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WORK PLAN

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

CANNONS ENGINEERING CORPORATION SITE
BRIDGEWATER, MASSACHUSETTS

EPA WORK ASSIGNMENT
NUMBER 27-1L27
CONTRACT NUMBER 68-01-6699

NUS PROJECT NUMBER 0737.01

FEBRUARY 1984

SUBMITTED FOR NUS BY:

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1.0 WORK PLAN SUMMARY

1.1 Objectives of Study

The objectives of this Remedial Investigation/Feasibility Study (RI/FS) at the Cannons Engineering Corporation (CEC) Bridgewater Site are as follows:

- To more fully delineate the extent and nature of contamination in the vicinity of the site.

- To determine the extent of remedial action necessary to mitigate the potential threat from this contamination.

- To identify a list of potential remedial actions for the CEC Bridgewater Site and to evaluate the appropriateness and applicability of these actions.

- To recommend the most appropriate remedial action alternative(s) to prevent further contamination of environmental pathways and to mitigate existing contamination.

During the Remedial Investigation, additional data will be collected which are necessary to fully characterize the extent of contamination and to identify and evaluate potential remedial measures. The Feasibility Study evaluates the appropriateness of various remedial measures and assesses their cost-effectiveness.

1.2 Scope of Work

The CEC Bridgewater RI/FS will be subcontracted in whole or in part by NUS Corporation as the EPA Zone 1 Superfund Contractor. Overall project management and coordination will be the responsibility of NUS Corporation. The NUS Project Management Work Plan is outlined in Section 4.

Several assumptions have been used in the preparation of the Work Plan scope and costs. These assumptions include the following:

- All of the drums previously stored above-ground on site have been removed as part of the cleanup action initiated by the Massachusetts Department of Environmental Quality Engineering (DEQE) and conducted by Jet Line Services, Inc.

- All of the liquid and sludge wastes stored in onsite tanks were removed by the cleanup action performed by Jet Line Services, Inc.

- Level D protection will be used for most onsite work, with the posssible exception of activities involving entering onsite buildings and inspecting onsite tanks. The level of protection may be changed if air monitoring conducted during the initial phases of onsite work indicates that a potential respiratory hazard exists; in such an event, a higher level of protection may be required, resulting in adjustments to costs and schedules.

- The area of investigation will be limited to the immediate vicinity of the site, with the exception of the residential well survey, which will monitor wells within a 1.1-mile radius.

- The RI/FS will evaluate and use all data obtained during previous investigations on site.

- The costs of analytical services (with the exception of Sorbent Tube Analysis) were not computed in the total cost of the RI/FS. It is assumed that analytical costs will be covered by the CLP program.

- Detailed evaluation of remedial alternatives will be limited to those alternatives deemed appropriate to this site. This determination will be based on a screening analysis of all potential alternatives. The budget is based on the current understanding of site conditions which do not indicate a high level of complexity. If the results of the Remedial Investigation indicate a greater level of complexity than presently perceived, the Feasibility Study work plan will be accordingly developed and the appropriate level of effort projected.

- Tasks 1 through 28 will be peformed by a Pool Subcontractor.

The RI/FS for the CEC Bridgewater Site has been divided into 3 general phases and 28 detailed tasks. The phases and tasks are as follows:

Phase I - Initial Activities

Task 1	RI/FS Work Plan Review
Task 2	Project Management
Task 3	Community Relations Support Functions
Task 4	Collect and Evaluate Existing Data
Task 5	Health and Safety General Site Reconnaissance
Task 6	Procure Permits, Rights of Entry, and other Authorization Requirements
Task 7	Subcontractor Procurement
Task 8	Prepare Topographic Map
Task 9	Site-Specific Health and Safety Requirements
Task 10	Site-Specific Quality Assurance Requirements
Task 11	Site Operations Plan
Task 12	Field Equipment Mobilization

Phase II - Remedial Investigations

Task 13	Ground Survey
Task 14	Collect Residential Well Data
Task 15	Waste Sampling
Task 16	Surface Soil Sampling
Task 17	Surface Water and Sediment Sampling
Task 18	Subsurface Investigation (Borings)

Task 19 Perform Groundwater Sampling of Monitoring Wells and Residental Wells
Task 20 Data Reduction and Evaluation
Task 21 Identify Preliminary Remedial Technologies
Task 22 Prepare RI Report and FS Work Plan

Phase III - Feasibility Study

Task 23 Identification and Development of Alternatives
Task 24 Initial Screening of Alternatives
Task 25 Laboratory and Field Studies Work Plan
Task 26 Evaluate Remedial Alternatives and Prepare Preliminary Feasibility Study Report
Task 27 Conceptual Design
Task 28 Final Feasibility Study Report

All tasks included in this Scope of Work are described in Section 3.0, Technical Approach.

1.3 Manpower Estimates and Costs

The level of effort (man-hours) required for each of the three phases of the CEC Bridgewater Site RI/FS is as follows:

- Phase I - Initial Activities - 1632 man-hours
- Phase II - Remedial Investigations - 1792 man-hours
- Phase III - Feasibility Study - 1876 man-hours

A total of 5300 man-hours will be required for the pool-subcontracted work. The total for Phase III, Feasibility Study, does not include man-hours needed to perform any laboratory and field studies which may be required. The manpower estimate for these studies will be determined during the preparation of the laboratory studies work plan. The NUS manpower commitment for project management and coordination of the RI/FS activities is 1891.

The man-hours and costs estimated for the RI/FS are presented in Section 5.0. This estimate is for the Scope of Work described in Section 3.0. The estimates were made using assumptions for drilling, sampling, analyses, and mapping subcontract amounts which could change with time. The costs presented should be valid for 90 days from the submittal of this plan.

The total cost for the performance of the RI/FS has been estimated at $377,273 excluding CLP costs. Higher levels of personnel protection than those anticipated during preparation of this Work Plan may result in a substantial increase in the cost of the Remedial Investigation. CLP costs for the RI are anticipated to be $111,000.

1.4 Schedule

It is estimated that the RI/FS for the CEC Bridgewater Site will take 11 months to complete following approval of the Work Plan and authorization to begin work. Due to the availability of existing data and the relatively short period of performance, individual tasks in the RI and FS will be integrated and overlapped.

The RI/FS schedule has been developed assuming a 6-week turnaround of analytical results from EPA's Contract Laboratory Program (CLP). Also, the EPA and the Massachusetts Department of Environmental Quality Engineering (DEQE) review time of draft and final reports is estimated at 1 to 3 weeks (task specific). A delay in laboratory turnaround or review by EPA or DEQE may result in a substantial increase to the schedule and/or budget.

This schedule also assumes expedient procurement of necessary permits and authorizations, favorable response times from subcontractors, and adequate weather conditions for the conduct of the site activities without excessive delays.

It is emphasized that the foregoing cost and the manpower estimates do not contain any provision for conducting laboratory or field studies. If such studies are found to be necessary, a separate work plan will be prepared, along with an estimated cost to perform the studies.

Similarly, the impact upon that portion of the schedule which is dependent upon the laboratory and field studies cannot be defined until the laboratory and field studies work plan has been prepared under Task 25.

2.0 PROBLEM ASSESSMENT

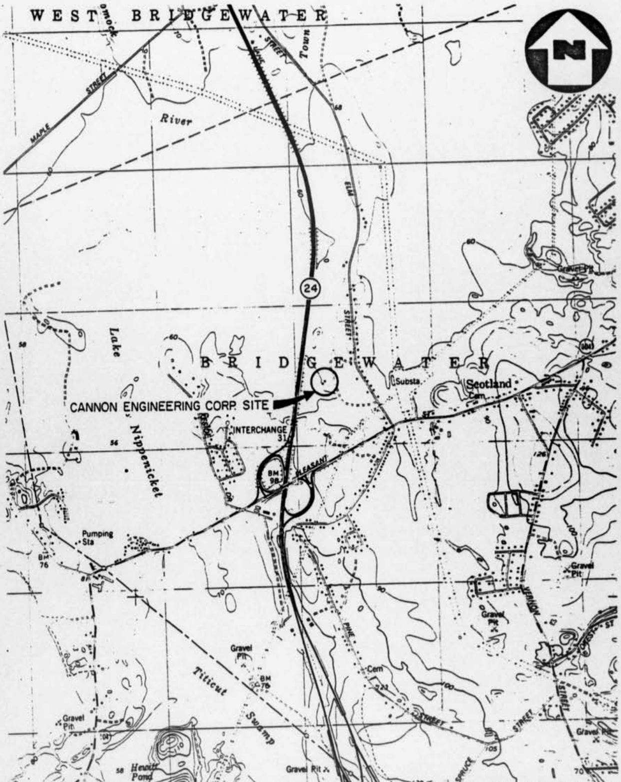
2.1 Site History and Description

The Cannons Engineering Corporation (CEC) Bridgewater Site was a hydrocarbon storage and incineration facility located in the western portion of Bridgewater, Plymouth County, Massachusetts, approximately 25 miles due south of Boston. The site is located at approximately 41°58'30" latitude and 71°01'30" longitude on 3 acres belonging to CEC and approximately 1 acre of the south adjoining lot currently owned by Benson Realty Trust. The site is located on First Street in the Bridgewater Industrial Park in the Town of Bridgewater. First Street is accessible from Route 24 and Route 104 (Pleasant Street) via Elm Street. The site is situated in a low-lying swampy area and is built on a back-filled wetland. Figure 2-1 illustrates the general location of the CEC Bridgewater Site.

The site was used in the past to store bulked wastes in tanks and drums for onsite incineration. The fact that spillage and leakage of waste has occurred on site has led to contamination of the soil in certain areas and possible contamination of the surface water and shallow groundwater on site. However, it is not suspected that the site was used as a direct disposal receptor for such activities as landfilling or direct discharge of wastes. The primary concerns for the CEC Bridgewater Site include: airborne contamination; direct human or animal contact with contaminated soil and surface water; and groundwater contamination.

In February of 1974, a site assignment was granted by the Board of Health for Lot 4 on First Street (now the CEC Bridgewater Site). This lot had previously been granted provisions by the Bridgewater Board of Selectmen Licensing Authority for use as a storage area for hydrocarbons.

CEC purchased this property from Benson Realty Trust in November 1974. Between 1974 and 1980 CEC constructed a hydrocarbon storage facility and began incinerating combustible materials on site.



BASE MAP IS A PORTION OF THE U.S.G.S. TAUNTON, MA QUADRANGLE (7.5 MINUTE SERIES, 1978, CONTOUR INTERVAL 10').

FIGURE 2-1

LOCATION MAP
CANNONS ENGINEERING SITE, BRIDGEWATER, MA
SCALE: 1" = 2000'

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CEC applied for and received two annual licenses from the Massachusetts Department of Environmental Quality Engineering (DEQE) in 1978 and 1979 to operate a Hazardous Waste Collection and Disposal Facility. The materials to be conveyed, stored, or disposed of were hydrocarbon liquids, aqueous liquids, solids, and sludges. Pesticides were included in the 1979 license, but neither license included handling PCBs.

In June of 1980, CEC's 1979 hazardous waste license was revoked by the Massachusetts Executive Office of Environmental Affairs (EOEA) amid allegations in the press that CEC had engaged in illegal dumping. In its revocation, the EOEA stated that CEC had submitted false monthly reports for every month from October 1978 to March 1980. EDEA claims that CEC reported incinerating quantities of hazardous waste far in excess of the actual quantities incinerated and failed to report the delivery of hazardous waste to persons not licensed to handle hazardous waste. CEC indicated receiving hazardous waste from a company named Chem-Waste, Inc. when in fact it had received no such waste.

Furthermore, CEC was required to retain the services of a contractor to prepare a plan for removal and disposal of all hazardous wastes.

Since 1980, various cleanup activities have been performed at the site including incineration or removal of, surface drums. Nevertheless, available information indicates that additional remedial actions may be required.

Figure 2-2 illustrates the layout of the CEC Bridgewater Site as described in the most recent available information. The following is a list of the major structures currently on the site:

- Tank farm building, which contains 11 tanks with a total capacity of 165,000 gallons

- Ready building, which contains 4 tanks with a total capacity of approximately 50,000 gallons

KEY TO EXISTING FACILITIES:

- A 30,000 GAL. TANK (APPARENTLY UNUSED)
- B TRANSPORT TRAILERS
- C DRUM STORAGE AREA
- D LOADING DOCK
- E CONCRETE PAD
- F TANK FARM BUILDING
- G SITE STORM DRAINAGE DISCHARGE
- H 30,000 GAL. TANKS (APPARENTLY UNUSED)
- J INCINERATOR
- K FUEL TANK
- L INCINERATOR BUILDING
- M SEPTIC TANK
- N OFFICE
- P EQUIPMENT BUILDING
- R BOX TRAILERS
- S VENTED UNDERGROUND VAULT
- T READY BUILDING

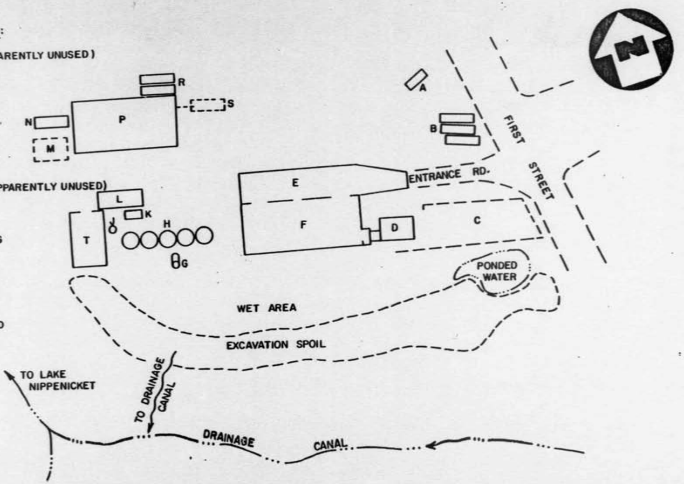

FIGURE 2-2

SITE LAYOUT MAP

CANNONS ENGINEERING SITE, BRIDGEWATER, MA

NOT TO SCALE

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- Incinerator, fuel tank, and adjacent building

- Equipment building

- Six outdoor surface tanks (approximately 30,000 gallons each)

- Miscellaneous items such as two box trailers, three tankers, one flatbed, an underground vault and other smaller items

The site is currently fenced on the east side bordering First Street; however, it is not fenced on the south, west or north sides. This circumstance provides ready access to animals and the public. Because the site borders wet areas on the south and west sides and is fenced on the east, it is not considered an attractive location for trespass by motorbike or foot. In addition, the site is not in a highly populated area.

