin irritant	Cummulative neurotoxin

D. SITE SAFETY PROCEDURES

Map/Sketch Attached? Yes Site Secured? Yes

Perimeter Identified? Yes Zone(s) of Contamination Identified? Yes, partially.

Perimeter Establishment: Access to the Indian Head Naval Ordnance Station restricted at all points.

MOBILIZATION AND SITE ENTRY: An air monitoring survey will be conducted prior to site investigation to assess health and safety requirements. A contamination reduction zone will be established at the site. Field work preparation, staging, and decontamination will take place in this area. It will be necessary to remain upwind if the wind is blowing. Use the buddy system at all time. Jordan will always be accompanied by NOS personnel while onsite.

SITE MONITORING INSTRUMENTATION:	USE:
Jerome mercury vapor analyzer	Establish background, and continuous monitoring during sampling. Reading above background requires evacuation to a "clear area".

TEAM ORGANIZATION:

Team Member	Responsibility	Qualified To Work @ Level
Tony Allen	Site Safety Officer	B
Jay Johnson	Sampler	C
Dave Crane	Sampler	B

PERSONNEL PROTECTION

TASK	MINIMUM LEVEL OF PROTECTION
Site 8-all times	Level D. Upgrade to Level B if Hg analyzer exceeds 0.05 mg/m^3

Action Level for Modifications: Mercury vapor measured with Jerome analyzer above 0.05 mg/m^3 in ambient air will require evacuation upwind and upgrade to Level B.

Rationale: Because respirator cartridges provide no organic mercury vapor protection, therefore continuous mercury monitoring will be conducted at all times and a concentration of greater than or equal to 0.05 mg/m^3 will require an upgrade to Level B.

DECONTAMINATION PROCEDURES:

A decontamination station for personnel sampling equipment will be established at the site. Between sampling locations, sampling equipment will be brought to this area for washing and/or steam cleaning. Temporary decontamination stations will be established at individual sampling sites to more conveniently accommodate limited decontamination operations. Decontamination fluids will be water, detergent/water and ispopropyl alcohol. Water and detergent/water mixtures will be disposed of via discharge to the NOS's Sanitary wastewater treatment system. Isopropyl alcohol will be containerized and disposed at an appropriate treatment and/or disposal facility. The Hg analyzer will be kept in a plastic bag as much as possible.

WORK LIMITATIONS (Time of day, etc.): Daylight hours, and as required by security at Indian Head NOS.

PERSONNEL PROTECTIVE GEAR, DECONTAMINATION AND OTHER MATERIAL DISPOSAL: Personnel will use Level D Protection if possible. See Table 2 for a list of personnel protective gear. Decontamination fluids will be left onsite. Other disposable materials will be bagged and turned over to base personnel for proper disposal.

SPECIAL FIRST AID INSTRUCTIONS:

EYE: Flush eyes immediately with large quantities of water and get medical attention immediately.

SKIN: Wash with soap and water and get medical attention promptly.

BREATH: Move victim to fresh air and if breathing has stopped perform artificial respiration. Keep warm and at rest. Get medical attention as soon as possible.

SWALLOW: Get medical attention immediately.

TABLE 2

PERSONNEL PROTECTIVE GEAR
LEVEL D

Respirator - Escape (5 minute oxygen supply)

Boots - rubber (steel toe)

Safety glasses or equivalent

Hard hat

Gloves - inner chlor-polyvinyl
outer nitrile

Polyester/Cotton overalls

E. EMERGENCY INFORMATION:

LOCAL RESOURCES

Ambulance: 911 (Non-Emergency 934-2214)

Hospital Emergency Room: Physicians Memorial 645-0100; NOS Clinic 743-4449

Poison Control Center: 1-800-492-2414

Police: 911 (Non-Emergency 934-2222)

Fire Department: 911 (934-2214)

Airport: ---

Explosives Unit: ---

EPA Contact: ---

SITE RESOURCES

Water Supply: ---

Telephone: ---

Radio Frequency NA

Other: ---

EMERGENCY CONTACTS

1 Maine Poison Control Center . . . . . (207) 871-2950
4. E.C. Jordan (Maine) . . . . . (207) 775-5401
5. E.C. Jordan (Florida) . . . . . (904) 656-1293
6. E.C. Jordan (Massachusetts) . . . . . (617) 245-6606
7. Envirologic Data. . . . . (207) 773-3020
8. USEPA Emergency Response. . . . . (800) 414-8802
9. National Poison Control Center. . . . . (800) 492-2414
10. CMA Chemical Referral Center. . . . . (800) 262-8200
11. Thomas Woo NOS Safety . . . . . (301) 743-4320

F. EMERGENCY ROUTES

(Give road or other directions; attach map)

HOSPITAL: From Building 766, proceed on Coffee Road, go right onto Hanlon Road, left onto Strauss Avenue, left onto Jackson Road, right onto West Wilson Road to Building 1600.

SITE EVACUATION: In the remote possibility that the site needs evacuating, Jordan personnel will notify Thomas Woo of base safety and evacuate throughout the nearest gate.

APPENDIX B

TASK QUALITY ASSURANCE PROJECT PLAN

Appendix B:

TASK QUALITY ASSURANCE PLAN

Task: NOS Indian Head Supplemental Investigation

Task Objective:	Standard Protocol Selected
Surface Water Sampling	QAPP (6.6.3)
Sediment Sampling	QAPP (6.5.5)

Task Organization

Name	Function
J. Johnson	Task Leader
R.A. Allen	Field Operations Leader
Environmental Engineer	Sampling
Environmental Engineer	Sampling
Subcontractor	Geophysics

Subcontractor	
CompuChem, Inc.	Chemical Analysis

Contacts	Function
Paula Pritz	Oak Ridge National Laboratory
Thomas Woo	NOS Indian Head

ANALYTICAL DATA

Matrix/Analysis	Methods to be utilized
Water: Mercury and TSS	NCLP-CIP
Sediment: Mercury	NCLP-CIP

Comments

Sediment samples will be screened for mercury vapor using an Mercury Analyser in the field.

APPENDIX C

PERSONNEL RESUMES

WILLIAM R. ADAMS, JR., VICE PRESIDENT

Education

University of South Carolina - B.S. in Civil Engineering, 1951

Professional Licenses

Professional Engineer - Maine and New Hampshire

Land Surveyor - Maine

Affiliations

Vice Chairman, New England Interstate Water Pollution Control Commission (seven-state regional water pollution control agency)
U.S. Chairman, U.S.-Canada Committee on Water Quality in the St. John River
Environmental Protection Agency, Decentralization Task Force
New England River Basin Commission
National Commission on Water Quality (Task Force on Public Participation)

Professional Experience

Mr. Adams has extensive professional experience in the administration of state and Federal environmental laws as the result of more than 10 years with the U.S. Environmental Protection Agency as Region I Administrator, and with the Maine Department of Environmental Protection as Commissioner. His experience includes leadership in hazardous waste management and implementation of several new state statutes, including the innovative Oil Conveyance and Site Location statutes.

