N60087.AR.000286
NAS BRUNSWICK
5090.3a

U.S. DEPARTMENT OF THE NAVY

INSTALLATION RESTORATION PROGRAM

NAVAL AIR STATION, BRUNSWICK

BRUNSWICK, MAINE

FOCUSED FEASIBILITY STUDY

SITE 8

CONTRACT: N62472-84-C-1108

E.C.JORDAN PROJECT NO. 6836-02

APRIL 1992

FOCUSED FEASIBILITY STUDY

SITE 8

NAVAL AIR STATION BRUNSWICK
INSTALLATION RESTORATION PROGRAM

Prepared for:

U.S. Department Of The Navy
Northern Division Naval Facilities
Engineering Command
Contract No. N62472-84-C-1108

Prepared by:

E.C. Jordan Co.
Portland, Maine
Project No. 6836-02

APRIL 1992

DRAFT FEASIBILITY STUDY
DETAILED ANALYSIS OF ALTERNATIVES: SITE 8
NAVAL AIR STATION BRUNSWICK

TABLE OF CONTENTS

Section	Title	Page No.
1.0	INTRODUCTION	1-1
2.0	SUMMARY OF RESPONSE OBJECTIVES AND REMEDIAL ALTERNATIVES	2-1
2.1	PERIMETER ROAD DISPOSAL AREA: SITE 8 - SUMMARY OF CONTAMINATION	2-1
2.2	SUMMARY OF BASELINE RISK ASSESSMENTS	2-4
2.2.1	Human Health Risk Assessment	2-4
2.2.2	Summary of Environmental Risks	2-6
2.3	IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	2-8
2.3.1	Definition of ARARs	2-9
2.3.2	Development of ARARs	2-10
2.3.2.1	Chemical-specific ARARs	2-10
2.3.2.2	Location-specific ARARs	2-14
2.3.2.3	Action-specific ARARs	2-20
2.4	SUMMARY OF REMEDIAL ACTION OBJECTIVES: SITE 8	2-25
2.5	RATIONALE FOR NO REMEDIAL ACTION	2-25
2.6	SUMMARY OF REMEDIAL ALTERNATIVES	2-26
2.7	TREATABILITY STUDY RESULTS	2-27
3.0	DETAILED EVALUATION OF REMEDIAL ALTERNATIVES	3-1
3.1	ALTERNATIVE 8A: NO ACTION	3-1
3.1.1	Overall Protection of Human Health and the Environment	3-4
3.1.2	Compliance with ARARs	3-4
3.1.3	Long-term Effectiveness and Permanence	3-5
3.1.4	Reduction in Mobility, Toxicity, and Volume Through Treatment	3-5
3.1.5	Short-term Effectiveness	3-5
3.1.6	Implementability	3-5
3.1.7	Cost	3-5
3.2	ALTERNATIVE 8B: MINIMAL ACTION	3-5

TABLE OF CONTENTS
(continued)

Section		Title	Page No.
	3.2.1	Overall Protection of Human Health and the Environment	3-7
	3.2.2	Compliance with ARARs	3-7
	3.2.3	Long-term Effectiveness and Permanence	3-9
	3.2.4	Reduction in Mobility, Toxicity, and Volume Through Treatment	3-9
	3.2.5	Short-term Effectiveness	3-9
	3.2.6	Implementability	3-9
	3.2.7	Cost	3-10
3.3	ALTERNATIVE 8C: SOIL COVER		3-10
	3.3.1	Overall Protection of Human Health and the Environment	3-13
	3.3.2	Compliance With ARARs	3-13
	3.3.3	Long-term Effectiveness and Permanence	3-15
	3.3.4	Reduction in Mobility, Toxicity, and Volume Through Treatment	3-15
	3.3.5	Short-term Effectiveness	3-16
	3.3.6	Implementability	3-16
	3.3.7	Cost	3-16
4.0	COMPARATIVE ANALYSIS OF ALTERNATIVES		4-1
4.1	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT		4-1
4.2	COMPLIANCE WITH ARARS		4-1
4.3	LONG-TERM EFFECTIVENESS AND PERMANENCE		4-1
4.4	REDUCTION IN MOBILITY, TOXICITY, AND VOLUME THROUGH TREATMENT		4-2
4.5	SHORT-TERM EFFECTIVENESS		4-2
4.6	IMPLEMENTABILITY		4-2
4.7	COST		4-2

REFERENCES

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

TABLE OF CONTENTS
(continued)

Section	Title	Page No.

APPENDICES

APPENDIX A - TREATABILITY STUDY RESULTS
APPENDIX B - COST BACK-UP TABLES
APPENDIX C - RESPONSE TO REGULATORY AND TRC COMMENTS: DRAFT FOCUSED FEASIBILITY STUDY: SITE 8
APPENDIX D - SUPPORTING INFORMATION FOR VOLUME ESTIMATES
APPENDIX E - SUPPLEMENTAL RISK CALCULATIONS

DRAFT FEASIBILITY STUDY
DETAILED ANALYSIS OF ALTERNATIVES: SITE 8
NAVAL AIR STATION BRUNSWICK

LIST OF FIGURES

Figure	Title	Page No.
1-1	Site Location Map	1-3
2-1	Site Location Map: Site 8	2-2
2-2	PAH and DDT Concentrations in Soil and Sediment	2-3
3-1	Alternative 8B: Minimal Action Site 8	3-8
3-2	Alternative 8C: Soil Cover Site 8	3-12
3-3	Proposed Cover Cross Section	3-14