2.2 Nature and Extent of Problem

2.2.1 Previous Site Conditions

As described in Section 2.3, considerable cleanup activities have been performed at the CEC Bridgewater Site, including the removal of onsite drums, the removal of material from the bulk storage tanks, and the excavation of some contaminated soil. Soil contamination may still exist as a result of the documented spillage from drums and bulk storage tanks as well as incidental spillage from cleanup efforts. Sufficient levels of contamination may still be present in the soil to affect water supplies in the area and to present a risk to human health from contact with moderate levels of toxic or carcinogenic compounds. Therefore, an explanation of the materials that were stored on site is necessary so that some inference can be made as to the existing contamination.

Because the hazardous waste manifest system was not activated prior to late 1980, there are no manifests available for the CEC Bridgewater operation. In addition, a comprehensive list of materials and the methods of disposal are also absent.

According to CEC's 1979 license for Hazardous Waste Collection and Disposal issued by EOEA, CEC was licensed to store the following:

(A) Hydrocarbon Liquids - motor oils; industrial oils and emulsions; solvents, lacquers, etc.; and organic chemicals

(B) Aqueous Liquids - organic chemicals; inorganic chemicals; and cyanide and plating waste

(C) Solids and Sludges - chemical compounds; clay and filter media with chemicals; plating sludge; and oily solids

(D) Special Hazards - pesticides

During full operation, CEC handled between 2.5 (1979 CEC permit application) and 5.5 (1980 CEC permit application) million gallons annually of a variety of wastes, storing them in at least three separate locations, as indicated below:

Location	Capacity (Gallons)
First Street - Bridgewater, MA	480,000
350 Main Street - West Yarmouth, MA	70,000
Cordage Park - Plymouth, MA	950,000

The West Yarmouth and Plymouth sites have been considered under separate agency actions and generally are not referenced in this document.

As seen in the site layout diagram (Figure 2-2), there are four buildings on site labeled as follows:

- Tank farm building
- Ready building
- Incinerator building
- Equipment building

Within the tank farm and ready buildings are the (15) tanks most recently used to hold liquid waste. In addition, waste may have been stored in a vented underground vault which is believed to be connected to a drain in the floor of the equipment building, and in tank trucks at the east end of the site. Approximately 400 deteriorating drums were kept at various locations throughout the site, including the drum storage area, the tank farm building, and, most recently, the equipment building. The drums have since been removed. The five vertical 30,000-gallon storage tanks located between the tank farm building and the ready building have reportedly never held waste.

In July 1980, CEC performed a waste inventory at the site. Roughly 230,000 gallons of sludge and liquid wastes were reported as being stored in the 11 tanks inside the Tank Farm Building and in the 4 tanks inside the Ready Building. No wastes were reported present in the outdoor storage tanks.

In October 1982 Jet Line Services, Inc., began cleanup operations at the site. In an inventory of wastes removed from the site, Jet Line reported that roughly 155,000 gallons of sludge and liquid wastes were removed from the site. Coupled with the approximately 45,000 gallons of waste incinerated in November 1980, it can be calculated that about 200,000 gallons of waste have been removed from the site or roughly 30,000 less than was reported in the June 1980 inventory. This difference could be the result of wastes remaining on site, inaccuracies in inventory reporting, or undocumented waste disposal activities. For a more detailed description of the waste inventories, refer to Section 1 of the Remedial Action Master Plan prepared for the site by Camp Dresser and McKee (CDM) (1983).

In 1979, CEC submitted notification to EPA, in compliance with Section 3010 of RCRA (Resource Conservation and Recovery Act), stating that CEC and its sister company, Cannons Engineering (CE) of West Yarmouth, Massachusetts were engaged in the generation, transportation, treatment, storage, and disposal of hazardous wastes. Included with this notification was a list of all wastes supposedly handled at each facility. Table 2-1 lists the wastes reportedly handled at CEC Bridgewater, and Table 2-2 lists those wastes reportedly handled at West Yarmouth. Although the West Yarmouth facility is owned by a

TABLE 2-1

LIST OF WASTES HANDLED AT CEC BRIDGEWATER[1]
(Circa Nov. 1980)

Hazardous Waste Code	Hazardous Waste Stream or Substance
D000	Any Combination of Waste D004 through D007 (Arsenic, Barium, Cadmium, Chromium)
D001	Non-listed Ignitable Wastes
D003	Non-listed Reactive Wastes
F001	Spent Halo Chlorides & Sludge Fm. Gray Iron Foundries
F002	Halo Solv. and Rel. Still Bottoms
F003	Non-Halogenated Solv. and Solv. Rec. Still Bottoms
F004	Non-Halogenated Solv. and Solv. Rec. Still Bottoms
F005	Non-Halogenated Solv. and Solv. Rec. Still Bottoms
F006	Electroplating Treat Sludge
F007	Spent Bath Solu. Fm Electroplating Oper.
F008	Sludges Fm Bottom of Bath Fm. Electroplating Oper.
F009	Spent Strip & Clean Bath Solu. Fm. Electroplating Oper.
F012	Wastewater Treatment Sludge Fm. Metal Heat Treating Oper.
F017	Paint Residues Generated from Industrial Painting
F018	Wastewater Treatment Sludge Fm. Industrial Painting
K058	Wastewater Treat. Sludge Fm. Leather Tanning/Finishing
K059	Wastewater Treat. Sludge From Leather Tanning/Finishing
K078	Solvent Cleaning Wastes from Paint Manufacturing
K079	Water Cleaning Wastes from Paint Manufacturing
K081	Wastewater Treatment Sludge from Paint Manufacturing
K082	Air Pollution Control Sludges from Paint Manufacturing
K086	Sludges/Wastes from Tub Washers (Ink Formulation)
P008	4-Aminopyridine or Avitrol, Philips 1861
P053	Ethylenediamine
P086	Oleyl Alcohol Condensed W/2 Moles Ethylene Oxide
P090	Pentachlorophenol (includes 17 varieties of product)
P100	1,2-Propanediol
P102	2-Propyn-1-01 or Propargyl Alcohol

[1]Excerpt from EPA Region I RCRA Notification Document SW 897.1 Dec. 1980; at the time of notification, CEC Bridgewater was listed as a generator (Gen.), transporter (Trans.) and Treatment, Storage or Disposal Facility (TSDF).

TABLE 2-2

PARTIAL LIST OF WASTES HANDLED AT CANNON ENGINEERING IN WEST YARMOUTH[1]
(Circa Nov. 1980)

Hazardous Waste Code	Hazardous Waste Stream or Substance
F010	Quench Oil Bath Sludge from Metal Heat Treating Oper.
F014	Wastewater Treat. Tailing Pond Sed. from Min. Met. Rec. Oper.
F015	Spent Cyanide Bath Solu. from Min. Met. Rec. Oper.
P005	Allyl Alcohol or Megatox
P024	P-Chloroaniline
P077	P-Nitroaniline
U001	Acetaldehyde
U002	Acetone (I)
U003	Acetonitrile (I,T) or Cyanomethane
U004	Acetophenone
U007	Acrylamide
U014	Auramine* 4-4-(Imidocarbonyl)BIS(N,N-Dimethyl)Aniline
U019	Benzene
U021	Benzidine
U031	N-Butyl Alcohol
U032	Calcium Chromate
U037	Chlorobenzene
U038	Chlorobenzilate
U039	P-Chloro-M-Cresol
U044	Chloroform (I,T)
U047	2-Chloronaphthalene
U048	2-Chlorophenol
U049	4-Chloro-O-Toluidine Hydrochloride
U050	Chrysene
U051	Creosote
U052	Creosols
U055	Cumene
U056	Cyclohexane (I)
U057	Cyclohexanone (I)
U069	Di-N-Butyl Phthalate
U070	1,2-Dichlorobenzene
U071	1,3-Dichlorobenzene
U072	1,4-Dichlorobenzene
U073	3,3-Dichlorobenzidine or C.I. 23060* 3,3-Dichloro-4-4-Diaminobiphenyl
U076	1,1-Dichloroethane
U077	1,2-Dichloroethane

TABLE 2-2
PARTIAL LIST OF WASTES HANDLED AT CANNON ENGINEERING IN WEST YARMOUTH[1]
(Circa Nov. 1980)
PAGE TWO

Hazardous Waste Code	Hazardous Waste Stream or Substance
U080	Dichloromethane
U081	2,4-Dichlorophenol
U082	2,6-Dichlorophenol
U083	1,2-Dichloropropane
U084	1,3-Dichloropropene
U088	Diethyl Phthalate
U089	Diethylstilbestrol
U090	Dihydrosafrole
U091	3,3'-Dimethoxybenzidine
U092	Dimethylamine
U093	P-Dimethylaminoazobenzene
U094	7,12-Dimethylbenz(A)Anthracene
U095	3,3'-Dimethylbenzidine
U101	2,4-Dimethylphenol
U102	Dimethyl Phthalate
U104	2,4-Dinitrophenol
U107	Di-N-Octyl Phthalate
U108	1,4-Dioxane
U110	Dipropylamine
U112	Ethyl Acetate (I)
U113	Ethyl Acrylate (I)
U118	Ethyl Methacrylate
U127	Hexachlorobenzene
U128	Hexachlorobutadiene
U132	Hexachlorophene
U140	Isobutyl Alcohol
U141	Isosafrole
U154	Methanol or Methyl Alcohol
U158	4,4'-Methylene-BIS-(2-Chloroaniline)
U159	Methyl Ethyl Ketone
U161	Methyl Isobutyl Ketone
U162	Methyl Methacrylate
U165	Naphthalene
U166	1,4-Naphthoquinone
U168	2-Naphthylamine
U170	4-Nitrophenol
U181	5-Nitro-O-Toluidine
U184	Pentachloroethene

TABLE 2-2
PARTIAL LIST OF WASTES HANDLED AT CANNON ENGINEERING
IN WEST YARMOUTH[1]
(Circa Nov. 1980)
PAGE THREE

Hazardous Waste Code	Hazardous Waste Stream or Substance
U185	Pentachloronitrobenzene or PENB
U187	Phenacetin
U190	Phthalic Anhydride
U191	2-Picoline
U200	Reserpine
U201	Resorcinol
U202	Saccharin/1,2-Benzisothiazolin-3-1,1,1,-Dioxide
U203	Safrole
U207	1,2,4,5-Tetrachlorobenzene
U208	1,1,1,2-Tetrachloroethane
U209	1,1,2,2-Tetrachloroethane/Acetylene Tetrachloride
U210	Tetrachloroethane*
	PERC
	Perchloroethylene
	Tetrachloroethylene
U211	Tetrachloromethane or Carbon Tetrachloride
U212	2,3,4,6-Tetrachlorophenol
U213	Tetrahydrofuran (I) or 1,4-Epoxybutane
U219	Thiourea
U220	Toluene
U221	Toluenediamine
U222	O-Toluidine Hydrochloride
U226	1,1,1-Trichloromethane*
	Aerothene TT
	Chloroethene NU
U228	Trichloroethene*
	Acetylene Trichloride
	Trichloroethylene
	Tri-Clene
U230	2,4,5-Trichlorophenol
U231	2,4,6-Trichlorophenol
U232	2,4,5-Trichlorophenoxyacetic Acid (2,4,5-T)
U239	Xylene

[1]Excerpt from EPA Region I RCRA Notification Document SW 897.1 Dec. 1980

different Cannon company, reference was made in a May 4, 1981 site visit memorandum by Ron White of DEQE that "A tanker from Cannon's Engineering Yarmouth facility had delivered 5000 to 6000 gallons of waste oil to the Bridgewater facility and placed such into a storage tank in the tank storage building." As seen in Tables 2-1 and 2-2, the West Yarmouth facility was listed as handling a much broader spectrum of waste types than Bridgewater. Because a transfer of waste from West Yarmouth to Bridgewater has been documented, this expanded list should be assumed for the Bridgewater facility. Three specific substances known for their toxicity or carcinogenicity and listed as being handled by the West Yarmouth company but not listed for the Bridgewater facility are 2,4,5-Trichlorophenoxy-acetic acid, Chlorobenzene, and Benzidene. These substances may be present at the CEC Bridgewater Site as the result of the one documented transfer and possibly other undocumented transfers of waste.

2.2.2 Existing Site Conditions

Contaminants have been found in soil, water, and air samples collected at various locations throughout the site. Subsequent to the closure of the facility in November 1980, several sets of soil, water, and waste samples were collected for analysis by representatives of DEQE and the Town of Bridgewater. The analytical results for these samples are discussed in Section 2.4.4.

On July 19, 1982, the Field Investigation Team (FIT) performed a site inspection of the CEC Bridgewater Site. Three groundwater, two surface water, and one soil samples were collected at the site. Also, one groundwater sample was collected from a private well north-northeast of the site (444 Elm Street). The results were obtained by head-space analysis using an organic vapor analyzer (OVA) and are also discussed in Section 2.4.4. Other observations recorded at the site during the FIT visit included the following:

- Ambient air volatile organic concentrations of 4 to 5 parts per million (ppm) were recorded. Downwind of the site and in areas of soil contamination, levels of 1-2 ppm above ambient air levels were recorded on the OVA.

- The ponded water located west of First Street and south of the drum storage area had globules of oil on its surface. Head-space analysis using an OVA did not show contamination by volatile organics; however, extractable organics may be present.

- An oily sheen was observed on the swamp located west of the site. Again, head-space analysis using an OVA did not detect any volatile organics; however, extractable organics could be present.

- Areas of stained soil were evident on the site.

The most current set of data defining the degree and extent of contamination at the site are the results of the soil samples collected during November 1982 by DEQE. These samples were collected to define which areas of the site, if any, should be excavated. An outline of the soil sampling plan, a sketch of the sample locations, and the analytic results are presented in Appendix A and are discussed in Section 2.4.4. As a result of insufficient evidence of grossly contaminated soil from this and previous samplings, DEQE declined to excavate soil from the site under the waste removal contract.