Mr. Adams has served as project officer on many of the firm's recent contracts to assist state and local governments and industry in the assessment of hazardous waste problems and in the proposal of remedial actions. For services provided to the Massachusetts Department of Environmental Quality Engineering at the much acclaimed Silresim Chemical Corporation site in Lowell, Massachusetts, Mr. Adams was responsible for such management and administrative duties as reviewing, coordinating, and monitoring the project's organizational and technical efforts; and representing the company in meetings with the client and, as necessary, representing the client in meetings with others.

In addition to the Silresim project, Mr. Adams has also served as project officer for a hazardous waste evaluation for the Vermont Agency of Transportation at a Superfund site in Montpelier, Vermont; a cost effectiveness study of remedial action at the Picillo Superfund site in Coventry, Rhode Island for the Rhode Island Department of Environmental Management (RIDEM); a toxic organic groundwater abatement program at a Superfund site in Smithfield, Rhode Island, also for RIDEM; a geophysical and hydrogeologic investigation at a Superfund site in Winthrop, Maine for the Inmont Corporation; and contamination assessments for the Boston Edison Company.

Mr. Adams serves on Jordan's quality assurance team for the firm's remedial action assessment and long-term environmental monitoring at Love Canal in Niagara Falls, New York.

While with the U.S. EPA Mr. Adams administered Federal environmental laws in the New England region, placing major emphasis on improvement of state/federal relations. Mr. Adams developed working relationships with the six state governors and the state program administrators, and implemented a partnership in the development of the annual state/EPA agreements. He pursued delegation of authority to the states, making the region a leader in this effort. He also provided leadership in the management of uncontrolled hazardous waste sites utilizing the expertise of the region's water, air, laboratory, and enforcement personnel as well as agency contract authority. Mr. Adams worked closely with the states on energy matters, especially on the relaxation of stringent sulfurin-fuel standards.

As Commissioner of the Maine Department of Environmental Protection, he administered state and Federal environmental laws. He drafted, presented, received legislative approval, and implemented the governmental reorganization plan. Additional responsibilities included service as a member of Maine State Pesticides Board, Historic Preservation Commission, Mining Bureau, Coastal Development and Conservation Advisory Committee.

Mr. Adams was also selected by the Governor of Maine to serve as his principal liaison with a five-agency Natural Resources Cabinet Group. He was Chairman of the Land and Water Resources Council formed to advise the executive and legislative branches of the state government on the development of a comprehensive land and water resources planning and management program. He was also a member of the Governor's five-member Cabinet Management Advisory Committee on all state policy and management matters.

While Head of Region I, EPA, Mr. Adams aggressively pursued the assessment and clean-up of illegal hazardous waste sites in New England. During his tenure, a full 25 percent of the total hazardous waste assessment funds in U.S. EPA was spent in New England. There were seven major hazardous waste clean-up operations conducted by EPA under Mr. Adams direction. The projects were spread geographically throughout New England and he was in constant close contact with mayors, governors and congressional delegations concerning hazardous waste impact.

RAYMOND A. ALLEN, III, SOIL CHEMIST

Education

University of Maine - B.S. in Soil Science, 1982
NUS Seminar for Hazardous Material Handling, 1984
BSCE Lecture Series on Controlling Hazardous Wastes, 1985

Professional Experience

Mr. Allen develops, implements and directs soil and hydrogeologic remedial investigations, hazardous waste contamination assessments, RCRA/CERCLA Preliminary Assessments and Site Investigations, soil mapping and site identification for land application of municipal sludge. He has also conducted laboratory chemical analyses of soils, herbicide field testing, and subsurface investigations for proposed wastewater spray irrigation areas.

Mr. Allen's hazardous waste project experience includes several Superfund sites in Maine, New York and Massachusetts; hydrogeologic investigations of heavy metal, PCB, volatile organic, sulfuric acid and oil contamination of soils and groundwaters; RCRA/CERCLA site investigations; geophysical surveys; and conducting soil gas surveys in Florida and Massachusets.

Mr. Allen was a member of the Jordan team that prepared 110 preliminary assessments under the EPA RCRA 3012 program for the State of Florida. As a member of the field team, Mr. Allen assisted in the completion of 40 site investigations.

As technical director for a soil and groundwater quality assessment at Delta Chemical Inc. in Searsport, Maine, Mr. Allen directed the field investigation, which included soil borings, soil sampling, monitoring well installation and groundwater sampling. Upon completion of the field program he compiled and evaluated the data and wrote the final report. Mr. Allen conducted a similar soil and groundwater quality assessment involving oil and grease contamination at Eagle Precision Metals Inc. of Fryeburg, Maine.

As assistant technical director of a multi-site soil and groundwater quality assessment project for the Florida Department of Transportation conducted in Fort Lauderdale, Florida, Mr. Allen was involved in workplan development and in charge of implementing field investigations.

Mr. Allen is Jordan's representative in a team of consultants assisting the Seminole Refining Corporation of St. Marks, Florida in addressing a consent order placed on them by the Florida Department of Environmental Regulation. Specific responsibilities include development and implementation of a phased hydrogeologic remedial investigations for the asphalt refinery, wastewater treatment ponds and a wood preservative manufacturing plant located on Seminole's property.

Mr. Allen served as technical director in charge of the verification phase-Step 1A of the Pollution Abatement Confirmation Study conducted at the Brunswick Naval Air Station in Brunswick, Maine for the U.S. Department of the Navy. He directed the implementation of fieldwork, evaluation and report writing activities and is currently acting as technical director in charge of the characterization phase-Step 1B of this same study.

As Phase II activity leader, Mr. Allen is in charge of the remedial investigations being conducted at the Massachusetts Military Reservation in Falmouth, Massachusetts for the U.S. Department of the Air Force as part of the Installation Restoration Program.

Mr. Allen is currently serving as technical director in charge of the verification phase studies of the NACIP Confirmation Study Program being conducted at Mayport Naval Station, Mayport, Florida.

JAMES S. ATWELL, MANAGER OF ENVIRONMENTAL SERVICES

Education

University of Maine - B.S. in Civil Engineering, 1965
University of Maine - M.S. in Civil Engineering, 1966

Professional Licenses

Professional Engineer - Maine, Massachusetts, Michigan

Affiliations

American Society of Civil Engineers, Solid Waste Management Committee
National Solid Waste Management Association
Water Pollution Control Federation

Professional Experience

As Manager of the Environmental Services division of E.C. Jordan Co., Mr. Atwell oversees the firm's geotechnical, solid and hazardous waste, wastewater, water, environmental laboratory and planning departments.

Mr. Atwell is responsible for the development of hazardous and nonhazardous waste management programs for public and private sector clients. Management programs include: 1) evaluation and design of remedial action at Superfund and other uncontrolled hazardous waste sites; 2) planning and design of land disposal systems including secure landfills and land treatment systems; 3) permitting for the treatment, storage and disposal of hazardous wastes in accordance with 40 CFR 122 and 40 CFR 264; and 4) planning and design of resource recovery facilities. Recent projects have included remedial investigations/feasibility studies at Superfund and other hazardous waste sites in Michigan for the Michigan Department of Natural Resources; evaluation and design of remedial action at the Pine Street Canal Superfund site in Burlington, Vermont for the Vermont Agency of Transportation; evaluation and implementation of closure plans for several industrial hazardous waste facilities including design of capping systems and monitoring programs; and a geologic investigation and contamination assessment at a site formerly used for chemical storage and now under consideration for purchase by the Boston Edison Company.