DRAFT FEASIBILITY STUDY
DETAILED ANALYSIS OF ALTERNATIVES: SITE 8
NAVAL AIR STATION BRUNSWICK

LIST OF TABLES

Table	Title	Page No.
2-1	Summary of Total DDT, DDE, DDD Concentrations Detected at NAS Brunswick	2-7
2-2	Chemical-Specific ARARs, Criteria, Advisories, and Guidance for Site 8	2-11
2-3	Location-Specific ARARs, Criteria, Advisories, and Guidance for Site 8	2-15
2-4	Potential Action-Specific Applicable or Relevant and Appropriate Requirements for Site 8	2-21
3-1	Criteria for Comparative Analysis of Alternatives	3-2
3-2	Summary of Remedial Alternatives	3-3
3-3	No Action (8A) Cost Summary: Site 8	3-6
3-4	Minimal Action (8B) Cost Summary: Site 8	3-11
3-5	Soil Cover (8C) Cost Summary: Site 8	3-17
4-1	Summary of Comparative Analysis of Alternatives: Site 8	4-3

1.0 INTRODUCTION

The Naval Air Station at Brunswick (NAS Brunswick) is located south of the Androscoggin River between Brunswick and Bath, Maine. The NAS is an active base owned and operated by the federal government through the Department of the Navy. This facility is currently participating in the Navy's Installation Restoration Program (IRP). In 1987, the U.S. Environmental Protection Agency (USEPA) placed NAS Brunswick on the National Priorities List (NPL), and in 1990 a Federal Facility Agreement (FFA) among the Navy, the USEPA, and the Maine Department of Environmental Protection (MEDEP) was established. This FFA identifies timetables and deadlines for the completion of a Remedial Investigation and Feasibility Study (RI/FS) at NAS Brunswick.

An Initial Assessment Study (IAS) was performed on nine sites at NAS Brunswick by Roy F. Weston, Inc. (R.F. Weston) in 1983. This study recommended further investigation at seven of the nine sites.

In 1984, E.C. Jordan Co. (Jordan) was contracted by the Navy to perform a Pollution Abatement Confirmation (PAC) Study, and in 1987, to conduct a complete RI/FS on seven sites identified during the IAS and PAC study. Based on further information, two additional sites, Sites 11 and 13, were added to the RI/FS program in 1989 and a third site, Site 14 was included in 1990. Sites 5 and 6, initially identified in the IAS were brought back into the RI/FS program in 1989. A total of 13 sites are currently part of the RI/FS program, as follows:

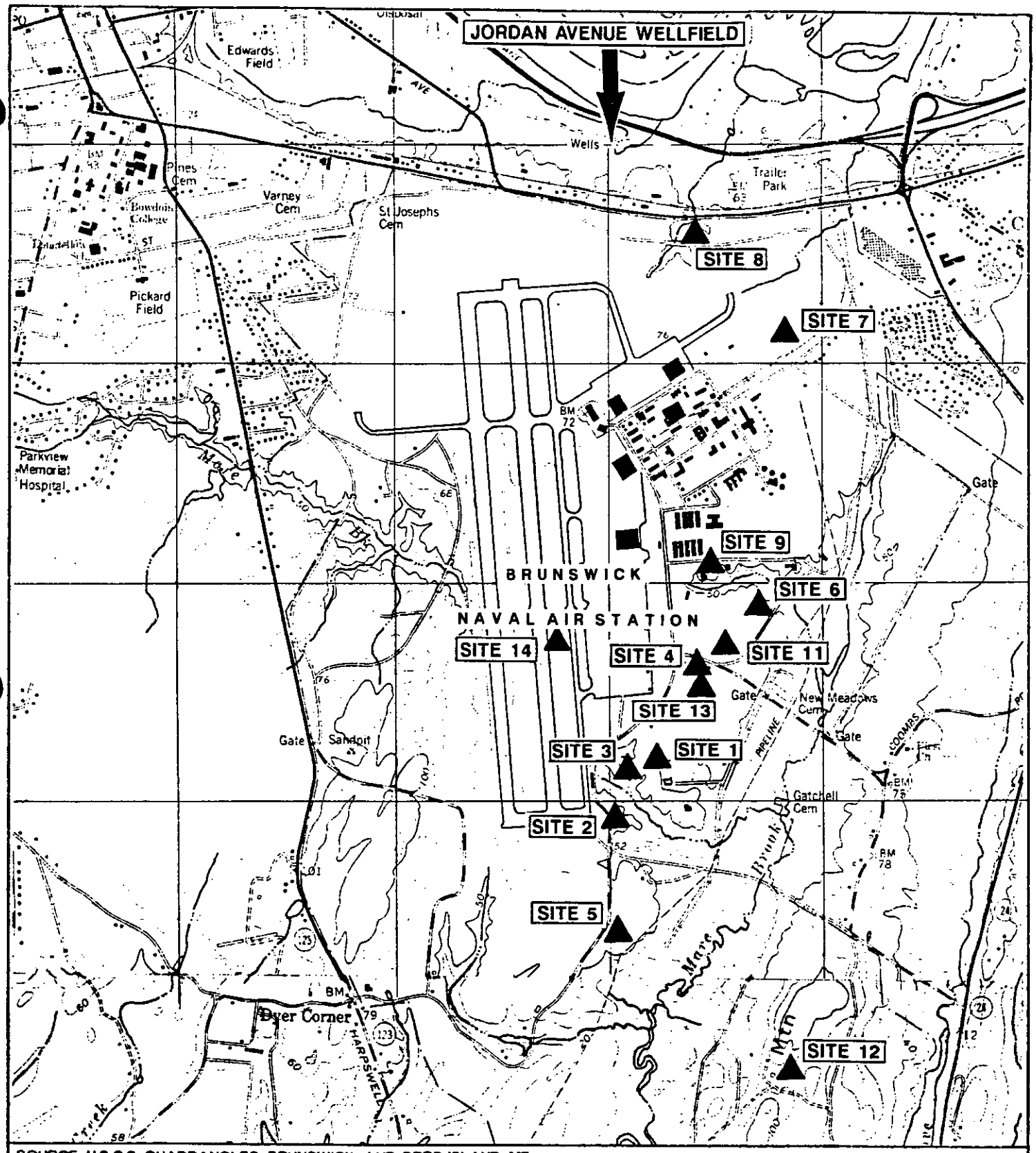
- Site 1 Orion Street Landfill - North
- Site 2 Orion Street Landfill - South
- Site 3 Hazardous Waste Burial Area
- Site 4 Acid/Caustic Pit
- Site 5 Orion Street Asbestos Disposal Site
- Site 6 Sandy Road Rubble and Asbestos Disposal Site
- Site 7 Old Acid/Caustic Pit
- Site 8 Perimeter Road Disposal Site
- Site 9 Neptune Drive Disposal Site
- Site 11 Fire Training Area and
- Site 12 Explosive Ordnance Dump Training Area
- Site 13 Defense Reutilization and Marketing Office
- Site 14 Old Dump No. 3