On August 17, 1983, NUS personnel conducted a site visit for purposes of the preparation of this Work Plan. The following observations were made:

- No surface drums were observed on site, verifying their removal by Jet Line Services.

- No wastes were observed in the five 30,000-gallon tanks located between the ready building and the tank farm building. OVA readings taken inside these vessels were negative.

- The area north of the concrete pad and in the vicinity of the equipment building appeared to be backfilled wetlands, although the nature of the fill material is unknown.

- Soils in the vicinity of the tank farm building loading dock were stained.

- Soils and rocks in the vicinity of the former drum storage area appeared to be iron stained.

The tank farm building, ready building, and equipment building could not be entered; therefore, the status of these buildings could not be evaluated. In general, based on the visual observations, the site did not appear to be in an imminently dangerous condition.

2.2.3 Potential Receptors

The primary routes for offsite migration of contaminants are via groundwater and surface runoff. Surface water and groundwater flow are both presumed to travel southwest from the site to Lake Nippenicket. Although most area residents are supplied by town water, there are several private residential wells located within 1 mile of the site. These residential wells generally lie north, south, and west of the site, and are possibly in the direction of groundwater flow. The Bridgewater Board of Health lists approximately twelve wells within 1.1 miles of the site which are capable of supplying domestic water.

If the flow direction of surface and groundwater is toward Lake Nippenicket, then a hydraulic gradient may exist between the CEC Bridgewater Site, which drains to the lake, and the Raynham Water District well located adjacent to the lake. Also, since Lake Nippenicket is used for fishing, boating, and general recreation, there is the potential for human exposure to contaminants as a result of direct contact with lake water or ingestion of fish from the lake.

In addition to offsite receptors, there is the potential for exposure to the contaminated soils on site since fencing only exists along the eastern side of the site. This exposure may be in the form of direct human contact with contaminated soil or water on the site, or in the form of bioaccumulation in the food chain as a result of wildlife being directly exposed to contaminated soil or water from the site.

2.3 History of Response Actions

In June of 1980, CEC's 1979 Hazardous Waste License was revoked by the Massachusetts Executive Office of Environmental Affairs (EOEA) amid allegations that CEC had engaged in illegal dumping. The EOEA reported that CEC had submitted false monthly reports, had failed to report the delivery of hazardous waste to persons not licensed to handle hazardous waste, and had claimed to receive hazardous waste from a company named Chem-Waste, Inc., when in fact it had received no such waste. CEC was required to retain the services of a contractor to prepare a plan for removal and disposal of all hazardous wastes on site.

Following various court actions, CEC was allowed to retrofit the onsite hazardous waste incinerator in order to comply with the court's order to liquidate all waste currently being retained at the Bridgewater site. Following the retrofit, a successful test-burning of approximately 45,000 gallons of liquid waste occurred in November, 1980. During November 1980, the court-appointed receiver for the site informed the court that approximately $200,000 would be needed to incinerate or dispose of the waste at the site. The court ordered that incineration continue until available money ran out.

Apparently CEC applied for a Small Business Administration (SBA) loan that would have been sufficient to fund the incineration of the existing inventory, but CEC's felony indictment of illegal dumping made the Corporation ineligible for an SBA loan. On November 28, 1980, CEC closed.

DEQE inspections in January and February of 1981 revealed the presence of leaking drums. DEQE sent a disposal contractor to clean or contain the spilled waste and employ temporary measures to prevent further leaking. From February to July 1981, SCA Services attempted to take over or purchase the CEC facility if compliance with Chapter 21D of Massachusetts General Law (Hazardous waste facilities siting regulation) was not required. SCA Services did not pursue purchase or takeover following the determination by DEQE that compliance would be required. During May 1981, DEQE detected additional leaking drums. Soils and water samples were collected which contained chemical contamination, the results of which are discussed in Section 2.4.

In June 1981, hazardous waste site ranking was performed on the CEC Bridgewater Site. The site's model ranking score was 58.37 out of a worst possible score of 100.

In July 1981, Tank No. 1 was found to be leaking. Subsequently, the State Division of Water Pollution Control declared that an emergency existed at the Bridgewater Site and DEQE submitted the CEC Bridgewater Site to the EPA for "Superfund" assistance. The contents of Tank No. 1 were subsequently transferred to five other tanks on site (Tanks No's. 2, 6, 8, 10 and 11).

Additional documentation of the diversity of hazardous waste activities conducted at the CEC Bridgewater Site occurred in September 1981. At this time the State initiated emergency action which resulted in the inventorying and repackaging of several drums of laboratory chemicals. This action was performed by Jeffery Dill of Recycling Industries for Jetline Services. Mr. Dill referenced the fact that "oxidizers were mixed with flammables and corrosives, cyanide salts were present in almost every container and the containers were not D.O.T. approved for the material contained within." Further reference was made to the use of inappropriate containers and packing materials that presented a potential for spontaneous combustion.

In July 1982, soil samples collected by the FIT showed elevated levels of organic contaminants, the results of which are discussed and summarized in Section 2.4.4.

Jet Line Services, Inc., was contracted by the DEQE on October 15, 1982, for the cleanup of two CEC hazardous waste sites, one in Bridgewater and one in Plymouth. Cleanup activities were initiated at the CEC Bridgewater Site on

October 18, 1982 and were completed in mid-December 1982. The combined contract upper limit for both Bridgewater and Plymouth sites is $725,000.

The cleanup activities conducted by Jet Line at the CEC Bridgewater Site included sampling, repackaging, and removing all drums from the site. Additionally, the materials in the bulk storage tanks on site were pumped from the tanks and disposed of off site. The bulk storage tanks were then cleaned. Also, excavation of grossly contaminated soil was planned during the cleanup.

Because of the waste removal and cleanup activities conducted at the CEC Bridgewater Site, and the results from the most recent soil analyses, DEQE now considers the site to be free of containerized hazardous waste and highly contaminated soil. The actions to date, however, do not necessarily alleviate the dangers associated with historical contamination of soil or groundwater by the hazardous waste.

In December 1982, the CEC Bridgewater Site was listed as one of 418 hazardous waste sites on the National Priorities List; therefore, the site is eligible for cleanup funding under "Superfund."

2.4 <u>Previous Investigations and Evaluation of Existing Data</u>

2.4.1 Geology and Soils

The CEC Bridgewater Site is located in the New England Physiographic Province. The site generally has about a 3% slope to the southwest and lies approximately 65 feet above mean sea level (MSL). It is bordered to the south and west by swamp lowlands. There are two lithologic units of importance underlying the site: unconsolidated overburden of glacial origin and bedrock. The unconsolidated glacial overburden is composed predominantly of stratified beds and lenses of well sorted fine to coarse sandy gravel. Numerous beds and lenses of sand, silt, and clay are interbedded in the gravel. At least part of the site appears to have been filled with offsite soils. The Field Investigation Team (FIT) report listed the soil type for the site as a well-sorted, fine to coarse sandy gravel with a permeability of 10^{-3} to 10^{-5} cm/sec.

The unconsolidated sediments are underlain by the Rhode Island Formation, which is sedimentary. It is composed of shale, slate, sandstone, and conglomerate and includes beds and lenses of coal, felsite, agglomerate, and arkose. From geologic reports published for the Taunton River Basin, the depth to bedrock appears to range from 35 to 70 feet.

2.4.2 Groundwater

The CEC Bridgewater Site lies within the Taunton River Basin of southern Massachusetts. The principal aquifer system is stratified, unconsolidated glacial drift, consisting of gravel, sand, silt, and clay. About 20 percent of the area of the Taunton Basin aquifer system is underlain by relatively impermeable lacustrine clay, silt, and fine sand; the remainder of the basin is underlain by permeable sand and gravel. Transmissivity values range from less than 1,000 gpd/ft (gallons per day per foot) in thin stratified drift near the margins of the aquifer and in fine-grained lacustrine deposits to about 400,000 gpd/ft in thick, coarse, sandy gravel. In all parts of the aquifer system there are local horizontal and vertical changes in the texture of the stratified drift and changes in aquifer thickness. Till material has such a low transmissivity that it is not considered an aquifer. However, locally, wells in till are used to provide domestic supplies.

Nearly all water from the bedrock aquifers is obtained from secondary fractures, such as joints or faults, that are within the upper 200 feet of the bedrock. At depths greater than 200 feet below the bedrock surface, the chances of increasing well yield become significantly less because the fractures are generally smaller and less numerous. Yields of bedrock wells are variable, ranging from 0 to 250 gallons per minute (gpm).

It is suspected, based on site topography, that groundwater flow parallels surface water drainage which flows approximately to the west. Also, the depth to the water table at the site is estimated to be about 2 feet.

Although the Taunton River has been listed as the largest potential source of water in the basin, it is generally not used as a domestic supply. The predominant trend in Bridgewater and surrounding towns is toward obtaining domestic supplies from groundwater. Both the Towns of Bridgewater and Raynham obtain all or most of their water from groundwater wells.

The Town of Bridgewater has six municipal wells numbered 1 through 6. Wells 1, 2, 4 and 5 are approximately 4 miles east of the site and are probably recharged by the Carver Pond drainage. Wells 3 and 6 are approximately 5.5 miles northeast of the site and are probably recharged by the Matfield River. The town pumped approximately 49 million gallons of water from all wells in December 1982. If groundwater flow generally follows the surficial drainage pattern, none of the Bridgewater domestic supply wells should be affected.

Drinking water for the Town of Raynham is supplied by two water districts. The district closest to the site obtains its water from two wells (500 gpm capacity each, 350 gpm total average use) placed 52 feet and 54 feet deep on the southwest corner of Lake Nippenicket, within 2 miles of the CEC Bridgewater Site. In addition, the Town of Bridgewater has records of several private domestic supply wells located within 1.1 miles of the site to the north, south, southeast, and southwest.

Area groundwater is generally soft (less than 60 mg/l hardness), slightly acidic (6.5 pH), and contains levels of iron and manganese that typically exceed U.S. Public Health Standards.

2.4.3 Surface Waters

The FIT reported that the mean annual precipitation for the Bridgewater area is about 44 inches and the mean annual lake evaporation is about 26 inches. Therefore, the average net annual precipitation available for surface runoff and groundwater recharge is 18 inches.

Onsite surface waters consist of an area of shallow ponded water located to the south of the drum storage area, as illustrated in Figure 2-2. This ponded water is located in a land surface depression and does not appear to have a surface outlet.

The surface area and depth of this water probably depends on prevailing meteorological conditions. An aerial photograph taken in August 1982 showed the ponded water as covering about 1500 square feet.

Along the southern portion of the site, immediately south of the tank farm building and the outdoor bulk storage tanks, is located an area from which soil was excavated. This area appears to be wet year-round, indicating that it may be at the water table. The three storm drains which are located on site all drain into this wet area. An embankment of excavation soil is located along the southern and western sides of this wet area. An overland connection at the southwest corner of the wet area allows water to drain from the wet area to the drainage canal.

A drainage canal is located along the southern edge of the CEC Bridgewater Site, south of the wet area and the embankment. This canal flows from east to west and receives drainage from the site. The areas constituting this drainage are the wet area, as well as surface runoff from the upland area to the south, drainage from a small open water area east of First Street, and discharge from the First Street storm sewer system. Other areas may also drain into this drainage canal. The drainage canal flows through a culvert under Route 24, west of the site, and continues west to Hockomock Swamp. Hockomock Swamp eventually flows into Lake Nippenicket, which is located about 1/2 mile west of the site. During the November 19, 1982 site visit, no apparent water flow was observed in the drainage canal.

Of the surface waters mentioned in the previous discussion, only Nippenicket Lake is known to be used by the general public. Reportedly, the lake is used for boating, fishing, and other recreational activities.

2.4.4 Summary of Contaminants Found at the CEC Bridgewater Site

The following is a summary of the contamination which may still exist at the CEC Bridgewater Site. This summary includes only that contamination which has been identified by environmental sampling and does not specifically name contaminants for which there are no analytical data.

Soil

Soil samples collected at the site in May 1980 and July 1981 were analyzed for volatile organics using head-space analysis with an Organic Vapor Analyzer (OVA); the results are qualitative. Three samples from the excavation area south of the tank farm building (two at the surface and one 4 to 5 inches below the surface) showed twelve major responses on the OVA, six of which were tentatively identified. These identified contaminants were acetone, methyl ethyl ketone, benzene, toluene, ethyl benzene, and xylene. A soil sample taken from the area immediately east of the equipment building on July 2, 1981 was similarly analyzed and was found to contain acetone, benzene, methyl ethyl ketone, and toluene, though at much lower levels than detected in the samples from south of the tank farm building.

On October 6, 1981, a soil sample was taken in the excavation area south of the tank farm building at a depth of 1 foot. This sample was analyzed for purgeable organics at DEQE's Lawrence Laboratory using "EPA method 624 - Organics by Purge and Trap." The following is a list of the lab's findings:

Contaminant	Concentration (ppm)
methylene chloride	0.08
acetone	0.32
methyl ethyl ketone	1.1
benzene	0.13
methyl isobutyl ketone	0.55
toluene	0.44
ethyl benzene	0.08
xylenes	0.24

A soil sample taken by the FIT on July 19, 1982 from a hand-driven auger hole located about 27 feet south of the tank farm building was analyzed for volatile organics using head space analysis by an OVA in the gas chromatograph (GC) mode. The contaminants tentatively identified were 1,1,1-trichloroethane, benzene, and toluene.

The most recent data on soil contamination are from a soil sampling program conducted by DEQE in November 1982. A diagram of the sampling locations and the results of the analyses are presented in Appendix A of this report. The soil analyses included testing for purgeable organics and EP Toxic metals. Cambridge Analytical, under contract to Jet-Line Services, reported that soil samples were subjected to head-space analysis for organics and totals for EP Toxicity Test metals.

As for the purgeable organics analyses of the soil samples from the November 1982 sampling program, many soil samples had no purgeable organics detected. Of those samples that did show organic contamination, the organics detected were basically the same as those listed in the previous paragraphs, with the inclusion of 1,1,2,2-tetrachloroethane, chlorobenzene, and 1,2-trans-dichloroethane. The concentrations of the organics detected were similar to those reported previously in this subsection. The areas of the site that showed organic contamination in the soil included the excavation area (wet area) south of the tank farm building, the area around the tank farm building loading dock, and the area near the entrance to the site at First Street.