He has served on Jordan's Quality Review Committee for such projects as a remedial action assessment and long-term environmental monitoring at Love Canal in Niagara Falls, New York; an assessment of the extent of solvent, resin and inorganic contamination in soils and surface and groundwaters at the Silresim Superfund site in Lowell, Massachusetts; data evaluation and remedial action assessment at the North Hollywood Dump Superfund site in Memphis, Tennessee; and the site evaluation, selection and design of three ash disposal systems for Central Maine Power Co. These landfills incorporated dual liner systems (flexible synthetic liner and compacted clay) and leachate collection. He also played a major role in Jordan's support to the U.S. EPA in review and recommendations for hazardous waste regulation guidance documents.

During the past five years, Mr. Atwell has been responsible for several design projects including secure landfills with low permeability liners and leachate collection, industrial waste lagoon closures, and remedial actions at closed hazardous and non-hazardous waste sites.

Mr. Atwell served as project manager for EPA Contract No. 68-01-5772 from February 1979 until April 1980. This contract involved several subcontracts and required the establishment of large-scale sampling programs for the collection and analysis of solid and liquid samples for priority pollutant analyses. The contract also required assessment of waste management technologies and the preparation of industry profiles, regulatory support packages, and technical guidance documents.

He was also responsible for solid waste management projects which emphasized the evaluation and development of resource or energy recovery alternatives including waste/resource recovery projects for the North Kennebec Regional Planning Commission; the municipalities of Biddeford, Saco, Old Orchard Beach, Orono, and Old Town; and the University of Maine at Orono.

Partial List of Publications and Presentations

"Boiler Ash Disposal." Presented at TAPPI Annual Meeting, Chicago, Illinois; March 3, 1981. TAPPI Magazine, July 1981.

"Practical Approaches to Coal Ash Disposal." Presented at annual meeting of the Associated Industries of Maine, Portland, Maine; October 1980.

"Design of Hazardous Waste Landfills." Presented at Fall Meeting of New England Water Pollution Control Association, Falmouth, Massachusetts; October 1980.

Atwell, James S. and Walker, Stanley E., "Site Selection and Design of Utility Oil Ash Landfill." Presented at Third Annual Madison Conference of Applied Research and Practice on Municipal and Industrial Waste; September 10-12, 1980.

Solid Waste Disposal for the Pulp and Paper Industry." Presented at the American Institute of Chemical Engineers Annual Meeting, Houston, Texas; April 1979.

"Wastewater Sludge Incineration." Published by and presented at the Spring TAPPI Meeting, New York; March 1979.

ANDREW H. BALDWIN, SCIENTIST

Education

Tufts University - B.S. in Biology and Engineering, 1983

Professional Experience

Mr. Baldwin is a scientist in Jordan's Southern New England office providing technical support on environmental assessments, specifically wetlands assessments, for uncontrolled hazardous waste sites. He is currently at work on the wetlands assessment task of the RI/FS program for Cannons/Bridgewater site (Massachusetts); Saco Tannery Waste Pits site (Maine); New Bedford Harbor (Massachusetts); and the environmental assessment for the LDI site (Michigan).

Prior to joining Jordan he served as project manager for wetlands assessments for Superfund hazardous waste sites. Responsibilities include budgeting and scheduling, development of sampling and analysis programs, field characterization of wetland hydrology and biota, mapping, impact evaluation, assessment of remedial alternatives, and development of mitigative measures. For CERCLA endangerment assessments and feasibility studies he reviewed analytical data, evaluated extent of contamination and contaminant transport and fate; screened technologies and developed remedial alternatives for sites contaminated with PCBs, dioxin, metals, and volatile and semivolatile organic chemicals, and conducted environmental evaluation of remedial alternatives. His background in the area of RCRA regulatory work included site inspections of treatment, storage, and disposal facilities, assessment of releases and exposure pathways from RCRA facilities, development of guidance manuals for controlling volatile organic releases and for modeling of exposures resulting from releases of contaminants to air and evaluating the scope and effectiveness of wetlands regulations to allow for development of wetlands protection regulations under RCRA.

DONALD R. COTE, SENIOR VICE PRESIDENT

Education

Northeastern University - 1967, B.S. in Sanitary Engineering
Northeastern University - 1969, M.S. in Sanitary Engineering

Professional Licenses

Professional Engineer - Maine, New Hamsphire, Vermont, Massachusetts, Connecticut, Pennsylvania, New York, Delaware, Rhode Island, Illinois, Michigan, Maryland, and New Jersey

Professional Experience

Mr. Cote has overall technical and administrative responsibility for the firm's multidisciplinary consulting services in design engineering, earth and water resources, pulp and paper design, and project management. These responsibilities include the direction of Jordan projects in the solid and hazardous waste field, which incorporate services offered by the firm's environmental and geotechnical engineers, hydrogeologists, soil scientists, and chemists.

Recent solid/hazardous waste-related projects under his management include: a remedial action assessment and long-term environmental monitoring at Love Canal in Niagara Falls, New York; EPA Effluent Guideline Division's Best Available Technology Programs for food, and pulp, paper, and paperboard point source categories; toxic pollutant identification and treatment research and development for EPA's IERL; development of remedial action plans for three uncontrolled hazardous waste disposal sites; design of four secure waste disposal sites; development of a process water reclamation system for removal of non-conventional and toxic pollutants; and the planning and design of a 200-tpd incineration/energy recovery system.

DAVID P. CRANE, ENVIRONMENTAL ENGINEER

Education

University of Florida - B.S. in Environmental Engineering, 1985
NUS Seminar for Hazardous Material Handling

Professional Experience

Mr. Crane has assisted in the preparation of four Remedial Investigation / Feasibility Study (RI/FS) reports. His responsibilities included the analysis of existing systems, suggesting modifications to existing systems, research and design of remedial alternatives, estimation of costs, report writing and review.

Mr. Crane has been involved with the planning of Site Investigations (SI) and Expanded Site Investigations (ESI) in Florida, Georgia, Alabama, and Tennessee. Additionally, he has directed SI's in Florida and Tennessee including site reconnaissance, project planning, health and safety planning, sampling management, preparation of the HRS documentation package, preparation of the final report, and interaction with the EPA project offices. Mr. Crane has worked extensively on other hazardous waste sites in South Florida. As a member of the sampling team he has experience in the collection of groundwater, surface soil, subsurface soil, and surface water/sediment samples.

As manager of a site investigation in Miami, Florida he was responsible for the characterization of the site, isolation of the site from surrounding industries, determination of the extent of contamination, determination of targets for the HRS documentation package, and suggestions for possible remediation.

As manager of an emergency response site investigation in Tennessee, Mr. Crane was responsible for the direction of sampling abandoned waste oil pits suspected of organic, PCB, and possible dioxin contamination. Work on this site included site characterization, sampling of residential wells in the site vicinity, and determination of HRS targets.

Mr. Crane was responsible for the preparation of FDER permit applications (solid waste landfill), stormwater management, evaluation of existing collection and treatment systems, and construction inspection.