Site locations are shown in Figure 1-1. In August 1990, Jordan submitted both a Draft Final RI and Phase I FS report to the Navy. These reports included Sites 1, 2, 3, 4, 7, 8, 9, 11, and 13. The RI report described the field sampling investigations, geology, hydrogeology, and presented contamination and risk assessments; the Phase I FS report identified the remedial action objectives, and developed and screened remedial actions for each site. In August and July, 1991, Jordan submitted Draft Final Supplemental RI and Supplemental Phase I FS reports, respectively. The Supplemental RI report included initial studies at Sites 5, 6, 12, and 14, and additional studies at Sites 8, 9, and 11. The Supplemental Phase I FS report provided remedial action objectives and developed and screened remedial alternatives for Sites 5, 6, and 12.

Because the Navy is committed to providing a timely response to environmental contamination at NAS Brunswick, a strategy was developed to expedite the RI/FS process. This strategy involves separating the 13 sites into "operable units" and establishing separate timetables for the completion of the Final FS reports and Records of Decision. The Navy has identified Sites 1 and 3, Site 8, and the Eastern Plume (i.e., contaminated groundwater originating from Sites 4, 11, and 13) as three distinct operable units and believes the remedial process can be initiated for these sites.

This report is submitted in support of the Navy's overall strategy for remediation at NAS Brunswick and completes the Focused Feasibility Study (FFS) for the Perimeter Road Disposal Site (i.e., Site 8). This approach enables the Navy to proceed with developing remedial strategies for this well-defined site at NAS Brunswick. This report was conducted in accordance with the Superfund Amendments and Reauthorization Act of 1986 (SARA), the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) (USEPA, 1990), and USEPA guidance (USEPA, 1988), and fulfills part of the requirements established in the FFA. It consists of the detailed evaluation and comparative analysis of the remedial alternatives developed and screened for Site 8 that were presented in the Phase I FS (E.C. Jordan Co., 1990b).

The report is organized as follows. Section 2.0 of this report summarizes the site history and response objectives that were detailed in the RI (E.C. Jordan Co., 1990a) and the Phase I FS reports (E.C. Jordan Co., 1990b); Section 3.0 evaluates each alternative in accordance with the criteria set in the NCP and contains a general description of and cost estimate for each remedial action; Section 4.0 provides a comparative summary of the alternatives.



SOURCE: U.S.G.S. QUADRANGLES, BRUNSWICK, AND ORRS ISLAND, ME., 1984, 1978. 7.5 MINUTE SERIES.

QUADRANGLE LOCATION

N

SCALE IN FEET

0 2000 4000

E.C. JORDAN CO. CONSULTING ENGINEERS	SITE LOCATION MAP
INSTALLATION RESTORATION PROGRAM NAVAL AIR STATION BRUNSWICK, MAINE	SITE 8 FFS
	4607-57 FIGURE 1-1