Groundwater

Groundwater analyses for the CEC Bridgewater Site are severely limited. Three groundwater samples were collected from onsite auger holes in July 1982. A sample from an auger hole located 81 feet south of the tank farm building and a sample from an auger hole located south of the drainage culvert did not indicate the presence of detectable volatile organics as measured using head-space analysis with an OVA. A groundwater sample from an auger hole located about 27 feet south of the tank farm building tentatively showed the the presence of trichloroethylene, 1,1,1-trichloroethane, and toluene. Also in July 1982, one sample was taken from a residential well located at 444 Elm Street (north-northeast of the site). Volatile organics were below the detection limit based on the results of the tests conducted with the OVA.

The above samples were tested using head-space analysis with an OVA operating in the GC mode; the detection limits are unknown.

Surface Water

The available information on the surface water quality on site and downstream of the site is also very limited. A water sample taken on May 19, 1981 from the drainage canal flowing from the site to Lake Nippenicket was analyzed for purgeable organics using "EPA Method 624 - Organics by Purge and Trap." The only contamination found was methylene chloride at a concentration of 3.38 parts per billion (ppb). A surface water sample taken from the wet area just south of the incinerator on July 15, 1980 showed 1,2-trans-dichloroethylene at 8.6 parts per billion (ppb) and 1,2-dichloroethane at 1.3 ppb. This sample was also analyzed by using "EPA Method 624 - Organics by Purge and Trap." Samples taken from the ponded water near the drum storage area on July 15, 1980 and September 15, 1981 showed no purgeable organics present as analyzed by EPA Method 624.

Another surface water sample taken from the ponded water on July 19, 1982 was analyzed for volatile organics by the FIT using head-space analysis with an OVA. No volatile organics were detected in the sample (detection limit is unknown).

Surface water samples taken from the drainage canal on July 2, 1981, and from the swamp west of the site on July 19, 1982 underwent head-space analysis for volatile organics; none were found (detection limit is unknown).

Despite the fact that no purgeable and/or volatile organics were detected in the swamp west of the site or in the ponded water near the former drum storage area, these surface waters may, nevertheless, be contaminated, possibly with extractable organics. (Additionally, the contaminants may have been present below the detection limit of the equipment used.) The possibility of contamination by extractable organics is substantiated by field observations made by the FIT during the site inspection on July 19, 1982. The FIT observed globules of oil on the surface of the ponded water located near the former drum storage area and also observed an oily sheen on the surface of the swamp located west of the site.

Air

Limited information is available on the concentrations of volatile organics in the air around the site. During the FIT site inspection on July 19, 1983, ambient air concentrations of 4 to 5 ppm were observed using an OVA. Downwind of the site and in areas of suspected soil contamination, levels of 1 to 2 ppm above ambient concentrations were observed using an OVA.

During an NUS site visit on August 24, 1983, volatile organic concentrations were not observed using an OVA in the survey mode.

2.5 Identification of Data Gaps

There are several data base gaps associated with the CEC Bridgewater Site which must be filled before a plan for site remediation can be developed. These gaps include the following:

- Field inspection by the subcontractor verifying that all containerized waste has been removed from the site and that all onsite storage tanks or vaults have been adequately cleaned.
- Data concerning the horizontal and vertical extent of soil contamination including the contaminants involved.
- Data concerning the extent of surface water and sediment contamination, including the contaminants involved.
- Data concerning the extent of groundwater contamination, including the contaminants involved.
- Information concerning the onsite soil characteristics.
- Information concerning the onsite subsurface geologic formations, including the stratigraphy and hydrology.

2.6 Initial Remedial Measures

Initial Remedial Measures (IRMs) are those activities at hazardous waste sites which are required to alleviate a situation that presents an immediate and significant threat to the health and safety of the public. Such situations may include: (1) human, animal, or food-chain exposure to acutely toxic substances; (2) contamination of drinking water supplies; (3) fire and/or explosion hazards; or (4) other similarly acute and dangerous situations.

As indicated by the most current information for the CEC Bridgewater Site, there appears to be a low risk of imminent onsite danger requiring IRM action, especially in light of the major remedial action initiated by DEQE in which all containerized wastes were removed from the site. Therefore, at this time, an IRM is not recommended for the site.

3.0 RI/FS SCOPE OF WORK

3.1 Introduction

Section 3 presents the technical approach to be implemented for the CEC Bridgewater Site for the Initial Activities, Remedial Investigation, and Feasibility Study, which are described in Section 3.2, 3.3, and 3.4, respectively. The remedial activities, as described specifically in Tasks 1 through 28, will be performed by a Pool Subcontractor.

Initial Remedial Measures have already been addressed at this site. These measures, as discussed in Section 2, include removal of all wastes from onsite storage tanks and drums.

Initial Activities at the CEC Bridgewater Site will include collection and assessment of pertinent site data prior to commencement of the Remedial Investigation and Feasibility Study tasks. These tasks are discussed in Section 3.2.

The Remedial Investigation will include those activities necessary to determine the extent and nature of wastes on site and the degree of environmental contamination. The Remedial Investigation will produce data of adequate technical quality for evaluation of remedial alternatives during the Feasibility Study. The Remedial Investigation is described in Section 3.3.

The Feasibility Study will identify and evaluate the appropriate remedial actions for the site, based on existing data and information gathered during the Remedial Investigation. The most cost-effective remedial alternative will be recommended. A conceptual design will be prepared for the selected remedial alternative. Section 3.4 describes the required components of the Feasibility Study.

3.2 Phase I - Initial Activities

A total of 12 tasks have been identified for the Initial Activities Phase.

Task 1 - RI/FS Work Plan Review

Task 1 of the Initial Activities Phase will include Pool Subcontractor review of the Contractor-prepared Work Plan. The Work Plan outlines those tasks of the Initial Activities Phase and Remedial Investigation Phase and briefly outlines the tasks currently perceived for the Feasibility Study Phase.

Task 2 - Project Management

Coordination with the EPA and DEQE will be maintained to monitor the course of the project and to incorporate the comments of the EPA and DEQE. These coordination activities would include presence at project review meetings, including a project initiation meeting, monthly reporting, onsite meetings when appropriate, and regular project discussion.

Project management and interface structures available to implement the Cannons Engineering Corporation, Bridgewater RI/FS are described in Section 4.0 of this Work Plan. Contents of monthly financial management and technical progress reports are outlined in 4.0.

Task 3 - Community Relations Support Functions

Community relations support provided by the Contractor and Pool Subcontractor will be at the request of EPA and may include logistical support for the planning and execution of the activities at the CEC-Bridgewater Site, as well as technical support to ensure that all information is accurate and current. Due to the nature of public involvement, community relations input must be flexible to accommodate fluctuations in public interest. Community relations input must also remain flexible to complement technical progress at the site. The Contractor and Pool Subcontractor will assist the EPA in presenting the findings of the RI/FS to the Public. For costing purposes, it is assumed that the Pool Subcontractor will attend three public meetings as follows:

- Project start-up
- Conclusion of remedial investigation
- Selection of remedial alternative and conceptual design

Task 4 – Collect and Evaluate Existing Data

The data/literature available for the preparation of this Work Plan includes:

- Camp Dresser and McKee (CDM) RAMP, April 29, 1983
- EPA, Region I files predating August 3, 1983
- Massachusetts Department of Environmental Quality Engineering (DEQE) files predating August 3, 1983

For the purpose of this Work Plan all previous literature will be obtained and reviewed to further facilitate an understanding of the potential problems associated with this site. The primary thrust of this task, however, will be to obtain existing data that were unavailable at the time of the Work Plan preparation. Sources for these data will include:

- EPA & DEQE files postdating August 3, 1983
- Local water company records (particularly the Bridgewater Board of Health, Water Department, and Department of Public Works)
- Local well drilling companies
- Soil Conservation Service
- Jet Line Services (EPA Cleanup subcontractor) Health and Safety Plan.

These data will be used in conjunction with existing reports to complement the program presented in the Work Plan. The analytical data will be reviewed and evaluated. Additional data requirements, not addressed by this Work Plan, will be identified at this time.

Task 5 - Health and Safety General Site Reconnaissance

An initial site reconnaissance will be conducted by an investigation team to fully evaluate the existing site conditions. Several objectives have been identified for the site reconnaissance.

- Conduct onsite startup meeting with EPA and DEQE
- Perform health and safety reconnaissance
- Locate physical hazards and features
- Perform geologic and hydrologic field reconnaissance
- Evaluate site conditions for location of initial surface water, sediment, and soil sampling points
- Conduct air sampling using charcoal and/or Tenax Tubes
- Verify the extent of cleanup activities performed by Jet Line Services, Inc.
- Perform magnetometer and radiation survey in suspected fill and/or disturbed soil areas.

A site meeting with EPA and DEQE will be used to exchange site data, to review the objectives for Remedial Actions at the CEC Bridgewater Site, and to review pertinent site hazards and conditions.

The investigation team will conduct a reconnaissance and inspection to assess potential health and safety hazards. An air-monitoring scan will be performed using an Organic Vapor Analyzer (OVA) or (HNU) Photoionization detector and Tenax Tubes with low-flow suction pumps to assess the level of protection necessary for site personnel. For costing purposes, it is assumed that three Tenax Tube samples will be taken. The number and type of the samples taken for analysis is provided in Table 3-1. The Tenax Tubes will be analyzed by the Pool Subcontractor. The team will indicate physical hazards and features on a preliminary field plan drawing and will document the features photographically. The site, nearby terrain, and surface water will be inspected visually for contamination, including signs of water pollution, vegetation stress, and effects on wildlife.

Topographic and surface condition, soils, geology, air, surface water, and groundwater information will also be recorded. Regional geologic patterns (bedrock outcrops) will be observed.

Much of this information might be available from records not available at this time. However, verification of the data, updating of site conditions, and retrieval of additional information will be required.

Task 6 - Permits, Rights of Entry, and Other Authorization Requirements

Access to the work areas will be obtained prior to initiation of site activities. Permits for Remedial Investigation Activities and onsite treatability studies will be obtained where necessary. Permits, rights of entry, utility easements, and other authorizations (e.g., sampling local wells) will be identified to the EPA. The EPA will be responsible for obtaining the required access.

Task 7 - Subcontractor Procurement

The following elements of work are under consideration for subcontracting to firms other than the Pool Subcontractor:

- Exploratory Borings/Monitoring Well Installation

TABLE 3-1

THE NUMBER AND TYPE OF SAMPLES TO BE COLLECTED FOR ANALYSIS AT THE CEC BRIDGEWATER SITE

Task	Sample Type	Criteria	Number of Samples (incl. dupl. and blnks.)
5	Air	3 Locations	4
15	Waste	Wipe Tests of Storage Tanks Composite Sample from Septic Tank	12
16	Soil	Eight Locations Sample Surface and 18-inches below the surface	26
17	Surface Water/ Sediment	3 Locations for Surface Water Once during Wet and Once during Dry Season 4 Additional Locations for the Sediment Samples	18
18	Soil	Multiple Samples in Each of Ten Proposed Well Borings	22
19	Groundwater	From the Onsite Wells and Residential Wells	52

The subcontractors will be obtained using the procedure outlined in the Basic Order of Agreement. The process of advertising for and evaluating bids will begin upon project authorization for those tasks.

Task 8 - Prepare Topographic Map

A topographic map will be prepared to supplement the Remedial Investigation and Feasibility Study planning activities. The contractor or approved subcontractor will establish horizontal and vertical ground control as required to provide horizontal control for sampling locations.

The topographic survey should include the site (approximately 3 acres) and immediate surroundings (within 400 feet). The drainage area to the south and west should be included (both areas appear to be within 400 feet of the site).

The product of Task 8 shall be single scribed, double matte, 3 mil, washoff mylar with reversed image. The map shall have a horizontal scale of 1 inch = 50 feet and a contour interval of 2 feet. A grid coordinate system will be established based on the highest order of accuracy available for control points in the immediate vicinity of the site. Control points to be considered include, but are not limited to, state plane coordinate system, USGS monuments, Army map service monuments, county highway monuments or, in rural areas, local monuments. Mapping and ground surveying will be completed to the National Map Accuracy Standards for the scale indicated.

Task 9 - Site-Specific Health and Safety Requirements

Site-specific Health and Safety Requirements will be identified for the CEC Bridgewater Site. These requirements will be based on the guidelines presented in the current revision of the NUS Superfund Division Health and Safety Manual. It is recommended that the site plans prepared by Jet Line Services, Inc. (DEQE's waste removal subcontractor) be obtained and reviewed.

The purpose of establishing the site-specific health and safety requirements will be to:

- Provide minimum safety protection requirements and procedures for field crews and subcontractors working on site.

- Provide ongoing site monitoring to verify the adequacy of preliminary safety requirements and to revise specific protection levels as required.

Levels of protection will be approximated during the field reconnaissance and will be modified as new data is acquired in the course of the site investigation. Health and Safety Requirements will be incorporated into the Site Operations Plan in Task 11.

Task 10 - Site-Specific Quality Assurance Requirements

Quality Assurance Requirements will be developed for the CEC Bridgewater Site based upon the general NUS Quality Assurance Project Plan. These plans will refer to or include site-specific details on sampling; field testing; surveying; chain-of-custody; sample handling, packaging, preserving and shipping; and record keeping and documentation. Appropriate NUS Corporation Quality Assurance Plans will be imposed on all subcontractors. Analytical requirements, in addition to those listed in the Contract Laboratory Program (CLP), will be given, along with any other procedures necessary to properly conduct the Remedial Investigation/Feasibility Study. The Quality Assurance Requirements will be incorporated into Task 11, Site Operations Plan.

Task 11 - Site Operations Plan

A Site Operations Plan will be developed and will include the health and safety and quality assurance requirements developed in tasks 9 and 10 as well as the following:

- Base operations (office) location
- Decontamination zones

- Sanitary facilities
- Communications
- Equipment storage
- Sample storage
- Proposed sampling locations for soil, surface water, sediments, and wastes
- Analytical requirements
- Locations of test borings and monitoring wells

The site operations plan will be submitted to EPA.