DCRESUME
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MICHAEL J. DONATO, AQUATIC TOXICOLOGIST

Education

Bentley College - M.S. in Computer Information Systems, 1986
University of Washington - B.S. in Biological Oceanography, 1981

Affiliations

Society of Environmental Toxicology and Chemistry

Professional Experience

Mr. Donato is an aquatic toxicologist in Jordan's Southern New England office. His project experience includes the development of exposure and risk characterization data for endangerment assessments at hazardous waste sites. This phase of the project requires the formulation of methodologies to use ecotoxicity data to quantify and/or qualify potential risks to organisms and entire food chains and the assessment of impact to surface water bodies and wetlands in unique ecosystems.

To assess potential risk at an NPL site, Mr. Donato was involved in interpreting and evaluating bioassay data for groundwater discharge for the purpose of generating alternate concentrations limits. He established a data base to interpret the diverse life history and habits of certain freshwater fishes; this involved an assessment of the effects of mercury contamination on aquatic species at a Superfund site in Virginia. Mr. Donato was also involved in the development of an exposed species analysis, toxicological evaluation and concentration response assessment of PCB contamination in New Bedford Harbor.

Previous responsibilities include setting up and running toxicology tests with different fish and invertebrate species, and interpreting and presenting the results.

Mr. Donato is an Instructor at Middlesex Community College and is responsible for preparing and presenting class lectures introducing students to the environmental principles of matter and energy; ecosystem structure; food resources; energy resources; and wildlife resources.

JOHN M. DUMEYER, WATER RESOURCES ENGINEER

Education

University of Arizona - M.S. in Hydrology, 1971
University of Arizona - B.S. in Geology, 1966

Professional Licenses

Professional Engineer - Florida, Colorado, Kansas, Alabama, and Georgia

Professional Experience

Mr. Dumeyer manages the Earth Resources Department in Jordan's Florida office. He has nineteen years of experience in the areas of groundwater investigations and development, groundwater-surface water relationships, design and construction of wells, hazardous waste site investigations and remedial action plans. He is responsible for all of Jordan's Florida Department of Environmental Regulation (FDER) and Florida Department of Transportation (FDOT) work, as well as contamination assessments for industrial clients. He has been responsible for coordinating the technical operations to perform site reconnaissance and site investigations at 29 sites throughout Florida under the CERCLA Site Screening Program.

He has also been responsible for the evaluation of gasoline contamination at 15 sites throughout Florida regarding underground storage tank leakage. He has prepared the plans for remedial actions at these to recover free product and contaminated groundwater. One of the sites in Tallahassee involved detection and interception of free gasoline which was entering the sanitary sewer system.

Prior to joining Jordan, Mr. Dumeyer's responsibilities included water well construction, wasteewater disposal, groundwater monitoring plans and hazardous waste site remedial investigation and remedial action feasibility studies. projects for which he served as Project Manager include:

- RI/FS for a Superfund hazardous waste site in Arkansas. Responsibilities included budget tracking, work schedule, coordination of work with engineering subcontractors, preparation of monthly status reports and preparation of reports and presentations to EPA.

- Design and construction of a 3,200-foot injection well at Margate, Florida. Responsibilities included budget tracking, work schedule, design report and permit, plans and specifications, contract processing and contractor submittals.

- Design and construction of three percolation and pond systems in Florida. Responsibilities included design of two systems, permitting, bidding and contract processing, construction management, payment processing and progress report preparation.

Mr. Dumeyer's areas of specialization include groundwater use evaluations. water rights, irrigation water use, construction of wells and irrigation systems, and evaluation of water quality problems in alluvial aquifers. He appeared as an expert witness in geology and hydrology for several water court trials. He was Project Manager for the design and construction of repairs to a 5,000 acre irrigation system in Penrose, Colorado. Responsibilities included preparation of a feasibility study, funding application, design, plans and specifications, as well as contract processing, construction management and contractor payments.

As a hydrologist with the U.S. Geological Survey, Mr. Dumeyer was responsible for groundwater supply and water resources investigations in Yellowstone National Park and the Rio Grande Valley of Colorado.

JOHN W. JAQUES, ESTIMATOR

Education

University of Maine - Credits toward a degree in Industrial Technology
Bath Iron Works - Graduate Apprentice, Outside Machine Shop Apprenticeship Program
Central Maine Vocational Technical Institute - 15-week course in Construction Estimating

Affiliations

American Society of Professional Estimators

Professional Experience

Mr. Jaques has assisted in cost estimating for a variety of design projects, including wastewater treatment plants, commercial/industrial plant expansions, hydroelectric projects, pulp and paper mills, and solid and hazardous waste sites.

For remedial investigations and feasibility studies at several Superfund sites, Mr. Jaques has assisted in the confirmation and review of pricing of the scope of services. He has assisted in the estimating of remedial actions for Michigan Department of Natural Resources and the McKin site in Maine, including such site actions as excavation of soils, capping, and off-site and onsite disposal of wastes.

Other major projects include:

- Crown Zellerbach Corporation (New York), Service Products East Expansion ($200 million)
- Town of Old Orchard Beach (Maine), Wastewater Treatment Plant ($9 million)
- Shape Video (Maine), Manufacturing Facilities Expansion ($4 million)
- University of Maine Chemical Engineering Building ($2.5 million)
- Madison Paper Industries (Maine), Groundwood Mill Expansion ($12 million)

JARET C. JOHNSON, SENIOR ENGINEER

Education

University of North Carolina - M.S. in Environmental Engineering, 1973
Rensselaer Polytechnic Institute - B.S. in Metallurgical Engineering, 1967

Professional Licenses

Professional Engineer - Massachusetts, Maine

Affiliations

Air Pollution Control Association
Water Pollution Control Federation

Professional Experience

Mr. Johnson's eighteen years of engineering experience have emphasized the treatment of industrial solid and liquid wastes. He has provided project management and technical direction for a wide variety of government and industry contracts related to ground water/water quality, wastewater treatment and hazardous waste. He is the author of numerous technical papers on hazardous materials treatment and ground water protection.

Mr. Johnson recently managed a comprehensive aquifer restoration and lagoon/landfill closure investigation for a large chemical complex. He also managed the design and construction services for the selected remedy. Other projects to which Mr. Johnson contributed include a design report for a wastewater treatment system for an automobile manufacturer and the design of a tank farm/chemical distribution center for a semiconductor manufacturer. Mr. Johnson was project manager for a laboratory investigation of the ability of fixation process to reduce leaching of arsenic from hazardous industrial solid wastes. He also served as a member of a senior technical negotiating team developing a consent decree regarding remedies to an uncontrolled hazardous waste site. Negotiations were held with technical representatives of the responsible company, and covered methods for leachate treatment, ground water control techniques, and remedies for an adjacent affected water treatment plant.

Mr. Johnson has provided project management and engineering on assignments such as: sampling and analytical study to determine fate of toxic chemicals discharged by industries to publicly owned treatment works; shipboard test director on two research cruises in the Gulf of Maine investigating physical and chemical behavior of crude oil slicks; project manager on research cruise investigating behavior of crude oil slicks to which chemical dispersants were applied by helicopter. In addition to the helicopter, he directed the movements of four remote sensing aircraft and three research vessels in this offshore operation. He was also project manager and shipboard test director on a study of toxic pollutants in sediments of a harbor on the Great Lakes. As a result of his work on contaminated sediments, he was an invited expert panelist in the 1979 Symposium on the New York Bight, "Ecological Effects of Environmental Stress."