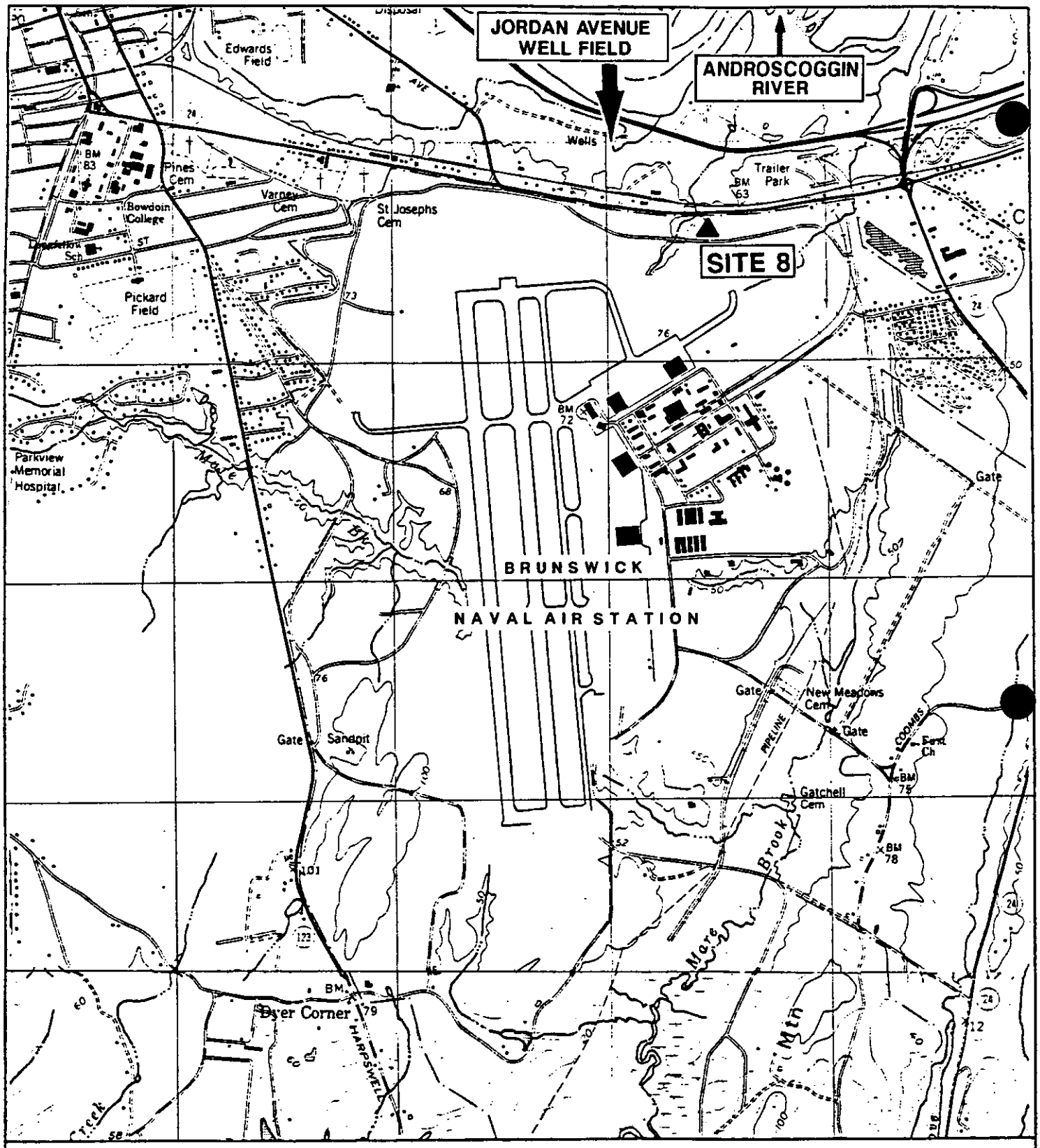
2.0 SUMMARY OF RESPONSE OBJECTIVES AND REMEDIAL ALTERNATIVES

This section summarizes the contamination assessment, risk assessments, Applicable or Relevant and Appropriate Requirements (ARARs), response objectives, and remedial alternatives developed for Site 8, which were presented in the Draft Final RI and Phase I FS reports (E. C. Jordan Co., 1990a,b). The RI and Phase I FS reports contain more detailed information on this site including the site history, hydrology, geology, and contamination evaluations.

2.1 PERIMETER ROAD DISPOSAL AREA: SITE 8 - SUMMARY OF CONTAMINATION

Site 8 was a disposal area reportedly used from 1964 to 1974 to dispose of rubble, debris, and trash generated at the NAS (R.F. Weston, Inc., 1983). Solvents were reportedly disposed of at this site, however, there are no data to substantiate this claim. The site is approximately 0.6-acre and is located in the northern portion of the base (Figure 2-1). Perimeter Road, which runs east to west on the NAS, is adjacent to the site.

Two small tributaries border the site. Surface runoff from the northern 2,000 feet of the NAS drain into these tributaries, which flow approximately 1,800 feet to the north and discharge to the Androscoggin River. The Jordan Avenue Wellfield, a municipal drinking water supply for the Town of Brunswick, is located 2,000 feet north-northwest of Site 8. Contaminants detected at Site 8 that pose a potential risk to human health or the environment include polynuclear aromatic hydrocarbons (PAHs) in surface and shallow soil and DDT (dichlorodiphenyltrichloroethane) in leachate sediment (Figure 2-2) (E.C. Jordan Co., 1990). PAHs were detected in test pit soil samples collected in the eastern portion of the site at concentrations ranging from 2.7 to 53 milligrams per kilograms (mg/kg) of total PAHs. Carcinogenic PAH concentrations ranged from less than 2.5 to 30 mg/kg. DDT was detected at one leachate location in sediment at concentrations ranging from 0.034 to 0.058 mg/kg. The presence of DDT at Site 8 was an initial concern because this compound is known to bioaccumulate and bioconcentrate in aquatic and terrestrial food chains. However, because of the small area of contamination and relatively low levels (i.e., less than 0.06 mg/kg) detected at Site 8, DDT is not expected to cause adverse impacts to the ecological receptors in this area. (This is discussed in more detail in Subsection 2.2.2). Other contaminants were detected at Site 8, but at concentrations that do not pose a risk to human health or the environment (E.C. Jordan Co., 1990a). No trash or source areas of gross contamination were identified during field investigations at this site.



SOURCE: U.S.G.S. QUADRANGLES, BRUNSWICK AND ORRS ISLAND, ME. DATED 1984/1978. 7.5 MINUTE SERIES.