Task 12 - Field Equipment Mobilization

Equipment necessary for the Remedial Investigation includes:

- Field office
- Surveying equipment
- Drill rig (subcontractor)
- Sampling tools and equipment
- Health and safety equipment
- Decontamination equipment

Small equipment will be .stored on site in a secure field office trailer. The placement of the trailer will be specified in the Site Operations Plan.

3.3 Phase II - Remedial Investigation

During this phase, site investigations will be conducted. A total of 10 tasks have been identified for the Remedial Investigation Phase.

Task 13 - Ground Survey

Ground survey activities are necessary to supplement the Remedial Investigation and Feasibility Study planning activities.

A baseline will be established on site for the purpose of providing horizontal control for soil, sediment, and surface water sampling locations. The final location of the baseline will be determined following an inspection of offsite conditions. Stakes will be set at 50-foot intervals and marked with stations and elevations. A grid system will be surveyed and staked for sampling. Other physical features and improvements will be located as required.

The borings will be located horizontally and vertically with respect to the site grid and datum. These elevations are necessary to determine the hydrogeologic conditions beneath the site. The sample locations will be staked and located.

Task 14 - Collect Residential Well Data

An inventory of water users within a 1.1-mile radius will be prepared. Data sources for the inventory are listed in Task 4, Collect and Evaluate Existing Data. Information collected for each well will include the following, if possible:

- Location
- Ownership
- Usage
- Well depth
- Well diameter
- Construction
- Age
- Well Yield

This information will be used in determining which wells will be sampled in Task 19, Groundwater Sampling.

Task 15 - Waste Sampling

The wastes previously stored in site tanks, drums, etc., were removed by Jet Line Services, Inc. The tanks and storage facilities on site will, however, be examined to ensure that the removal and cleaning operations were complete. Major areas of concern include:

- Fuel tank next to incinerator
- 30,000-gallon tanks
- Ready building
- Tank farm building
- Vented underground vault

Examination of onsite storage tanks will include visual inspection of the tanks accompanied by OVA or HNU readings taken inside the tanks. Tanks that register a reading or tanks that fail the visual inspection will be further investigated by sampling any residual wastes; or in the event that no wastes are visable, yet a reading is observed, a wipe test will be conducted following the guidelines established in the site operations plan. Any waste samples or wipe test samples will be subjected to a full priority pollutant scan. Strict adherence to the Site Health and Safety Plan must be observed for this task, especially when entering or approaching any enclosed spaces.

In addition to the above-mentioned wipe test, a composite sample from the septic tank (Figure 3-1) will be collected and subjected to a full priority pollutant scan. For costing purposes, it was assumed that ten samples would be taken for analysis. A duplicate and blank will also be submitted for analysis (see Table 3-1).

Task 16 - Surface Soil Sampling

Soils on site will be sampled and analyzed to determine the extent and nature of soil contamination. A total of sixteen (16) samples will be collected (see Table 3-1). A total of six locations have been selected; these locations are shown in Figure 3-1. Each location will be sampled at two depths using a hand auger. One sample will be taken at or near the surface and another sample will be taken at or near a depth of 18 inches below the surface. Two contingency locations (four samples) will be selected as necessary.

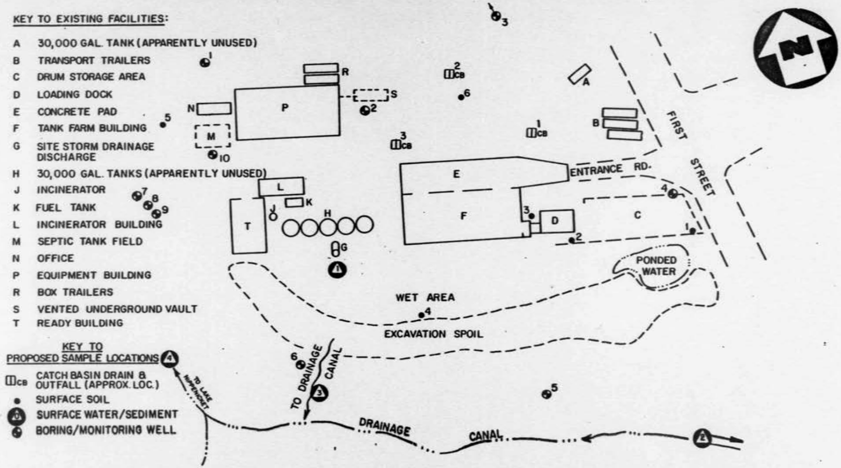


FIGURE 3-1

WORK PLAN SITE MAP
CANNONS ENGINEERING SITE, BRIDGEWATER, MA
NOT TO SCALE

NUS CORPORATION
A Halliburton Company

Sample locations were selected to complement the soil investigations conducted by the FIT and CDM. The siting rationale is delineated in Table 3-2. Additional soil sampling will be conducted during the Subsurface Investigation (Task 17).

All soil samples will undergo a full priority pollutant scan. All of the 18-inch deep samples will undergo an EP Toxicity analysis. A duplicate will be submitted for a full priority pollutant scan and one for EP Toxicity analysis.

Task 17 - Surface Water/Sediment Sampling

A total of seven (7) sediment and six (6) surface water samples will be collected (see Table 3-1). The locations of these sampling points are illustrated in Figure 3-1. The six surface water samples will be collected from the following locations, with one set of three samples being taken during wet meteorological conditions and one set of three samples being taken during dry meteorological conditions:

- The drainage canal upstream of First Street.
- The creek draining the onsite wet area.
- The drainage canal at a point downstream of where it is joined by South Creek and the creek draining the onsite wet area.

One sediment sample will also be taken from each of the locations listed above. Additionally, four (4) sediment samples (one from each location) will be collected during dry conditions from the following locations:

- The storm drain south of the five outdoor 30,000-gallon tanks
- Each of three (3) catch basin drains north of the tank farm building

Before collecting surface water and sediment samples, the drainage system in and around the site (particularly to the south and west) should be defined and mapped.

An estimate of the runoff contribution to the adjoining drainage canal should be made, along with an estimate of the flows in the canal.

TABLE 3-2

SOIL SAMPLING SITING RATIONALE
CANNONS ENGINEERING CORPORATION SITE
BRIDGEWATER, MASSACHUSETTS

Soil Sample	Siting Procedure
1 & 2	These samples will be located in the drum storage area where drum leakage was noted. Previous investigations have shown no evidence of volatile organics (CDM RAMP, 1982).
3	This sample is located next to the loading dock in an area of suspected spillage.
4	This sample is located south of the tank farm building. Low levels of volatile organics and toxic metals have been detected in this vicinity during previous investigations. (FIT Investigation, 1982; and CDM RAMP, 1983).
5	This sample will be located west of the office in an area previously not sampled.
6	This sample will be located east of the equipment building in an area previously not sampled.

Surface water and sediment samples will undergo a full priority pollutant scan. A duplicate of one sediment and surface water and a field blank of the surface water will be submitted for identical analyses.

Task 18 – Subsurface Investigation

The objectives of the subsurface investigation are to identify the waste locations, the extent of possible soil contamination in and around the site, and to identify the aquifers beneath the site, and study whether the encountered aquifers are or may be contaminated. Ten (10) borings are recommended for this investigation.

No site-specific data has been gathered concerning subsurface geologic formations, or concerning the nature and extent of subsurface contamination. In order to evaluate subsurface conditions, ten (10) borings/monitoring wells are recommended. Figure 3-1 shows the recommended locations for the borings. Siting rationale, in addition to depth information for these borings, is presented in Table 3-3. It is recommended that boring 7 be drilled first, followed by borings 8 and 9. Data collected as a result of this initial effort will be studied and, as necessary, the remaining boring locations/depths will be revised accordingly with approval of NUS, the EPA and the DEQE. Revisions to the program may be necessary since flow directions and subsurface structure can only be approximated based on existing data. The subsurface investigation will include the following:

- All borings will be drilled according to the depths delineated in Table 3-3. Borehole No. 7, however, will be drilled to bedrock plus 10 feet (for bedrock verification). The specific locations of the proposed borings will be determined by the field geologist. The depth of wells may be adjusted based on the results of borehole No. 7. All boreholes will have 6-inch diameters.

- The borings will be installed with drive or spun casing and rotary wash with continuous split-spoon sampling to the water table. Below the water table, sampling will be conducted at 4-foot intervals. Borehole 7 will be installed with continuous split-spoon sampling to bedrock.

TABLE 3-3

SUBSURFACE BORINGS
SITING RATIONALE AND SPECIFICATIONS

Boring Number	Depth Feet	Rationale
1	30	Northwest perimeter hole
2	30	Hole south of underground vented vault
3	30	Northeast perimeter hole
4	30	East perimeter hole
5	30	Southeast perimeter hole
6	30	Southwest perimeter hole
7	80	This hole will be drilled to bedrock. It should be drilled before boreholes 8 and 9 are drilled. Sampling will be continuous.
8 (shallow) 9 (deep)	15 30	West perimeter holes. These wells will comprise a nested pair, characterizing the groundwater hydrology and quality beneath the site. The shallow well will determine the existence of an upper unconfined aquifer and will sample the water in this aquifer if it exists. The deep well will determine the existence of an aquifer below the first major silt/clay zone and will sample the water in this lower aquifer if it exists. Lithologic information obtained from borehole No. 7 will aid in characterizing potential aquifers. The onsite geologist will specify the actual depths of these wells based on the lithologic information obtained in borehole No. 7.
10	15	This hole will be drilled into the onsite septic field. The location of borehole 10 as shown on Figure 3-1 is approximate; the location of the field will be determined prior to drilling.

- Table 3-4 presents a guideline for selecting samples for analysis, including the number of samples per hole.

- Continuous air monitoring will be conducted during drilling. An OVA or HNU photoionizer, as well as an explosivity meter, will be used for this monitoring.

- Boring logs will be prepared for all holes, and static water levels at the time of drilling will be noted.

- Borings No. 1, 2, 3, 4, 5, 6, 8, and 10 will be cased with 2-inch screened PVC pipe the entire length. (The upper 10 feet will not be screened.)

- If the ongoing subsurface investigation determines the existence of an upper unconfined aquifer and a lower confined aquifer, then boring No. 9 will be cased with 2-inch PVC pipe through the upper unconfined aquifer and underlying confining layer. The base of the casing will be screened to sample the lower, confined aquifer only. The length will depend on the thickness of the permeable zone.

- Boring No. 7 will be cased the entire length, using screened PVC pipe in the lower 10 feet.

- The drilling equipment coming in contact with the soil will be decontaminated after completion of each borehole. Cuttings and drilling fluids from the drilling operation will be collected and disposed of as described in the Site Health and Safety Requirements.

- Each cased borehole will be pumped (developed) and sealed around the PVC casing with bentonite and cement.

- A permeability test appropriate to the situation (such as rising or falling head) will be conducted in all wells approximately 1 week after development.

TABLE 3-4

SUBSURFACE SOIL ANALYSIS
CANNONS ENGINEERING CORPORATION SITE
BRIDGEWATER, MASSACHUSETTS

Boring Number	Rationale
1,3,4,5,6 & 8	A minimum of two samples each will be analyzed. Samples will be screened using an organic vapor analyzer (OVA) prior to submission to the CLP Laboratory for analysis. The field geologist will select samples from appropriate substrata. For each hole one sample will be selected from the unsaturated zone and one from the saturated zone.
2 & 10	Two samples will be selected for analysis--one from the midpoint and one from the base of the borehole.
7	Three samples will be selected for analysis--2 samples as described for boreholes 1, 3, 4, 5, 6, and 8, and one sample from the bottom of the borehole.
9	Two samples will be selected for analysis--one from the overlying, confining unit and one from the lower permeable unit.

- The water level in the boreholes will be measured within a 6-hour period. (This activity will also occur approximately 1 week after development).

At a maximum, all subsurface soil samples will undergo a full priority pollutant sçan. For costing purposes, it was assumed that 21 samples, as described in Table 3-4, would be taken for analysis. A duplicate will also be submitted for analysis (see Table 3-1). However, substantial savings on analytical costs can be realized if appropriate project coordination is practiced. Such coordination would involve having all surface soil samples analyzed first, then analyzing subsurface samples only for those parameters detected in the surface samples. Exceptions are the boring into the septic field and the boring near the underground vault; samples from these borings should undergo the full priority pollutant scan. Two additional wells, 11 and 12, have been costed into the drilling program to provide a contingency in the event that additional monitoring wells are required. The depths and locations of these wells will be based on the anaytical results of the other samplings. For costing purposes, the wells were assumed to be 25 feet deep.

Task 19 - Groundwater Sampling

There will be two rounds of groundwater sampling. The sampling sets will be collected within 3 months of each other. Each round of sampling will include the wells within a 1.1-mile radius, judged to be adequate for sampling in Task 14, as well as the 10 newly installed monitoring wells 1-10 (see Table 3-1).

In the first round, samples will be collected from the wells, analyzing for priority pollutants. The first-round samples will be collected as soon as possible, 7 days after development of monitoring wells. In the event that drilling of the new monitoring wells is delayed the residential wells thought to be adequate for sampling will be sampled as soon as possible after completion of Task 14. As many as twelve residential wells may be sampled.

In the second round of sampling, analytical parameters will be scaled down to reflect constituents detected in the first round and constituents detected in previous surface water, soil, and sediment samples. As a minimum, second-round sampling will include hazardous substance organics. The number of residential wells sampled may be re-evaluated and decreased if possible.

With each round of residential well sampling, a duplicate and field blank will be submitted for analysis.

Task 20 - Data Reduction and Evaluation

Following applicable RI tasks, data generated during the study will be used in the production of a report (Task 22) to be submitted by the Pool Subcontractor following the completion of all RI tasks. Data validation will be the responsibility of the contractor.

In addition, continuous data reduction and evaluation during the RI can provide input for subsequent RI tasks. For example, in cases involving analytical investigations, data evaluation can lead to cost savings by reducing the number of analytical parameters and samples required for subsequent analyses.

Task 21 - Identify Preliminary Remedial Technologies

The purpose of this task is to preliminarily identify remedial technologies potentially applicable to this site. The product of this task will be a cursory list of selected technologies and brief explanation of each. The list will include as a minimum the following:

- Groundwater Collection and Treatment

  Based on the review of existing and new data, it may be determined that mitigation of the groundwater contamination is necessary despite the removal of waste from onsite storage tanks and the removal of onsite drums. A system for groundwater collection and treatment may be proposed.