PUBLICATIONS

Johnson, J.C., B.H. Kolb, and P.J. Riordan, "Protection of a 700-gpm Municipal Well Filed with a 10-gpm Barrier Well," Fifth National Symposium on Aquifer Restoration, National Water Well Association, May 21-24, 1985.

Johnson, J.C., and P.B. Sorensen, "Computers: Super Sleuths for Contaminated Aquifers," Hazardous Materials and Waste Management, 2, 4, July/August 1984, pp. 18-28.

Whittaker, K.F., and J.C. Johnson, "Removal of Vinylidene Chloride from Groundwater by Air Stripping and Activated Carbon Absorption," Proc. 4th National Symposium on Aquifer Restoration and Ground-Water Monitoring, National Water Well Association, May 23-25, 1984.

Croswell, W.F., J.C. Fedors, F.E. Hoge, R.N. Swift, and J.C. Johnson, "Ocean Experiments and Remotely Sensed Images of Chemically Dispersed Oil Spills," IEEE Trans., Geoscience and Remote Sensing, GE-21, Jan. 1, 1983, pp. 2-15.

McAuliffe, C.D., J.C. Johnson, S.H. Greene, G.P. Canevari, and T.D. Searl, "Dispersion and Weathering of Chemically Treated Crude Oils on the Ocean," Environmental Science and Technology, 14, 12, Dec. 1980, pp. 1509-1518.

McAuliffe, C.D., G.P. Canevari, T.D. Searl, J.C. Johnson, and S.H. Greene, "The Dispersion and Weathering of Chemically Treated Crude Oils on the Sea Surface," Petroleum and the Marine Environment, International Conference and Exhibition, Monaco, May 27-30, 1980.

Johnson, J.C., and R.L. Lancione, "Assessment of Processes to Stabilize Arsenic-Laden Wastes," Proc. 6th Annual Research Symposium: Disposal of Hazardous Waste, Report No. EPA-600/9-80-010, U.S. Environmental Protection Agency, March 1980, pp. 181-186.

Johnson, J.C., and S. Foget, "Effect of RCRA on Disposal Options for Residues from Spill Cleanup," in Proc. Conference on Oil and Hazardous Material Spills, Dec, 3-5, 1979. Cherry Hill, NJ, pp. 6-11.

Johnson, J.C., C.D. McAuliffe, and R.A. Brown, "Physical and Chemical Behavior of Small Crude Oil Slicks on the Ocean" in Chemical Dispersants for the Control of Oil Spills, ASTM STP 659, L.T. McCarthy, Jr., G.P. Lindblom, and H.F. Walter, eds., American Society for Testing and Materials, 1978, pp. 141-158.

Johnson, J.C., and R.L. Lancione, "Laboratory Assessment of Fixation and Encapsulation Process for Arsenic-Laden Wastes," Proc. 4th Annual Research Symposium: Land Disposal of Hazardous Wastes, Report No. EPA-600/9-78-016, U.S. Environmental Protection Agency, August 1978, pp. 326-341.

Johnson, J.C., "Pathways of Photoprocessing Chemicals in Publicly Owned Treatment Works," presented at 31st Annual Conference, Society of Photographic Scientists and Engineers, May 1, 1978, Washington, D.C.

Soden, J.E., and J.C. Johnson, "Burial and Other High-Potential Response Techniques for Spills of Hazardous Chemicals that Sink," Proc, 1978 Conference on Control of Hazardous Material Spills, April 11-13, 1978, Miami Beach, pp. 202-207.

Johnson, J.C., and A.R. Curran, "Water Treatment Technologies for Reduction and Eliminating of Total Dissolved Solids Discharge," presented at 45th Fall Meeting of the New England Water Pollution Control Association, Hartford, CT, Oct. 23, 1974.

RUSSELL A. JOHNSON, SCIENTIST

Education

Yale School of Forestry and Environmental Studies -
M.F.S. in Forest Science in Water Resources, 1983
University of Rhode Island - B.S. in Plant Science, 1980

Professional Experience

As a Senior Scientist, Mr. Johnson was responsible for the design and implementation of a remedial investigation at a CERCLA site to provide input to a feasibility study; the field studies included geophysical surveys, soil sampling, and the installation of monitoring wells. He also was responsible for the design and implementation of a field program as part of an Alternate Concentration Limit (ACL) demonstration at a CERCLA site; the nested monitoring wells were installed to determine vertical gradients, plume definition, and to establish model boundaries. Mr. Johnson was task manager and lead technical advisor for the development of documentation and a user's guide for a numerical model of unsaturated, vertical flow.

In addition, Mr. Johnson was responsible for the computer modeling of groundwater flow and contaminant transport utilizing numerical and analytical techniques. He is familiar with the numerical models AQUIFEM, RANDOMWALK, PTC (Princeton Transport Code), and some USGS codes. Mr. Johnson developed and presented two workshops: "Computer Modeling Applications" offered at EPA Regional offices across the nation, and "SOILINER" offered at EPA's Washington Information Center.

Mr. Johnson participated in several water resource investigations. For the New Haven Water Authority he was involved in the analytical modeling of stream depletion by municipal wells as part of an Environmental Impact Assessment. For the Rhode Island Audobon Society, Mr. Johnson was responsible for the field study on the forest cover, soils, surficial geology, and hydrology of a 900-acre wildlife sanctuary, and he proposed a management plan for future property use.

For the Connecticut Fund for the Environment, Mr. Johnson was involved in the computer simulation of contaminant plume migration using an advection-dispersion analytical model with a Gaussian distributed source.

For the Nature Conservancy, he assessed the impacts of artificial drainage on a peat bog; and developed an analytical technique for modeling transient flow and drawdown. For the Town of Avon, CT, Mr. Johnson worked in cooperation with the Health Department modeling groundwater flow to the municipal wellfield using the finite element technique.

PATRICIA M. KOZAK, ENGINEER/BOTANIST

Education

University of New Hampshire, Durham, NH - M.S. in Civil Engineering, 1983-85
University of New Hampshire, Durham, NH - M.S. in Plant Physiology and Aquatic Plant Ecology, 1980-83
University of Massachusetts, Amherst, MA - Plant Physiology, 1978-80
Smith College, Northampton, MA - B.A. in Cellular and Molecular Biology, 1974-78

Affiliations

Water Pollution Control Federation
Society of Women Engineers
American Society of Plant Physiologists

Professional Experience

Ms. Kozak's current responsibilities with E.C. Jordan Co. include site assessments and feasibility studies related to industrial and municipal wastes. She is applying her knowledge and experience in wastewater treatment to the selection and design of processes to treat contaminated groundwater and industrial wastewater. In addition, she is contributing to wetland/aquatic effects assessments, based on her extensive background in aquatic ecology. Clients on these projects include industrial, municipal, state and federal organizations.