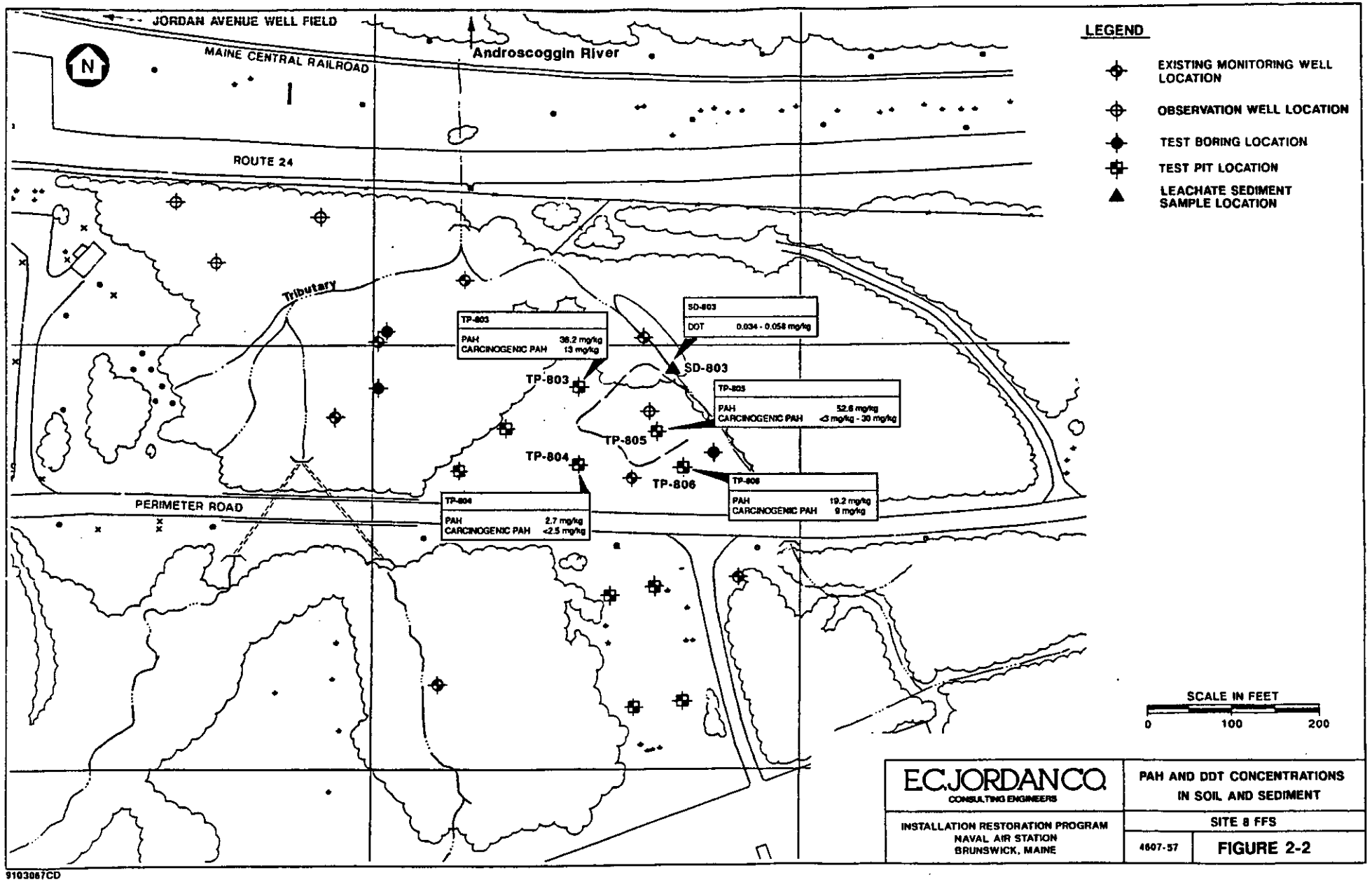
QUADRANGLE LOCATION

N

SCALE IN FEET

0 2000 4000

E.C. JORDAN CO. CONSULTING ENGINEERS	SITE LOCATION MAP SITE 8
INSTALLATION RESTORATION PROGRAM NAVAL AIR STATION BRUNSWICK, MAINE	SITE 8 FFS
	4607-57 FIGURE 2-1


JORDAN AVENUE WELL FIELD
MAINE CENTRAL RAILROAD
Androscoggin River
ROUTE 24
Tributary
PERIMETER ROAD
N
TP-803
PAH 36.2 mg/kg
CARCINOGENIC PAH 13 mg/kg
SD-803
DDT 0.034 - 0.058 mg/kg
TP-805
PAH 52.6 mg/kg
CARCINOGENIC PAH <3 mg/kg - 30 mg/kg
TP-804
PAH 2.7 mg/kg
CARCINOGENIC PAH <2.5 mg/kg
TP-806
PAH 19.2 mg/kg
CARCINOGENIC PAH 9 mg/kg
LEGEND
EXISTING MONITORING WELL LOCATION
OBSERVATION WELL LOCATION
TEST BORING LOCATION
TEST PIT LOCATION
LEACHATE SEDIMENT SAMPLE LOCATION
SCALE IN FEET
0
100
200
EC JORDAN CO.
CONSULTING ENGINEERS
INSTALLATION RESTORATION PROGRAM
NAVAL AIR STATION
BRUNSWICK, MAINE
PAH AND DDT CONCENTRATIONS IN SOIL AND SEDIMENT
SITE 8 FFS
4607-57
FIGURE 2-2
9103067CD

2.2 SUMMARY OF BASELINE RISK ASSESSMENTS

The human health and ecological risks associated with contaminant exposure at Site 8 were evaluated and presented in Appendix Q of the Draft Final RI report (E.C. Jordan Co., 1990a). Since the submittal of the RI, additional risk estimates for Site 8 have been developed at the request of USEPA Region I and based on more recent guidance (USEPA, 1991a). The results of these risk assessments are summarized in the following subsections and the revised risk estimates are presented in Appendix E.

2.2.1 Human Health Risk Assessment

The human health risks developed and presented in the Draft Final RI were estimated based on potential contaminant exposure under current and future land-use scenarios. Because access to this site is not controlled, repetitive exposure to surface soil, surface water, and sediment was considered possible. The exposure scenario used to evaluate risk was based on an older child (ages 7 through 12) who regularly accesses or trespasses on the site over a 6-year exposure duration. This scenario was assumed to reflect both current and reasonable future land-use at the site.

Direct contact with and incidental ingestion of surface soil are the only routes of exposure associated with incremental carcinogenic risks exceeding $1x10^{-6}$. Carcinogenic PAHs (i.e., benzo[*a*]anthracene, benzo[*b*]fluoranthene, benzo[*k*]fluoranthene, benzo[*a*]pyrene, chrysene, indeno[1,2,3-*cd*]pyrene, and dibenz[*a,h*]anthracene) were the only contaminants of concern detected in soil. The current human health risk associated with direct contact of PAH contaminated surface soil using the predicted exposure scenarios range from $6.8x10^{-6}$ for the most probable scenario (i.e., based on exposure to the average contaminant concentrations) to $1.5x10^{-5}$ for a realistic worst case scenario (i.e., based on exposure to the maximum contaminant concentration) (E.C. Jordan Co., 1990a). Lead and DDT were also detected in the soils at Site 8 at maximum concentrations of 37 and 0.08 mg/kg, respectively. The risks associated with exposure to these compounds were below levels considered to present a health risk (i.e., a Hazard Index less than one) (E. C. Jordan Co. 1990a). Risks associated with exposure to sediment (both leachate and drainage sediment) and surface water under current and reasonable future land use were also below levels considered to present a risk to human health (E.C. Jordan Co., 1990a).