- Construction of a Slurry Wall and Capping of the Site

Construction of a slurry wall to sufficient depth to either divert or contain the groundwater may be an effective method of reducing the risk of further groundwater contamination. A slurry wall is a subsurface barrier constructed by excavating a trench several feet in width down to an impervious layer and filling the trench with a slurry of bentonite clay and water to stop lateral groundwater flow. The results of the subsurface investigation will aid in the evaluation of this remedial action. This option may be used in conjunction with capping the site with an impervious layer to minimize the possibility of infiltration of rainwater into the site. Capping may also be used as a separate remedial measure.

- Regrading and Revegetation

Regrading and revegetation are used to provide a stable final cover following closure of hazardous waste sites. Grading can be designed to divert and manage runoff at the site; revegetation of disturbed areas prevents erosion and controls runoff. Regrading and revegetation are applicable to the options previously discussed.

- Removal of Contaminated Sediments

Sediments in adjacent water bodies (particularly the "swamp" and the drainage area to the south and west) may be contaminated. Sediment contamination poses a potential threat through direct contact during recreational use of the water body or through uptake into the food chain. Removal of these sediments by suction equipment may be proposed if contamination is found. Based on the potential cost and environmental impact associated with this alternative, a maximum level of contamination should be identified to define the extent of sediment removal. Construction of in-place silt barriers and other sediment control measures would be integral to a sediment removal operation.

- Removal of Contaminated Soils

  Where areas of heavily contaminated soils are found, removal of these soils may be necessary. Contaminated soils could be stabilized in place, contained in a properly designed onsite disposal facility, or disposed of in an approved offsite disposal facility (landfill or incinerator).

- No-Action Alternative

  This alternative assumes that no remedial measures will be implemented to mitigate contamination. Associated with a no-action alternative is risk assessment regarding the impacts to public health and the environment resulting from no action being taken at the site.

  These alternatives will be further developed during the Feasibility Study. The alternatives will be reviewed by the EPA and the DEQE.

Task 22 - Prepare Remedial Investigation Report and Feasibility Study Work Plan

Remedial Investigation Report

After completion of the field investigations, the pertinent field and laboratory data will be assembled into a detailed report of the Remedial Investigation. This report will include detailed descriptions of the following items:

- Objectives of the Remedial Investigations.

- A description of the study area, including soil type and depth, and the results of the laboratory testing.

- Geologic framework and subsurface geologic conditions in the vicinity of the site.

- Hyrogeologic conditions of the site vicinity including the depth of the aquifers and the rates and directions of groundwater flow.

- Groundwater and surface water quality in the study area.

- Transport of the wastes by surface water in the vicinity of the site.

- Supporting data, such as chemical analysis reports, logs, and monitoring well water level readings.

- Conclusions and recommendations of the study (including objectives and criteria for evaluation of remedial alternatives and identification of remedial technologies as developed in Task 21).

Maps, figures, and tables will be prepared to support the text. Chemical isopleth groundwater maps will be developed to illustrate the extent of groundwater contamination.

<u>Feasibility Study Work Plan</u>

The Feasibility Study portion of this Work Plan will be revised in accordance with the data and information developed in the Remedial Investigation. The revised Work Plan will present a detailed schedule and budget for the activities to be undertaken. The major tasks of the Feasibility Study are outlined below.

- Identification and development of alternatives
- Initial screening of alternatives
- Laboratory and field treatability studies Work Plan
- Remedial alternatives evaluation and preliminary Feasibility Study report
- Conceptual design for the selected alternative
- Final report

3.4 Phase III - Feasibility Study

Task 23 - Identification and Development of Alternatives

All appropriate remedial alternatives identified in Tasks 21 and 22 will undergo development. The results of this development will be used as the basis for the initial screening task.

Task 24 - Initial Screening of Alternatives

The alternatives developed in Task 23 will be screened to reduce the number of alternatives prior to undertaking detailed evaluations of the remaining alternatives. This screening will be carried out in close conjunction with EPA and the State.

Three broad considerations will be used as a basis for the initial screening: cost, effects of the alternative, and acceptable engineering practices. More specifically, the following factors will be considered:

1. Cost: An alternative whose cost far exceeds that of other alternatives will usually be eliminated. Total cost will include the cost of implementing the alternative and the cost of operation and maintenance.

2. Environmental effects: Alternatives posing significant adverse environmental effects will be excluded.

3. Environmental protection: Only those alternatives that satisfy the response objectives and that contribute substantially to the protection of public health, welfare, or the environment shall be considered further.

4. Implementability and reliability: Alternatives that may prove extremely difficult to implement, that will not achieve the remedial objectives in a reasonable time period, or that rely on unproven technology will be eliminated.

Task 25 - Laboratory and Field Studies Work Plan

Following the identification, development, and initial screening of alternatives, laboratory and field studies will be conducted as necessary to evaluate the effectiveness of remedial technologies and to establish engineering criteria necessary for design and implementation (e.g. groundwater treatment, compatability of waste with any proposed containment or cap structures). Since these studies are contingent upon the findings of the Remedial Investigation and on the identified and screened alternatives, a separate Work Plan for any proposed treatability studies will be submitted to EPA and the State for approval as the necessary information becomes available. The Work Plan will be developed under this task. The work plan submittal will be made in the time frame required to maintain steady progress of the overall Feasibility Study.

Task 26 - Remedial Alternatives Evaluation and Preliminary Feasibility Report

The remedial alternatives that pass the initial screening will be developed in detail and evaluated so that the most cost-effective alternative(s) can be recommended to EPA and the State. A preliminary report will be submitted to EPA and the State for approval and final selection of a remedial action.

The following is a breakdown of the subtasks involved in this phase of the Feasibility Study:

<u>Detailed Development of Alternatives</u>

Alternatives which pass the initial screening step will be developed in greater detail. This development will include:

- Description of appropriate treatment and disposal technologies.

- Special engineering considerations required to implement the alternative (e.g., pilot treatment facility, additional studies needed to proceed with final remedial design).

- Environmental impacts and proposed methods for mitigating any adverse effects.
- Operation, maintenance, and monitoring requirements of the remedy.
- Offsite disposal needs and transportation plans.
- Temporary storage requirements.
- Safety requirements for remedial implementation (including both onsite and offsite health and safety considerations).
- A description of how the alternative could be phased into individual operable units. The description should include a discussion of how various operable units of the total remedy could be implemented individually or in groups, resulting in a significant improvement to the environmental or savings in costs.
- A description of how the alternative could be segmented into areas to allow implementation of differing phases of the alternative.
- A review of any offsite storage or disposal facilities to ensure compliance with applicable RCRA requirements, both current and proposed.

Environmental Assessment

An Environmental Assessment (EA) will be performed for each alternative. The EA will include an evaluation of each alternative's environmental effects, physical or legal constraints, and regulatory requirements. In addition, the EA will include an analysis of measures to mitigate any adverse effects associated with an alternative.

Cost Evaluation

A detailed cost evaluation will be developed for the feasible remedial alternatives (and for each phase or segment of the alternatives). The cost will be presented as a present-worth cost and will include the total cost of implementing the alternative and the annual operating and maintenance cost. Both monetary costs and associated nonmonetary costs will be included.

Alternatives Evaluation and Final Recommendation

Alternatives will be evaluated using technical, environmental, and economic criteria. At a minimum, the following areas will be used to evaluate the cost-effectiveness of alternatives:

- Reliability: Alternatives that minimize or eliminate the potential for release of wastes into the environment will be considered more reliable than other alternatives. Institutional concerns such as management requirements can also be considered as reliability factors.

- Implementability: The requirements of implementing the alternatives will be considered, including phasing alternatives into operable units and segmenting alternatives into project areas on the site. The requirements for permits, zoning restrictions, right of ways, and public acceptance are also examples of factors to be considered.

- Operation and Maintenance (O & M) Requirements: Preference will be given to projects with lower O&M requirements, other factors being equal.

- Environmental Effects: Preference will be given to alternatives providing a positive environmental impact.

- Safety Requirements: Onsite and offsite safety requirements during implementation of the alternatives will be considered. Alternatives with lower safety impact and cost will be favored.

- Cost: The remedial alternative with the lowest total present-worth cost will be favored. Total present-worth cost will include the capital cost of implementing the alternative and the cost of operation and maintenance of the proposed alternative.

Based on the above evaluation, an alternative(s) will be recommended. The recommendation will be justified by stating the relative advantages over other alternatives considered. Evaluative considerations shall be applied uniformly to each alternative. The lowest-cost alternative that is technologically feasible and reliable and that adequately protects (or mitigates damage to) public health, welfare, or the environment will be considered the most cost-effective alternative.

Preliminary Report

A preliminary report will be prepared presenting the results of Tasks 23 through 25 and will identify the recommended remedial alternative(s). The report will be submitted to EPA and the DEQE for approval and final selection of a remedial alternative(s).

Task 27 - Conceptual Design

A conceptual design of the remedial alternative(s) selected by EPA will be prepared. The conceptual design will entail, but is not limited to: the engineering approach, which includes implementation schedule, special implementation requirements, institutional requirements, phasing and segmenting considerations, design criteria, and preliminary site and facility layouts; and a budget cost estimate, which includes the impact of cost on implementation. Any additional information required as the basis for the completion of the final remedial design will also be included. After EPA & DEQE approval, the plan will be presented to the public for comment.

Task 28 - Final Feasibility Study Report

A final report will be prepared by the Pool Subcontractor for submission to EPA and the DEQE. The report, structured to enable the reader to cross-reference with ease, shall include the results of Tasks 23 through 27 and will include additional information as appended.

Appended information may include but will not be limited to:

- Site topographic map
- General arrangement drawings of the remedial action
- Typical geologic and design cross sections
- Detailed data analysis
- Conceptual design drawings (Process and Instrumentation Diagrams and general arrangements)
- Design report with supporting calculations
- Preliminary cost estimates
- Construction schedule
- Erosion and sedimentation control plan
- Data from treatability studies necessary for final design
- Summary of assessment of contamination
- Summary of remedial measure evaluation

4.0 MANAGEMENT PLAN

Section 4.0 of this Work Plan outlines the Management Plan which will be used to complete the CEC Bridgewater Site Remedial Investigation/Feasibility Study (RI/FS). It is presently planned that the subsequent USEPA Work Assignment resulting from this Work Plan will be conducted by an RI/FS Pool Subcontractor under the supervision of an NUS Remedial Planning Office (REMPO) Project Manager.

The responsibility of the REMPO Project Manager and the assigned NUS project team is detailed below in the Subcontractor Project Management Work Plan.

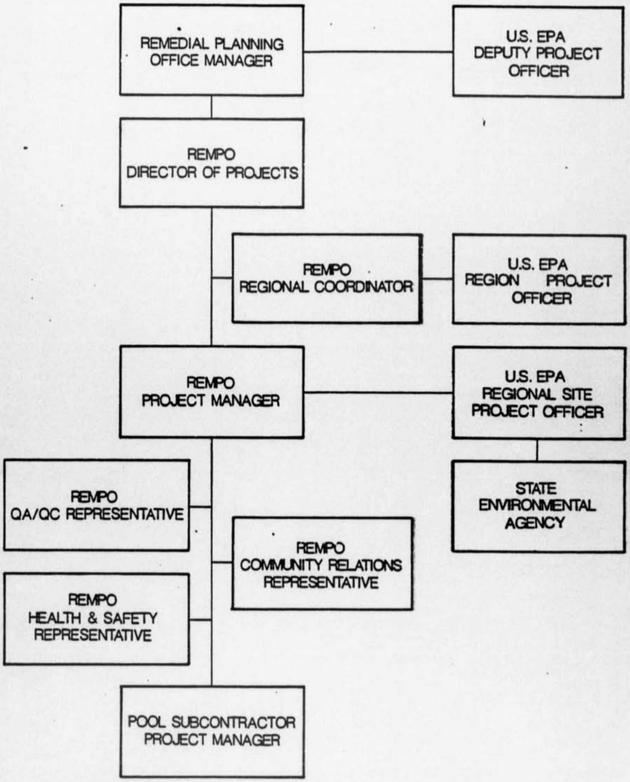
4.1 Project Organization

4.1.1 Project Manpower Plan

Figure 4-1 outlines the structure of the Project Organization.

The Remedial Planning Manager, through the REMPO Director of Projects, provides overall guidance and administrative support to the project, and also serves as the primary liaison to the USEPA Project Officer at USEPA Headquarters. Assisting the Remedial Planning Manager will be a REMPO Regional Coordinator, who serves as the primary liaison with the USEPA Regional Project Officer. The REMPO Project Manager works directly with the USEPA Regional Site Project Officer (RSPO) and is responsible for the day-to-day management of the Pool Subcontractor. All formal lines of communication will follow this organizational framework.

The REMPO Project Manager will serve as the focus for all interface between the USEPA-NUS and the Pool Subcontractor throughout the course of the project. Provisions will be made for direct interface opportunities between all team members in regard to completion of technical assignments. All communications which have a bearing on the scope of work, schedule, and financial commitments



PROJECT ORGANIZATION
REMEDIAL INVESTIGATION & FEASIBILITY STUDY
CANNONS ENGINEERING SITE
BRIDGEWATER, MA

FIGURE 4-1

NUS CORPORATION
A Halliburton Company

specified in the final study plan, must be completed through the REMPO Project Manager.

The REMPO Project Manager will initiate all work assignments and will monitor Pool Subcontractor performance with reference to the Final Work Plan scope of work, schedule, and financial matters. Monitoring of the Pool Subcontractor will encompass conformance with the approved Quality Assurance/Control, Health and Safety, and Community Relations Programs.

4.2 Project Management

NUS will manage this RI/FS project utilizing a Work Plan consisting of the following elements:

- Task 1 - Work Plan Preparation
- Task 2 - Subcontractor Procurement
- Task 3 - Project Initiation
- Task 4 - Quality Assurance and Health and Safety Support
- Task 5 - Subcontractor Management
- Task 6 - Overall Status Reporting
- Task 7 - Community Relations Support
- Task 8 - Project Close-Out

A summary delineating the elements of the Work Plan for subcontractor management, which will be implemented during this project, is presented below.