While employed as an engineer/aquatic botanist at another firm, Ms. Kozak was involved with the design and construction of an innovative wastewater management facility utilizing emergent, peat and submergent offshore wetlands for treatment. She was responsible for wetland plant selection, the preparation of process reports, monitoring reports and the writing of specifications for the emergent, peat and offshore wetlands. Ms. Kozak's design experience includes marina wastewater pumpout facilities along the Chesapeake Bay, MD.

Publications

Lombardo, P. and P.M. Kozak 1986. Design of Emergent and Peat Wetlands for Nitrogen and Phosphorus Removal From Wastewater. Presented at the WPCF Conference, Los Angeles, CA October 6-9.

Kozak, P.M. and P. Bishop 1986. The Effect of Mixing and Aeration on the Productivity of Myriophyllum heterophyllum Michx.(Water Milfoil), During Aquatic Wastewater Treatment Presented at the Conference on Aquatic Plants for Water Treatment and Resource Recovery, Orlando, FL, July 20-24.

Lombardo, P. and P.M. Kozak 1986. Wetlands for the Treatment and Dispersion of Wastewater Effluent. Presented at the Conference on Aquatic Plants for Water Treatment and Resource Recovery, Orlando FL, July 20-24.

Kozak, P.M. 1986. The Effect of Mixing and Wastewater Concentrations on the Productivit of the Submerged Aquatic Plant Myriophyllum heterophyllum Michx., Water Milfoil M.S. Thesis, University of New Hampshire, Durham, NH.

Kozak, P.M. 1983. In Situ Measurement of Ambient Ethylene in the Aquatic Plant, Myriophyllum heterophyllum Michx. (Water Milfoil), and Surrounding Sediment. Presented at the Northeast Branch of the American Society for Plant Physiologist, Storrs, CT.

Kozak, P.M. 1983. Measurement of Ambient Ethylene From the Aquatic Macrophyte, Water Milfoil (Myriophyllum heterophyllum Michx), and Surrounding Sediment, M.S. Thesis University of New Hampshire, Durham, NH.

Kozak, P.M. 1978. Endangered Plant Species. Amy Randall Brown Prize, Smith College.

CHRISTIAN E. OLSON, PROJECT ADMINISTRATOR

Education

University of Southern Maine - B.S. in Business Administration, 1983

Professional Experience

Mr. Olson is responsible for project administration and project control for the Environmental Services Division. In this capacity he initiates and maintains client communications, and assists in contract preparation and the development and coordination of schedules and budgets. His responsibilities also include acting as liaison in monitoring subcontractor services and budgets; ensuring services meet terms of contract; schedule and budget tracking; and reviewing, processing and issuing invoices. In addition, he coordinates staff and equipment to meet client requests not included in the original scope of work.

Currently, Mr. Olson is working with the Michigan Department of Natural Resources as a contract liaison between three subcontractors and the Jordan Company. In this role, he communicates regularly with the subcontractors and Jordan personnel regarding budgets and schedules. He also ensures invoices conform to the terms of the contract and are processed in a timely and efficient manner.

ROBERT A. STEEVES, CHAIRMAN, HEALTH AND SAFETY COMMITTEE AND QA/QC DIRECTOR, LABORATORY

Education

Tufts University - B.S. in Chemical Engineering, 1972

Affiliations

American Institute of Chemical Engineers

Professional Experience

As Chairman of Jordan's Personnel Health and Safety Committee, Mr. Steeves is responsible for assuring compliance with established safety procedures for Jordan's laboratory and field activities, particularly at hazardous waste sites. These responsibilities include monitoring of Jordan personnel to assure that proper safety precautions are taken; overseeing a health monitoring program at Maine Medical Center in which the appropriate Jordan individuals are enrolled; providing for training in the use of safety equipment, first aid and cardiopulmonary resuscitation techniques, and decontamination techniques; and overseeing access to Jordan's inhouse and outside computer banks. These computer banks provide data concerning known dangerous concentrations of chemicals, likely routes of personnel contamination, and common symptoms the employee may develop if exposure occurs.

As QA/QC Director for Jordan's environmental laboratory, Mr. Steeves is responsible for assessing analytical precision and accuracy, identifying problem areas, and developing remedial actions for all phases of work—from sample collection methodologies through data reporting.

Mr. Steeves had conducted nationwide sampling and analysis programs including 10 industrial waste surveys designed to measure the presence of 129 potentially toxic compounds. As part of these industrial surveys, Mr. Steeves was responsible for establishing safety procedures to be followed by sampling teams working in industrial facilities. These teams were collecting samples to be analyzed for potentially hazardous compounds. Mr. Steeves also assisted in the preparation of an E.C. Jordan safety manual used by field crews engaged in a variety of tasks at waste disposal sites, including the placement of borings and well monitoring. His sampling and analysis efforts also included five pilot plant studies. He developed six industrial wastewater discharge technical data bases as well as profiles of 10 industries describing raw materials processing techniques, products, and solid and liquid waste discharges in support of industry subcategorization and effluent guidelines development for the U.S. EPA.

He has prepared two state-of-the-art treatment technology reviews. "The Removal of Phenolic Compounds from Wastewater" included benchscale research. "Foam and its Elimination" reviewed foam-causing substances, the structure and stability of various types of foam, and technologies available to eliminate it.

JAN SULLIVAN, PUBLIC HEALTH SCIENTIST

Education

Boston College - B.A. in Mathematics, 1980
Harvard School of Public Health - M.S. in Environmental Health Management, 1982

Special Courses

Boston University School of Public Health - Methods in Chronic Disease Epidemiology, 1986

Affiliations

American Public Health Association
Massachusetts Public Health Association
Society for Risk Analysis

Professional Experience

Ms. Sullivan recently joined E.C. Jordan Co. as a Public Health Scientist. Her primary responsibilities include performing public health exposure and risk assessments. Currently Ms. Sullivan is conducting risk assessments for several Superfund hazardous waste sites. She is also developing a methodology to assess human health risks from exposure to contaminants found on coal tar sites for New York State Electric and Gas Corporation; she will be conducting risk assessments at several N.Y. sites. Ms. Sullivan is involved in the development of an employee health and safety training program for MASSPORT to assist MASSPORT in meeting its responsibilities under the Massachusetts Right-To-Know law.

While a Senior Scientist/Public Health Specialist with another firm, Ms. Sullivan's responsibilities included performing exposure and risk assessments under contract to the EPA for CERCLA- and RCRA-regulated hazardous waste sites and facilities. She also consulted with clients on Right-To-Know-related projects, including the development of employee health and safety training programs and Material Safety Data Sheets. Ms. Sullivan assumed project management duties including development of work plans, coordination of project tasks, tracking of budgets, and production and oversight of contract deliverables.

Previously, as a Staff Epidemiologist/Toxicologist with the Massachusetts Department of Public Health, Ms. Sullivan performed exposure and health risk assessments for toxic substances in air, water, food, and soil. She also performed descriptive epidemiological studies of cancer mortality and adverse birth outcomes in Massachusetts towns. Additional responsibilities included the review of environmental impact statements. Ms. Sullivan oversaw the maintenance of the Massachusetts Substance List for the Right-To-Know program and developed and gave presentations at training seminars and public and professional meetings. She responded to inquiries from the public, local health agents, and other state agencies on the potential health risks of toxic substances.