Additional risk estimates were developed for Site 8 based on supplemental guidance from USEPA (USEPA, 1991a). This guidance provides standard default scenarios and exposure parameters for evaluating potential risks under assumed future residential land use. The standard exposure scenario assumes long-term repetitive exposure through direct contact and

incidental ingestion of soil occurring 350 days per year over a 30 year exposure duration. This scenario was evaluated for Site 8 assuming exposure to the average, mean and maximum PAH soil concentration. The total incremental carcinogenic risks were $1x10^{-4}$, $6x10^{-5}$, and $3x10^{-4}$ based on exposure to the average, mean and maximum detected concentrations, respectively. These risk estimates are presented in Appendix E.

The risk estimates based on exposure to the average and mean concentrations fall within the USEPA target risk range of 10^{-4} to 10^{-6}. The risk estimate based on exposure to the maximum concentration slightly exceeds the 10^{-4} risk level. However, USEPA guidance presented in "Role of the Baseline Risk Assessment in Superfund Remedy Selection" states that "The upper boundary of the risk range is not a discrete line at $1x10^{-4}$ although USEPA generally uses $1x10^{-4}$ in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions."

Based on the conservative exposure assumptions used to develop risk estimate (i.e., long-term repetitive exposure to the maximum detected concentration), and the limited number of contaminants of concern (i.e., only PAHs), the upper bound estimate of $3x10^{-4}$ is not considered to represent a significant health risk at Site 8. Therefore, remedial action objectives for soil contamination are not required for this site.

The potential risks associated with exposure to groundwater were evaluated based on a comparison of contaminant concentrations to ARARs (i.e., Maximum Contaminant Levels [MCLs] or Maximum Contaminant Level Goals [MCLGs] or health based criteria (i.e., Reference Dose [RfD]). Inorganic compounds were the contaminants detected most frequently in groundwater both upgradient and downgradient of the site. The presence of these compounds was attributed to the natural chemistry of the subsurface soil at Site 8 (E.C. Jordan Co., 1990a and 1991). Cadmium was the only contaminant detected in the groundwater, downgradient of the site, above its respective drinking water standard or health based criteria. The concentration of cadmium detected downgradient of Site 8 ranged from ND to 0.012 mg/L. The MCL for cadmium is 0.005 mg/L. Cadmium was not detected in any samples collected during the Post-screening Work Plan (E.C. Jordan, 1991).

A detailed discussion of groundwater flow around Site 8, contained in the Supplemental RI report (E.C. Jordan Co., 1991), includes an interpretation of additional data collected as part of the Post-Screening Work Plan. Present available data indicate there is no hydraulic connection between the groundwater at Site 8 and the Jordan Avenue Wellfield. Therefore, contaminants detected at Site 8 are not expected to impact the municipal drinking water supply for the Town of Brunswick.

Applying the USEPA guidance presented in "Role of the Baseline Risk Assessment in Superfund Remedy Selection Decision" (USEPA, 1991b), remedial action objectives are not required for this site. This guidance states: "If the baseline risk assessment and the comparison of exposure concentrations to chemical-specific standards indicates that there is no unacceptable risk to human health or the environment and that no remedial action is warranted, then the CERCLA Section 121 cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs are not triggered. CERCLA Section 121 (a) requires only that those remedial actions that are "determined to be necessary...under Section 104 or...106...be selected in accordance with Section 121". Because there is no current or likely future exposure to groundwater, no unacceptable risks were identified. Therefore, despite the slight exceedance of the MCL for cadmium, Site 8 is not considered to present an unacceptable risk to human health or the environment.

2.2.2 Summary of Environmental Risks

Environmental risks at Site 8 are associated with exposure to contaminants in leachate sediment and surface water. Exposure to contaminants by wildlife drinking from leachate seeps and from uptake of soil contaminants into the terrestrial food-chain appear to be minimal (E.C. Jordan Co., 1990a).

Exposure to DDT in leachate sediment was an initial concern because of the propensity of this compound to bioaccumulate and bioconcentrate in food chains. However, DDT was detected at only one sampling location (SD-803) in two of the four sampling rounds (see Figure 2-2). DDT concentrations in these samples were 0.034 (Round III) and 0.058 mg/kg (Round II). No DDT was detected at this location in samples collected during Rounds I or IV. The variation in the detection of DDT is probably a function to the relatively low concentrations present and the non-homogenous distribution of DDT in the leachate sediment. The average DDT concentration of all positive detects in sediments from Site 8 is 0.008 mg/kg. This is consistent with the residual concentrations of this contaminant across NAS Brunswick as DDT was widely used as an insecticide in the 1960s and early 1970s. Table 2-1 presents the range of DDT contamination detected at Site 8 and other sites under study at NAS Brunswick. The ecological Hazard Index associated with exposure to 0.008 mg/kg DDT is less than one.

Exposure to iron, aluminum, lead, and cyanide in surface water was associated with potential impacts to ecological receptors. These contaminants were detected in the tributary draining the western portion of Site 8 (see Figure 2-2). Elevated levels of these contaminants (compared to background concentrations) were also detected in upstream and off-base sampling locations (i.e., north of Route 24). There was no consistent trend in contaminant

TABLE 2-1
SUMMARY OF TOTAL DDT, DDE, DDD CONCENTRATIONS
DETECTED AT NAS BRUNSWICK; ROUNDS I - V

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

	RANGE (mg/kg)	MEDIUM[1]	SAMPLING ROUND[2]
Sites 1, 2 and 3	ND-0.93	LT	I
	ND-0.15	TP	I
	ND-0.071	SB	IV
	ND-0.052	SS	IV
	ND-0.028	TP	IV
	ND-0.052	LT	IV
Site 4	ND-0.01	TP	I
Site 7	ND-0.34	TP	I
	ND-0.41	TP	IV
Site 8	ND-0.058	SED	II
	ND-0.038	SED	III
	ND-0.076	TP	IV
Site 9	ND-0.064	SED	II
	ND-0.133	SED	III
	ND-0.097	SED	IV
	ND-2.62	LT	IV
	ND-0.87	SS	IV
	ND-0.09	TP	V
Site11	ND-0.020	TP	V
Site 13	ND-0.021	TP	IV

[Source: E.C. Jordan 1990a, 1991.]