Task 1 - Work Plan Preparation

A detailed work plan, outlining the scope of work presented in Section 3 of this submittal, will be prepared by NUS and submitted as a draft for EPA approval. Included will be a description of the technical approach with a listing of the tasks to be implemented by the Pool Subcontractor.

Task 2 - Subcontractor Procurement

By means of a previously USEPA-approved procurement program, NUS has entered into Basic Ordering Agreements with a sufficient number and geographically diverse group of Pool Subcontractors to perform anticipated RI/FS Work Assignments throughout the contract period. Issuance of work assignments to the Pool Subcontractors will be implemented in the following manner.

- USEPA issues work assignment to develop a Draft Work Plan.
- REMPO selects and assigns Work Plan Project Manager to immediately initiate Draft Work Plan development.
- Prior to completion of the Draft Work Plan, senior REMPO management, in consultation with the REMPO Project Manager, determine assignments of the Pool Subcontractor.
- Specific assignments to the subcontractor are identified.
- REMPO Project Manager continues to complete Draft Work Plan for submission. Simultaneously, REMPO senior management identifies potential Pool Subcontractor(s) for the work assignment.
- NUS Contracting Officer is advised of Pool Subcontractor requirements and a request for proposal is scheduled.
- Solicitation request, which includes the Draft Work Plan, is prepared.
- Solicitation is forwarded to Pool Subcontractor(s) and NUS Contracting Officer upon completion of Draft Work Plan. Draft Work Plan is simultaneously forwarded to USEPA for review and comment.

- Pool Subcontractor proposal(s) are received by NUS Contracting Officer. Proposals are reviewed by Contracting Officer and REMPO Project Manager. Pool Subcontractor is selected.

- Pool Subcontractor is notified of selection, and work assignment negotiations are initiated.

- REMPO receives USEPA comments on Draft Work Plan. REMPO Project Manager revises Work Plan and notifies Pool Subcontractor Project Manager of revisions. Pool Subcontractor is requested to revise the proposal in accordance with revisions.

- EPA Contracting Officer approves procurement.

- Work assignment negotiations are completed with Pool Subcontractor by NUS Contracting Officer and work assignment is issued.

- REMPO Project Manager assumes direct control of Pool Subcontractor and conducts project initiation meeting with Pool Subcontractor and USEPA Regional Site Project Officer.

Task 3 - Project Initiation

Shortly following completion of subcontractor work assignment negotiations, the REMPO Project Manager will schedule a project initiation meeting with the USEPA RSPO and Pool Subcontractor Project Manager. During this meeting, a final review of the work plan, project requirements, and task assignments will be completed. Formal lines of communication and alternate linkages will be specified. A contact directory will be developed. Correspondence identification needs and a transmittal system will be specified. A file index system may also be specified, depending upon the requirements for duplicate project files. A detailed schedule and logistical plan will be developed.

Prior to the project initiation meeting, the Pool Subcontractor will be provided with all necessary guideline and requirement materials to enable his project team to develop specific work assignments programs for Quality Assurance/Quality Control, Health and Safety, and Community Relations. Approval to initiate the development of these plans will be given to the Pool Subcontractor by the REMPO Project Manager and a completion-review-approval schedule will be specified. Depending upon the schedule requirements of the Work Plan, additional tasks may also be approved.

Task 4 - Quality Assurance and Health and Safety Support

The REMPO Project Manager, with assistance from REMPO Quality Assurance/Control and Health and Safety Representatives, will specify overall Project Requirements and will provide guidelines to the Pool Subcontractor to develop specific work assignment programs. The Pool Subcontractor will develop the programs and will submit a draft of the programs to the REMPO Project Manager for review and comment. The Pool Subcontractor will make revisions requested by the REMPO Project Manager and will submit final program descriptions for acceptance. These programs will become an integral part of the study plan and will be used by the REMPO Project Manager to monitor Pool Subcontractor performance.

Quality Assurance

The Subcontractor will develop site-specific Quality Assurance Requirements to be used in performing the work assignment. These requirements will be detailed in the Site Operations Plan. Quality Assurance shall be applied to both site and office activities. The Site Operations Plan will be approved by NUS prior to commencement of any field work. The Site Operations Plan will define Quality Assurance Requirements on a task-specific basis within the RI/FS. This plan will be reviewed and revised as necessary prior to the initiation of each activity to ensure that it contains the applicable Quality Assurance Requirements.

The quality assurance program to be applied to this project is a comprehensive program based on the quality assurance philosophy adopted by NUS when it was founded. The NUS President and Chief Executive Officer has promulgated a Corporate Quality Assurance Policy Statement that identifies the philosophy. This policy statement is the basis for the NUS Corporate Quality Assurance Policy Manual and for other manuals that direct each operating entry in the implementation of the quality assurance policy. Quality assurance is applied, as required, to all NUS projects.

A general Quality Assurance Project Plan has been developed to delineate the quality assurance activities for the project, particularly for environmentally-related measurements.

NUS has prepared a Quality Assurance Manual to control project activity. The Quality Assurance Requirements (QARs) applicable to the CEC Bridgewater Site include:

QAR 2.5	Work Plans
QAR 3.0	Design control
QAR 4.0	Data Acquisition
QAR 5.0	Procurement Document Control
QAR 6.0	Instructions and Procedures
QAR 7.0	Document Control
QAR 8.0	Control of Purchased Items and Services
QAR 9.0	Identification and Control of Laboratory Samples (Includes Chain-of-Custody)
QAR 11.0	Inspection
QAR 12.0	Control of Measuring and Test Equipment
QAR 13.0	Handling, Storage, and Shipping of Hazardous Substances
QAR 14.0	Control of Nonconformances
QAR 15.0	Corrective Action
QAR 16.0	Quality Assurance Records
QAR 17.0	Audits

The implementing procedures associated with the above QARs are also applicable, as are standard instructional procedures for sampling, chain-of-custody, shipping, and the like.

The relevant information required by the Pool Subcontractor from these documents shall be supplied by NUS. However, the entire manuals will not be supplied.

Health and Safety

A site-specific Health and Safety Plan, acceptable to NUS, will be developed for the project by the Pool Subcontractor. This plan may be modified based on data collected during the site reconnaissance (Task 5 of the Technical Approach) or during other activities of the Remedial Investigation. Individual Health and Safety Plans for each of the field tasks will be written and followed during Phase II of the Remedial Investigation.

Pool Subcontractors performing RI/FS tasks are expected to provide their own health, safety and training support. Sufficient planning, materials, and expertise are expected to ensure that subcontractor, NUS, and government personnel as well as the environment are protected from harm during the RI/FS activities.

Task 5 - Subcontractor Management

NUS, is contractually obligated to serve as the prime contractor for the project. The Pool Subcontractor will be managed by the REMPO Project Manager.

Statement of Work

The REMPO Project Manager will monitor the work of the Pool Subcontractor. As part of its proposal, the Pool Subcontractor will develop a project schedule indicating milestones for major events. Additionally, the Pool Subcontractor will estimate the number of man-hours to be expended each month. The Pool Subcontractor will report the number of actual man-hours utilized versus the estimate and will also provide an estimate of the percent completion of each task on a monthly basis.

Schedule of Deliverables

The Pool Subcontractor will be required to meet monthly with the REMPO Project Manager. One (1) week prior to the meeting, the Pool Subcontractor will submit a progress report indicating man-hours expended in the previous months, expenditures for the month, anticipated invoicing for the month, milestone events completed, schedule compliance, problems encountered and how they may affect milestone events, and solutions to the problems.

Draft reports of the RI/FS will be prepared by the Pool Subcontractor and submitted in advance of the established due date for the final reports. The draft reports will be submitted to the REMPO Project Manager for review and comment prior to the formal meeting with USEPA. All comments and changes will be considered at this meeting. Clarification changes will then be given to the Pool Subcontractor in written form for inclusion in the final reports.

Reports

Monthly progress reports will be prepared by the Pool Subcontractor and submitted to NUS. The Pool Subcontractor progress report will be incorporated into the final progress report to be submitted to the USEPA by NUS.

Financial

NUS will have the responsibility for administering the Pool Subcontractor and will review and authorize payment of invoices. The invoices will be prepared in sufficient detail and will indicate man-hours for each category of personnel utilized on the project during the invoice period as well as the hourly rate charged for each. Additionally, there will be adequate documentation for other expenses such as second-tier subcontractor services, equipment, travel and living, etc. No payment will be made for unauthorized work not included in the Work Plan or approved Work Plan Modifications.

The REMPO Project Manager will review and approve these invoices.

Task 6 – Overall Status Reporting

Project Status Reports

Monthly progress reports will include the following information:

- Technical Progress Reports
  - Identification of project task and milestone
  - Status of work at the site and progress to date
  - Percent of completion (e.g., percent of task completed and work hours expended)
  - Difficulties encountered during the reporting period
  - Actions being taken to rectify problems
  - Activities planned for the next month
  - Personnel changes

The progress report will list target and actual completion dates for each project task, including project completion, and will provide an explanation of any deviation from the Work Plan schedule.

- Financial Management Report
  - Identification of project task
  - Actual expenditures, including fee and direct labor hours expended for this period
  - Cumulative expenditures (including fee) and cumulative direct labor hours
  - Projection of expenditures for completing the project, including an explanation of any significant variation from the forecasted target

- A graphic representation of proposed versus actual expenditures (plus fee) and comparison of actual versus target direct labor hours. A projection to completion will be made for both.

Status reports will be distributed monthly as follows:

Technical Progress Reports	Financial Management Reports	Addressee
2	2	NUS Contract Officer
2	2	Zone Manager (EPA Headquarters)
2	2	EPA Project Officer (Region I)
2	2	State Project Officer

Draft and Final Reports

A draft final report (Tasks 22 and 28) will be submitted after the completion of all technical work. The report will incorporate any interim reports and will summarize results of all activities at the site. A final report, including the error-free masters, shall be submitted to USEPA within thirty (30) days, following draft approval.

Meetings

Four meetings are being proposed between NUS, the Pool Subcontractor, EPA, and the Massachusetts DEQE to monitor the progress of activities for the Remedial Investigation. Meeting No. 1 will take place upon acceptance of the Work Plan and prior to mobilization at the site. The purpose of this meeting will be to review and verify the objectives and priorities of the investigation at the site. Planning activities for the Remedial Investigation will be reviewed in detail.

Meeting No. 2 will be held prior to completion of the Remedial Investigation. Results-to-date of the Remedial Investigation will be discussed to evaluate the program and to determine whether additions to the proposed plan are required. The focus of the preliminary remedial alternatives will be discussed.

Meeting No. 3 will be held after EPA and DEQE have received the Preliminary Feasibility Study Report. The purpose of this meeting is to discuss the evaluation of the remedial alternatives and the EPA/DEQE decision relating to the selected remedial alternative. Requirements of the conceptual design and the Final Report will be reviewed.

Meeting No. 4 will be held after the Final Feasibility Study Report has been submitted. At this time, all aspects of the project will be reviewed and finalized.

Performance Assessment

The performance of the Pool Subcontractor will be routinely evaluated and assessed by NUS to determine that all work has been performed in a satisfactory manner. Additionally, all reports will be reviewed to ascertain that the terms of the subcontract have been fulfilled and that all the items included in the statement of work have been addressed.

Task 7 – Community Relations Support

A community relations program will be carried out concurrent with implementation of the Work Plan. The program will have the following objectives:

- Establishment of objectives and techniques for public involvement.
- Dissemination of information to inform the community of current and proposed action
- Solicitation of public input on proposed remedial actions
- Maintenance of a dialogue with the community
- Analyses of community attitudes towards proposed actions

The first step in the program will be the designation of a project spokesman who will support the EPA's efforts in public participation. This specialist will remain on the project for its duration and may be requested to organize public meetings and news conferences, prepare public notices and news releases, receive available information and comments, and distribute these to the proper parties. The activities of the project spokesman will be directed and approved by the project management team.

Press conferences, public meetings, and other means of information exchange may be used to solicit public comments and to disseminate information on current and proposed site activities.

Task 8 – Project Close-Out

Prior to final acceptance of the RI/FS reports, the REMPO Project Manager will review that work to certify that certain items have been adequately covered by the Pool Subcontractor. The documents and property of EPA or NUS will be recorded and returned to the proper source when the final reports are submitted and accepted. Proper records will indicate documents held by the Pool Subcontractor and those returned to the agencies. The Pool Subcontractor must ensure that all records and other project information are returned to NUS or to the Government. If any of the processes (or materials) recommended in the reports are covered by royalty payments and/or patents, the Pool Subcontactor will indicate this in the report.

A final audit may be performed to make certain that all charges, fees, and expenses are within the terms of the subcontract. The final releases will address any assignment of refunds, rebates, or credits and the manner in which they shall be handled.

4.3 Change Orders

The monthly progress report will identify any unusual problems that may be upcoming in the project.

If forecasts predict the work assignment budget or scope will change, written approval of the Contracting Officer must obtained. A written request for change initiates this process.

4.4 Scope of Work Modifications

Major changes in the scope of work are not anticipated during the performance of this study. However, if review of data collected indicates that Work Plan modifications are necessary, then the scope of work can be changed. Prior to initiating additional work or changes to the scope, the RI/FS Subcontractor must prepare a written documentation explaining the reasons for modifications, including an estimate of labor-hours and cost involved. The REMPO Project Manager will review these requests and, if justified, will prepare a request for additional funds. However, this additional work can not be performed until USEPA authorization is received. No payment will be made for work performed on unauthorized tasks. Modifications are authorized by USEPA, through NUS.

5.0 COSTS AND SCHEDULE

5.1 Project Schedule

The schedule for the CEC Bridgewater Site RI/FS is shown in Figure 5-1. The schedule indicates that approximately 11 months are required to complete the subcontracted portion of the RI/FS.