JAN SULLIVAN (Continued)

While a Research Assistant at the Harvard School of Public Health, Ms. Sullivan assisted in the development of a risk assessment model to be used by the EPA to evaluate benefits of RCRA landfill regulations, and edited and produced the final report submitted to the EPA.

Publications and Presentations

"Assessing the Potential Impacts of Coal Conversion: A State Health Department's Involvement" Invited paper presented at annual meeting of the American Public Health Association in Anaheim, CA, November 1984.

"An Analysis of Mortality in the Neighborhoods of Boston: 1979-1982" August 1985.

DAVID E. TROUTMAN, REGIONAL MANAGER, SOUTHEASTERN UNITED STATES

Education

Emory University - B.A. in Chemistry, 1970
University of Georgia - M.S. in Hydrology, 1975
Florida State University - Post-graduate studies in Geology, 1980

Affiliations

National Water Well Association
American Chemical Society
American Water Resources Association

Professional Experience

Mr. Troutman has extensive experience in multidisciplinary hazardous waste investigations both in the management and technical development of programs to assess and mitigate contamination. He is currently project manager for an investigation to assess the extent of groundwater contamination and recommend appropriate remedial measures at an oil refinery in Florida. Previously, he was the technical director for a project to perform preliminary assessments, conduct on-site inspections, evaluate water quality data, and rank the level of hazard at uncontrolled hazardous waste sites throughout Florida. In addition, he manages Jordan's Tallahassee, Florida office, which serves the southeastern United States.

Mr. Troutman's experience includes multidisciplinary hazardous waste investigations. While with the U.S. Geological Survey in Florida, he conceptualized and implemented a multidisciplinary research investigation at a Superfund site contaminated by wood-preserving wastes near Pensacola, Florida. This project involved describing, quantifying, and modeling the fate and transport of organic contaminants in groundwater.

Mr. Troutman has also managed and participated in a number of studies relating to surface water and groundwater contamination problems resulting from hazardous wastes. These include:

- the collection and evaluation of hydrogeologic and water quality data at four Superfund sites in Florida;
- an assessment of the extent to which organic contaminants in treated sewage contribute to the degradation of groundwater quality at land application sites in Florida;
- an assessment of the seasonal variability and annual transport of PCBs and trace metals in the Hudson River, New York;
- a study to assess the effect of organic contaminants associated with wood-preserving wastes on benthic organisms in marine systems;

- a study to determine the assimilation capacity and removal efficiency of detention and retention ponds on heavy metals and other contaminants associated with stormwater runoff; and

- a study to determine the susceptibility of the sand-and-gravel aquifer, an important source of water supply to northwest Florida, to contamination from surface impoundments containing hazardous wastes.

Partial List of Publications and Presentations

"Migration of Wood-Preserving Chemicals in Contaminated Groundwater in a Sand Aquifer at Pensacola, Florida," Environmental Science and Technology, Vol. 19, No. 10 (1985). (With D.F. Goerlitz, E.M. Godgy and B.J. Franks).

"Chemistry of Groundwater at a Cresote Works, Pensacola, Florida," In Movement and Fate of Cresote Waste in Groundwater, Pensacola, Florida: U.S. Geological Survey Toxic Waste--Groundwater Contamination Program. U.S. Geological Survey Open File Report 84-466 (1984). (With D.F. Goerlits, E.M. Godsy, and B.J. Franks.

"Phenolic Contamination in the Sand-and-Gravel Aquifer from a Surface Impoundment of Wood Treatment Waste, Pensacola, Florida," U.S. Geological Survey Water Resources Investigation 84-4230 (1984). (With E.M. Godsy, G.G. Ehrlich and D.F. Goerlitz.)

"Effect of Pentachlorophenol on Methanogenic Fermentation of Phenolic Compounds in Groundwater," American Chemical Society, Division of Environmental Chemistry, Washington, D.C. (1983). (With E.M. Godsy and G.G. Ehrlich.)

"Deposition and Transport of Heavy Metals in Three Lake Basins Affected by Acid Precipitation in The Adirondack Mountains, New York," In Acid Rain: Energy and Environmental Chemistry, Ann Arbor Science, L.H. Keith, editor (1982). (With N.E. Peters.)

"Polychlorinated Biphenyl Transport in the Hudson River, New York," U.S. Geological Survey Water Resources Investigation 81-9 (1981). (With J.T. Turk.)

"Temporal Trends in the Acidity of Precipitation and Surface Waters of New York," U.S. Geological Survey Water Supply Paper 2188 (1981). (With N.E. Peters and R.A. Schroeder.)

"Relationship of Water Quality of Hudson River, New York During Peak Discharges to Geologic Characteristics of Contributing Subbasins," U.S. Geological Survey Water Resources Investigation 80-185 (1980). (With J.T. Turk.)

Partial List of Publications and Presentations (continued)

"Comparison of Lead, Manganese and Zinc Transport in Three Adirondack Lake Watersheds, New York," In Proceedings, International Conference on Ecological Impacts of Acid Precipitation, SNSF Project, Norway (1980). (With N.E. Peters.)

"Snowpack Storage and Ion Release," In Proceedings International Conference on Ecological Impact of Acid Precipitation, SNSF Project, Norway (1980). (With A.H. Johannes and J.N. Galloway.)

BRUCE K. WALLIN, CHIEF CHEMIST

Education

Mansfield State College - B.A. in Chemistry, 1967
Cornell University - Ph.D. in Biochemistry, 1973

Professional Experience

Dr. Wallin is an experienced research scientist in the areas of organic, environmental, and biological chemistry. His background spans nearly a decade and includes conducting and supervising laboratory procedures involving isolation, purification, derivitization, gas chromatography, and gas chromatography/capillary column gas chromatography, mass spectrometry of organic compounds and toxic substances. He is responsible for E.C. Jordan's analytical efforts involving the assessment of hazardous waste samples. He is currently overseeing onsite sampling and analysis at Love Canal as part of the Jordan Company's remedial action assessment and long-term environmental monitoring project for New York State. Among his recent assignments are the analysis of samples collected from the former Silresim Chemical Corporation site in Lowell, Massachusetts, where chemicals were improperly stored and disposed for seven years, as well as the analysis of samples collected at Superfund sites in Maine, Vermont, and Rhode Island.

Dr. Wallin is responsible for all analytical work performed by the environmental laboratory. His responsibilities relative to the assessment of hazardous waste samples include:

- safe sample collection, handling, and cleanup techniques for materials contaminated with acutely and chronically toxic chemicals;
- development of quality assurance/quality control methods, and procedures; and
- application of state-of-the-art analytical techniques.

He is also responsible for coordinating in-house and subcontracted analytical services for testing of water, wastewater and solid/semi-solid samples resulting from the firm's EPA-ordered surveys of the nation's food and wood products industries. This includes a critical review of the applicability of existing procedures for the identification and quantitation of toxic pollutants and additional compounds within the industry. Procedures under scrutiny include gas chromatography/capillary column gas chromatography, mass spectrometry, high pressure liquid chromatography, and other advanced techniques. He has also been involved in short- and long-range analytical program development and research relating to physical and chemical treatment technologies for water and wastewater purification.