NOTES:
1. LT = Leachate
   TP = Test pit
   SB = Surface boring
   SS = Surface soil
   SED = Sediment
2. Five rounds of sampling were conducted at NAS Brunswick

concentrations by location or over the sampling rounds. The analytical data show inconsistent and sporadic detection of these inorganic compounds, suggesting that surface water contamination is not related solely to past disposal activities at Site 8. Nonpoint source discharges such as surface drainage of the runway and/or Route 24 appear to be impacting the water quality in these tributaries (E.C. Jordan Co., 1990a). Inorganic contaminants were not detected in surface water from the eastern drainage area of Site 8 which is immediately adjacent to the disposal area and would be most susceptible to contaminant impacts from past disposal activities.

Based on the results of the ecological risk assessment, remedial action objectives were considered to reduce exposure to or concentrations of cyanide, aluminum, iron, and lead in surface water. Concentrations of DDT in leachate sediments were consistent with expected background levels and below concentrations considered to present an ecological risk. Target Clean-up Levels for contaminants in surface water are proposed at the contaminant's Ambient Water Quality Criteria.

2.3 Identification Of Applicable Or Relevant And Appropriate Requirements

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) (i.e., Superfund) applies to each department, agency, and instrumentality of the U.S. (i.e., federal facility) including the executive, legislative, and judicial branches of government, both procedurally and substantively, in the same manner and to the same extent as any nongovernmental entity. All guidelines, rules, regulations, and criteria promulgated, and included by reference, under CERCLA (including the NCP) are applicable to federal facilities. Federal facilities must comply with the cleanup standards set forth in Section 121, including federal and state ARARs.

Under Executive Order 12580 (Superfund Implementation), USEPA was delegated the authority to select the extent of remedy at federal facilities on the NPL. Section 2701 of CERCLA (the Environmental Restoration Program [ERP]) authorizes the Secretary of Defense to carry out a program of environmental restoration at Department of Defense facilities. Program activities must be carried out consistent with Section 120 of CERCLA, in consultation with the Administrator of USEPA. Program goals include (1) identification, (2) investigation, (3) research and development, and (4) cleanup of contamination from hazardous substances, pollutants, and contaminants. The ERP consists of three main components: (1) the Department of Energy ERP; (2) the defense Environmental Restoration Program (DERP), for remediation of formerly owned federal facilities,

administered by the U.S. Army Corps of Engineers (USACE); and (3) the IRP for active and inactive Army, Navy and Air Force installations.

NAS Brunswick is an active Naval base being investigated under the IRP section of the ERP. The IRP has developed a remedial program that parallels the USEPA RI/FS process in following sites from discovery through remedial action. The Draft Final RI and Phase I FS reports present the chemical-, action-, and location-specific ARARs for the nine original sites at NAS Brunswick (E.C. Jordan Co., 1990a and E.C. Jordan Co., 1990b). In this section, all ARARs that potentially apply to Site 8 are identified.

2.3.1 Definition of ARARs

To properly consider ARARs and, more importantly, to clarify their function in the RI/FS and remedial response processes, the NCP defines two ARAR components: (1) applicable requirements, and (2) relevant and appropriate requirements. These definitions were revised to incorporate applicable portions of SARA, and are discussed in the following paragraphs.

Applicable requirements are those federal and state requirements that would be legally applicable, either directly or as incorporated by a federally authorized state program. Requirements that specifically address, and have jurisdiction over, a given situation are considered "applicable requirements". An example of an applicable requirement is the use of MCLs for a site where groundwater contamination enters a public water supply.

Relevant and appropriate requirements are those federal and state requirements that, while not legally "applicable", can be applied if the decision-maker's best professional judgement determines that site circumstances are sufficiently similar to those situations that are covered and use of the requirement makes good sense. Relevant and appropriate requirements are intended to have the same weight and consideration as applicable requirements.

The term "relevant" was included so that a requirement initially screened as non-applicable because of jurisdictional restrictions would be reconsidered and, if appropriate, be included as an ARAR for the site. For example, MCLs would be relevant and appropriate requirements at a site where groundwater contamination could affect a potential (rather than actual) drinking water source.

Other requirements to be considered (TBCs) are federal and state nonpromulgated advisories or guidelines that are not legally binding and do not have the status of potential ARARs. However, if there are no specific ARARs for a chemical or site condition, or if

existing ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure public health and environmental protection.

2.3.2 Development of ARARs

Under the description of ARARs in the NCP and SARA, state and federal environmental requirements must be considered that are:

- chemical-specific (i.e., govern the extent of site remediation)
- location-specific (i.e., pertain to existing features)
- action-specific (i.e., pertain to proposed site remedies and govern implementation of the selected site remedy)

2.3.2.1 Chemical-specific ARARs. Chemical-specific ARARs are usually health- or risk-based standards limiting the concentration of a chemical found in or discharged to the environment. Chemical-specific ARARs govern the extent of site cleanup and provide either actual clean-up levels or a basis for calculating such levels. Chemical-specific ARARs are also used to indicate acceptable levels of discharge to determine treatment and disposal requirements and to assess the effectiveness of remedial alternatives. Table 2-2 summarizes potential chemical-specific ARARs which are listed by the media to which they apply. The following paragraphs discuss the purpose and intent of the federal and state chemical-specific ARARs that apply to Site 8 and proposed remedial actions presented in this FS.