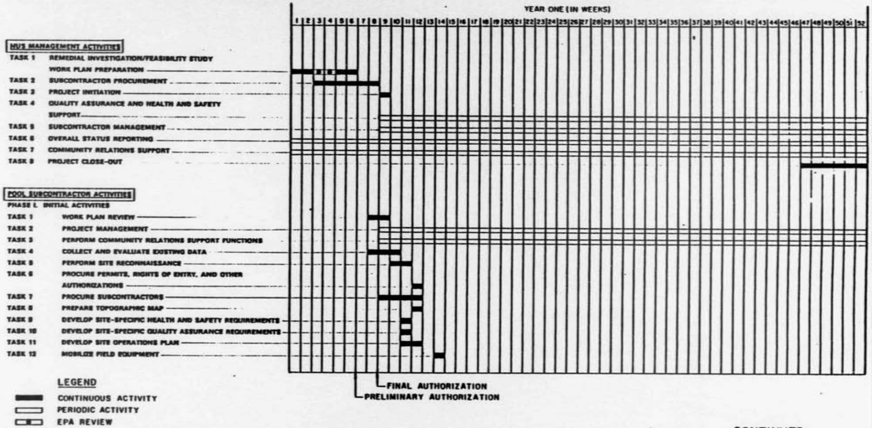
Completion of the RI/FS on schedule is contingent upon 6 week turnaround of analytical results from EPA's Contract Laboratory Program (CLP). Also, EPA and DEQE review time must be completed in a timely manner to allow for completion of the RI/FS within the designated time period (See Figures 5-1).

Deliverables (Reports) will be submitted to EPA and DEQE at the conclusion of Tasks 11 (Site Operations Plan); Task 21 (Identify Preliminary Remedial Technologies); Task 22 (Remedial Investigation Report and Feasibility Study Work Plan); Task 25 (Laboratory and Field Studies Work Plan); Task 26 (Evaluation of Alternatives and Preliminary Feasibility Report); Task 27 (Conceptual Design) and Task 28 (Final Report).

5.2 Cost and Budget

The total estimated cost of the site Remedial Investigation and Feasibility Study, including preliminary activities, is $377,273. An additional $111,000 will be required in CLP analytical costs. This includes the costs for the Pool Subcontractor to implement the RI/FS and for NUS to oversee and monitor the project.

Total Pool Subcontractor man-hours required for the Remedial Investigation and Feasibility Study have been estimated at 5300. Manpower requirements by task are presented in Table 5-1. Total NUS man-hours required for management of the Pool Subcontractor have been estimated at 1891. NUS manpower requirements by task are presented in Table 5-2.



CONTINUED

FIGURE 5-1

REMEDIAL ACTION SCHEDULE
CANNONS ENGINEERING SITE, BRIDGEWATER, MA

NUS CORPORATION
A Halliburton Company

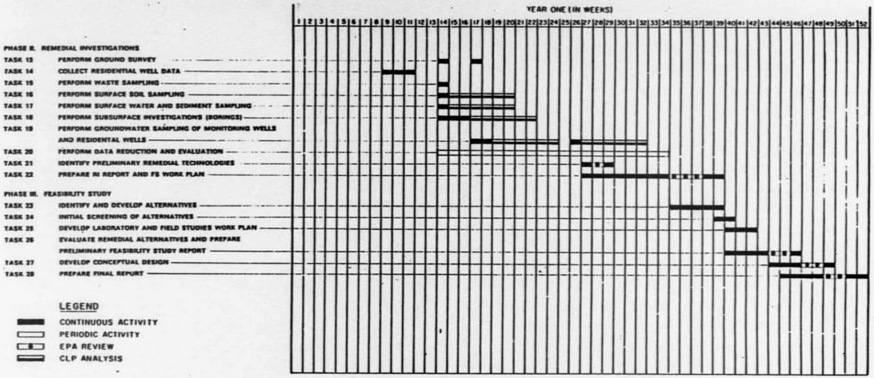


FIGURE 5-1 CONTINUED

REMEDIAL ACTION SCHEDULE
CANNONS ENGINEERING SITE, BRIDGEWATER, MA

NUS CORPORATION
A Halliburton Company

TABLE 5-1

POOL SUBCONTRACTOR

MANPOWER PROJECTIONS FOR INITIAL ACTIVITIES AND REMEDIAL INVESTIGATION/FEASIBILITY STUDY CANNONS ENGINEERING CORPORATION SITE BRIDGEWATER, MASSACHUSETTS

Phase	Task	Description	Manhours
	1	Work Plan Review	74
	2	Project Management	501
I. Initial	3	Community Relations Support Functions	90
Activities	4	Collect and Evaluate Existing Data	100
	5	Health, Safety, and General Site Reconnaissance	175
	6	Permits, Rights of Entry, and Other Authorization Requirements	84
	7	Subcontractor Procurement	123
	8	Prepare Topographic Map	162
	9	Site-Specific Health and Safety Requirements	75
	10	Develop Site-Specific Quality Assurance Requirements	67
	11	Site Operations Plan	105
	12	Field Equipment Mobilization	76
	Subtotal		1,632
II. Remedial	13	Ground Survey	109
Investigation	14	Collect Residential Well Data	53
	15	Waste Sampling	60
	16	Surface Soil Sampling	50
	17	Surface Water/Sediment Sampling	60
	18	Subsurface Borings	297
	19	Groundwater Sampling	88
	20	Data Reduction and Evaluation	555
	21	Identify Preliminary Remedial Technologies	90
	22	Prepare Remedial Investigation Report and Feasibility Study Work Plan	430
	Subtotal		1,792

TABLE 5-1
POOL SUBCONTRACTOR
MANPOWER PROJECTIONS FOR
INITIAL ACTIVITIES AND
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
CANNONS ENGINEERING CORPORATION SITE
BRIDGEWATER, MASSACHUSETTS
PÅGE TWO

Phase	Task	Description	Manhours
	23	Identification and Development of Alternatives	141
III. Feasibility Study	24	Initial Screening of Alternatives	241
	25	Develop Laboratory and Field Studies Work Plan	79
	26	Evaluation Remedial Alternatives, and Preliminary Feasibility Report	555
	27	Conceptual Design	370
	28	Final Report	490
	Subtotal		1,876
	TOTAL		5,300

TABLE 5-2

NUS SUBCONTRACTOR MANAGEMENT MANPOWER ESTIMATE BY TASK CEC BRIDGEWATER SITE RI/FS

Task	Description	Total Man-hours
Task 1	Work Plan Preparation	550
Task 2	Subcontractor Procurement	132
Task 3	Project Initiation	88
Task 4	Quality Assurance/Health and Safety Oversight	286
Task 5	Subcontractor Project Management	550
Task 6	Community Relations Support Functions	110
Task 7	Project Status Report	83
Task 8	Project Close Out	88
	Total	1,887

Higher levels of personnel protection than those anticipated during preparation of this Work Plan might result in a substantial increase in the cost of the Remedial Investigation.

Results of the Remedial Investigations might increase the scope of the Feasibility Study, resulting in possible increases in required manpower and funds. A separate Work Plan for any treatability studies will be submitted to the EPA for approval should these studies prove necessary to adequately evaluate the potential remedial actions. The cost and manpower requirements to prepare the Treatability Study Work Plan have been included in the estimates prepared for the Feasibility Study; however, the cost and manpower requirements to actually conduct any treatability studies have not been included in these estimates.

APPENDIX A

DEQE SOIL SAMPLING RESULTS[1]
CANNONS ENGINEERING SITE
BRIDGEWATER, MASSACHUSETTS
(NOVEMBER 1982)

Sample Number	Parameter	Observed Concentration (ppm)
1A*	No Purgeable Organics detected	
2A	Methylene Chloride	0.046
	Toluene	0.046
2B	Methylene Chloride	< 0.01
	Chloroform	< 0.01
	Benzene	0.01
	Toluene	< 0.01
3A	Methylene Chloride	< 0.01
	Benzene	< 0.01
	Toluene	0.266
3B	Benzene	< 0.01
4A	No Purgeable Organics detected	
	Arsenic	29
	Barium	21
	Cadmium	ND
	Chromium	5.8
	Lead	24
	Mercury	0.133
4B	No Purgeable Organics detected	
	Arsenic	3
	Barium	21
	Cadmium	2.3
	Chromium	2.8
	Lead	7
	Mercury	0.009

1 See site map at the end of this appendix for sampling locations

* Note: "A" denotes at or near the surface
"B" denotes at or near 18 inches below the surface
ND not detected

Source: Massachusetts DEQE, November, 1982.

APPENDIX A
DEQE SOIL SAMPLING RESULTS[1]
CEC BRIDGEWATER SITE
(NOVEMBER 1982)
PAGE TWO

Sample Number	Parameter	Observed Concentration (ppm)
*5A	Chloroform	< 0.01
	1,1,1-Trichloroethane	0.020
	Benzene	< 0.01
	1,1,2,2-Tetrachloroethane	0.120
	Toluene	0.050
5B	1,1,1-Trichloroethane	0.025
	Benzene	< 0.01
	1,1,2,2-Tetrachloroethane	0.155
6A	Benzene	0.056
	Chlorobenzene	0.076
	Total Xylene	1.356
	Ethylbenzene	0.272
	1,1,2,2-Tetrachloroethane	0.092
	Toluene	0.83
	1,2-Transdichloroethylene	0.13
	1,1,1-Trichloroethane	0.021
	Arsenic	25
	Barium	17
	Cadmium	0.1
	Chromium	4.8
	Lead	9
	Mercury	0.06
6B	1,1,1-Trichloroethane	0.025
	Arsenic	13
	Barium	12
	Cadmium	ND
	Chromium	4.0
	Lead	5.0
	Mercury	< 0.0002

1 See site map at the end of this appendix for sampling locations

* Note: "A" denotes at or near the surface
"B" denotes at or near 18 inches below the surface
ND not detected

Source: Massachusetts DEQE, November, 1982.

APPENDIX A
DEQE SOIL SAMPLING RESULTS[1]
CEC BRIDGEWATER SITE
(NOVEMBER 1982)
PAGE THREE

Sample Number	Parameter	Observed Concentration (ppm)
7A	No Purgeable Organics detected	
	Arsenic	31
	Barium	11
	Cadmium	1.3
	Chromium	5.0
	Lead	6
	Mercury	0.006
7B	No Purgeable Organics detected	
	Arsenic	21
	Barium	10
	Cadmium	ND
	Chromium	4.9
	Lead	6
	Mercury	0.009
8A	Benzene	0.02
	Arsenic	10
	Barium	8
	Cadmium	ND
	Chromium	5.5
	Lead	7
	Mercury	0.076
8B	No Purgeable Organics detected	
	Arsenic	44
	Barium	15
	Cadmium	ND
	Chromium	7.1
	Lead	7
	Mercury	< 0.0002

1 See site map at the end of this appendix for sampling locations

* Note: "A" denotes at or near the surface
"B" denotes at or near 18 inches below the surface
ND not detected

Source: Massachusetts DEQE, November, 1982.

APPENDIX A
DEQE SOIL SAMPLING RESULTS[1]
CEC BRIDGEWATER SITE
(NOVEMBER 1982)
PAGE FOUR

Sample Number	Parameter	Observed Concentration (ppm)
9	No Purgeable Organics detected	
	Arsenic	5
	Barium	8
	Cadmium	ND
	Chromium	3.9
	Lead	4
	Mercury	< 0.0002
10A	Benzene	0.250
	Chlorobenzene	0.127
	Chloroform	< 0.01
	Total Xylene	0.215
	Methylene Chloride	0.024
	1,1,2,2-Tetrachloroethane	0.033
	Toluene	2.130
	1,1,1-Trichloroethane	0.013
	Trichloroethylene	0.032
	Arsenic	55
	Barium	9
	Cadmium	ND
	Chromium	6.1
	Lead	7
	Mercury	0.030
10B	No Purgeable Organics detected	
	Arsenic	11
	Barium	1
	Cadmium	0.4
	Chromium	5.1
	Lead	4
	Mercury	0.006

1 See site map at the end of this appendix for sampling locations
* Note: "A" denotes at or near the surface
"B" denotes at or near 18 inches below the surface
ND not detected

Source: Massachusetts DEQE, November, 1982.

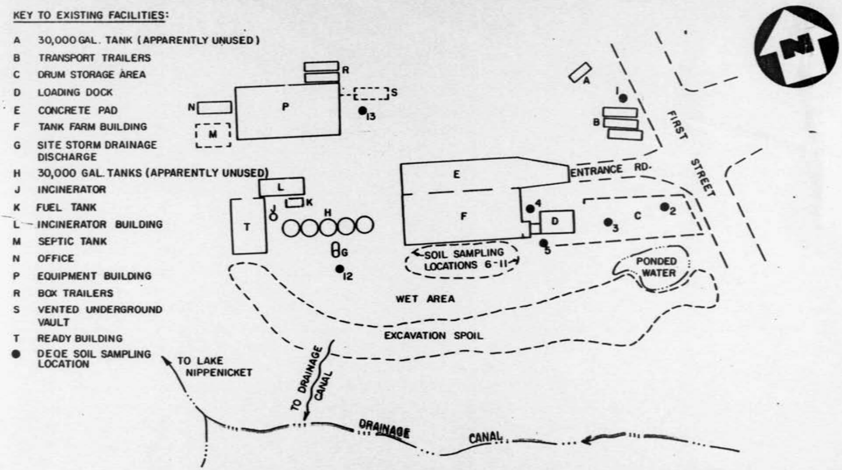
APPENDIX A
DEQE SOIL SAMPLING RESULTS[1]
CEC BRIDGEWATER SITE
(NOVEMBER 1982)
PAGE FIVE

Sample Number	Parameter	Observed Concentration (ppm)
11A	Chlorobenzene	0.011
	Arsenic	17
	Barium	7
	Cadmium	ND
	Chromium	4.5
	Lead	5
	Mercury	0.014
11B	**No Purgeable Organics detected**	
	Arsenic	29
	Barium	7
	Cadmium	ND
	Chromium	5.1
	Lead	7
	Mercury	0.001
12A	**Benzene**	< 0.01
12B	**No Purgeable Organics detected**	
	Arsenic	25
	Barium	4
	Cadmium	ND
	Chromium	4.5
	Lead	5
	Mercury	0.006
13A	**No Purgeable Organics detected**	
13B	**No Purgeable Organics detected**	

1 See site map at the end of this appendix for sampling locations

* Note: "A" denotes at or near the surface
"B" denotes at or near 18 inches below the surface
ND not detected

Source: Massachusetts DEQE, November, 1982



A-6

FIGURE A-1

DEQE SOIL SAMPLING LOCATIONS - NOVEMBER 1982
CANNONS ENGINEERING SITE, BRIDGEWATER, MA
NOT TO SCALE

NUS CORPORATION
A Halliburton Company