BRUCE K. WALLIN (Continued)

Publications and Presentations

"Removal of Phenolic Compound from Wood Preserving Wastewater." Wallin, B.K., Condren, A.C. and Walden, R.L. IERL Office of Research and Development, U.S. EPA, Cincinnati, Ohio, 1980.

"Origin and Chemical Composition of Androscoggin River Foam." Wallin, B.K. and Bisson, B.T., IERL Office of Research and Development. U.S. EPA, Cincinnati, Ohio, 1981.

"Fate of Toxicants in Wastewater Treatment Systems Within the Pulp, Paper and Paperboard Industry." Wallin, B.K. and Condren, A.C. IERL Office of Research and Development. U.S. EPA, Cincinnati, Ohio, 1981.

RICHARD E. WARDWELL, SENIOR CONSULTANT

Education

University of Vermont - B.S. in Civil Engineering, 1968
University of Maine, Orono - M.S. in Civil Engineering, 1973
Colorado State University - Ph.D in Civil Engineering, 1980

Professional Licenses

Professional Engineer - Colorado, Maine, Vermont, Wyoming, Texas, Arizona

Affiliations

American Society of Civil Engineers
International Society of Soil Mechanics and Foundation Engineering

Professional Experience

Dr. Wardwell's nearly 15 years of geotechnical, and groundwater engineering experience have stressed hydrogeologic investigations, earthwork stability, design of waste disposal systems, and evaluation of groundwater facility design for industry.

His hydrogeologic experience includes site investigations, detailed aquifer definition, extensive field testing programs, design applications, and evaluation of dewatering systems and containment barriers. He has had significant experience evaluating the impacts of partially saturated groundwater flow conditions on contaminant transport and the engineering behavior of soil and rock. His solid waste management experience includes: evaluating and designing waste disposal facilities for a variety of solid waste materials, including municipal wastes, pulp and papermill sludges, coal ash, all types of mill tailings, low-level nuclear waste, and a variety of hazardous waste materials. This work has included initial site feasibility studies, engineering behavior and stability of the waste deposits, and geohydrologic design considerations relating to the control and containment of potential releases from these sites.

His areas of specialization relating to the hydrogeologic and geotechnical behavior of waste materials include:

- Project engineering manager responsible for the entire set of baseline groundwater and geohydrologic studies conducted at a proposed open pit copper mine. This work included supervising the geohydrologic drilling of the volcanic basalts, granites and massive sulfides, placement of monitoring wells in mineral explorations exceeding 1,000 feet, development of detailed hydrologic studies conducted in three separate hydrologic zones and supervision, and interpretation of long term pump tests in deep bedrock wells.

- Investigating the physical characterization at several solid and hazardous waste landfill sites. The investigation included explorations, sampling and testing of embankment and foundation materials to evaluate their engineering behavior during operation and reclamation,

and development of hydrogeologic models to estimate impacts. Testing included identification, shear-strength compressibility testing of both saturated and partially saturated waste materials. Based on this characterization, each site's short-term and long-term stability was evaluated.

- Evaluating the design procedures associated with the development of a deep underground coal mine. This project included core sampling, bore hole geophysics, and hydrologic testing of four distinct subsurface water bearing zones at depths exceeding 1,500 feet to evaluate the significance of both the geotechnical properties of the strata and the hydrologic conditions in regards to their impacts on the proposed mine design.

- Assisting industry clients in obtaining state and federal approval for the landfill designs of waste materials. This work related to the overall operation, reclamation planning and implementation to meet current regulations. Investigations included the field and laboratory characterization of the hydraulic and engineering properties of waste materials and foundation consolidated strata.

- Principal groundwater consultant for the development of a proposed Diamond Mine responsible for the collecting of baseline geohydrologic data in addition to estimating the groundwater flows into the proposed audits. This work included the drilling of hard rock granites and kimberlites, completion of groundwater monitoring and testing wells in three different strata, field testing of these wells and the interpretation of the results.

- Developing a cost-effective final reclamation plans for several tailings impoundments. Emphasis was given to the investigation of internal tailings stability, design of the reclamation cover, evaluation of long-term stability, development of seepage models, prediction of long-term water quality, and development of the necessary license documents to obtain regulatory acceptance of the reclamation plan.

- Performing surface and groundwater characterization studies over a 5-mile segment of a major river valley in Colorado in conjunction with the proposed expansion of two underground coal mines. Monitoring wells were designed and installed in the river valley alluvium and contiguous bedrock; aquifer tests were conducted and interpreted, and water quality was analyzed. The results were interpreted to provide predictions of potential adverse environmental impacts to regional and local water resources.

Publications and Presentations

Dr. Wardwell has authored over 20 published technical papers on the topics of field behavior of waste materials, water movement in materials, and the geotechnical behavior of earthen structures.

Wardwell, Nelson, Abt, and Staub (1984), "Review of In-Situ Dewatering and Consolidation of Uranium Mill Tailings," Proceedings, 6th Symposium on UMTM, CSU.

McWhorter, D.B., J.D. Nelson, T.A. Shepherd and R.E. Wardwell (1983), "Role of Partially Saturated Soil in Liner Design for Hazardous Waste Disposal Sites," Role of the Unsaturated Zone in Radioactive and Hazardous Waste Disposal, Ann Arbor Science.

Wardwell, Nelson and McWhorter (1982), "Water Movement in Waste Piles from Surface Mining," 1982 Symposium on Surface Mining Hydro. and Sediment, University of Kentucky, Lexington.

Nelson, Volpe, Wardwell, Schum, and Staub, Design Considerations for Long-Term Stabilization of Uranium Tailings Impoundments, USNRC, NUREG/CR-3204, Washington, D.C.

Wardwell and Nelson (1981), "Settlement of Sludge Landfills with Fiber Decomposition," 10th ICSMFE, Sweden.

Wardwell, R.E., S.E. Walker, and J.A. Atwell, "Geotechnical Aspects of Papermill Sludge Disposal," Geotechnical Practice for Disposal of Solid Waste Materials, ASCE, 1977, pp. 756-772.

Wardwell, Richard E., Stuart R. Cooper, and Wayne A. Charlie, "Papermill Sludge Landfill Disposal - Geotechnical Design Applications," TAPPI Journal, Vol. 61, No. 12, December 1978, pp. 71-76.

Charlie, W.A., R.E. Wardwell, and O.B. Anderland, "Leachate Generation from a Sludge Disposal Area," Journal of the Environmental Engineering Division, ASCE. Vol. 105, EE5, Proc. Paper 14884, October 1979, pp. 947-960.

Wardwell, R.E., "Geotechnical Design Considerations of Papermill Sludge Landfill Areas," Transactions of the Technical Section, Vol. 7, No. 3, Canadian Pulp and Paper Association, September 1981.

Wardwell, van Zyl and Wong (1985), "Field Behavior of Tailings Subjected to Reclamation Cover," 11th ICSMFE, San Francisco.

Wardwell, R.E., W.A. Charlie, and K.A. Doxtader, "Testing Method to Determine Potential for Fiber Decomposition in Organic Soils," Testing of Peats and Organic Soils, ASTM STP 820, pp. 218-229.