Groundwater. The RI report and Risk Assessment indicate that the contaminants at Site 8 have not impacted groundwater. Chemical-specific ARARs regulating the quality of groundwater do not apply to the alternatives presented in this FS. However, chemical-specific standards for groundwater will be used to compare groundwater analytical data from the environmental monitoring that would be conducted as part of the five-year review process.

Air. Regulations promulgated under the Clean Air Act and Maine Ambient Air Quality Standards establish standards that limit the concentration of pollutants released to the air. These limits are promulgated under National Primary and Secondary Ambient Air Quality Standards (40 CFR Part 50) and Maine Ambient Air Quality Standards (MEDEP Regulations, Chapter 110). The alternatives under consideration in this FS do not employ any technology that would results in a point-source of air emissions. The excavation of soils

TABLE 2-2
CHEMICAL-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
GROUNDWATER/SURFACE WATER				
Federal	SDWA - MCLs (40 CFR 141.11 - 141.16)	Relevant and Appropriate	MCLs have been promulgated for several common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers used for drinking water.	To assess the potential risks to human health due to consumption of groundwater, contaminant concentrations were compared to their MCLs.
	SDWA - MCLGs (40 CFR 141.50 - 141.51)	Relevant and Appropriate	MCLGs are health-based criteria to be considered for drinking water sources as a result of SARA. MCLGs are available for several organic and inorganic contaminants.	The 1990 National Contingency Plan states that non-zero MCLGs are to be used as goals. Contaminant concentrations in groundwater were compared to their MCLGs.
	RCRA - Subpart F Groundwater Protection Standards, Alternative Concentration Limits (40 CFR 264.94)	Relevant and Appropriate	This requirement outlines standards, in addition to background concentrations and MCLs, to be used in establishing clean-up levels for remediating groundwater contamination.	These requirements may be relevant and appropriate if certain conditions relating to transport and exposure are met.
	Federal AWQC	Relevant and Appropriate	Federal AWQC are health-based criteria developed for carcinogenic and noncarcinogenic compounds and parameters. AWQC for the protection of human health provide levels for exposure from drinking water and consuming aquatic organisms, and from consuming fish alone. Remedial actions involving contaminated surface water or groundwater must consider the uses of the water and the circumstances of the release or threatened release; this determines whether AWQC are relevant and appropriate.	This requirement will be complied with when determining clean-up levels or potential discharge limits for treated groundwater.
Federal Guidance and Criteria To Be Considered	USEPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are considered the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	USEPA RfDs are used to characterize risks due to noncarcinogens in various media.

(continued)

TABLE 2-2
CHEMICAL-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
	USEPA Carcinogen Assessment Group Carcinogenic Potency Factors (CPFs)	To Be Considered	Carcinogenic effects present the most up-to-date information on cancer risk potency derived from USEPA's Carcinogen Assessment Group.	USEPA CPFs are used to compute the individual incremental cancer risk resulting from exposure to certain compounds.
State	Maine Drinking Water Rules (10-144A CMR Chapters 231-233)	Relevant and Appropriate	Maine's Primary Drinking Water Standards are equivalent to federal MCLs. Maine MEGs have been promulgated for several contaminants. When state levels are more stringent than federal levels and have been legally and consistently applied, the state levels may be used.	Primary drinking water standards will be used to set clean-up levels.
	Maine Regulations Relating to Water Quality Criteria for Toxic Pollutants (MEDEP Regs, Chapter 584)	Applicable	This rule limits the concentrations of certain materials allowed in Maine waters to prevent the occurrence of pollutants in toxic amounts as required by state and federal law. Except if naturally occurring, ambient levels of toxic pollutants shall not exceed the Clean Water Act AWQC. Where AWQC do not exist, the Board of Environmental Protection shall adopt site-specific numerical criteria.	These standards will be attained when determining clean-up levels or potential discharge limits.
AIR				
Federal	Clean Air Act - National Primary and Secondary Ambient Air Quality Standards (40 CFR 50)	Applicable	Primary ambient air quality standards define levels of air quality to protect public health. Secondary ambient air quality standards protect public welfare from known or anticipated adverse effects from pollutants.	Particulate standard for matter less than 10 microns is 150 $\mu g/m^3$, 24-hour average concentration.
State	Establishment of Air Quality Regions (38 MRSA, Section 583; MEDEP Regs, Chapter 114)	Relevant and Appropriate	The Metropolitan Portland Air Quality Region is Class II.	Remedial actions should not result in the degradation of air quality classification.

(continued)

TABLE 2-2
CHEMICAL-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
	Maine Ambient Air Quality Standards (38 MRSA, Section 584; MEDEP Regs, Chapter 110)	Applicable	This Chapter establishes ambient air quality standards that are maximum levels of a particular pollutant permitted in the ambient air.	Standards for specific contaminants include: (1) particulate matter-150 $\mu g/m^3$, 24-hour average concentration; (2) hydrocarbons-160 $\mu g/m^3$, 3-hour period; (3) lead-1.5 $\mu g/m^3$, 24-hour period; (4) total chromium-0.3 $\mu g/m^3$, 24-hour period; and (5) photochemical oxidants-160 $\mu g/m^3$, 24-hour period.

NOTES:

ARAR = Applicable or Relevant and Appropriate Requirement
AWQC = Ambient Water Quality Criteria
CFR = Code of Federal Regulations
CMR = Code of Maine Rules
CPF = carcinogenic potency factor
FS = feasibility study
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
MEG = Maximum Exposure Guidelines
MEDEP = Maine Department of Environmental Protection
MRSA = Maine Revised Statues Annotated
NAS = Naval Air Station
RI = remedial investigation
RCRA = Resource Conservation and Recovery Act
RfD = reference dose
SARA = Superfund Amendments and Reauthorization Act
SDWA = Safe Drinking Water Act
USEPA = U.S. Environmental Protection Agency
$\mu g/m^3$ = micrograms per cubic meter

proposed in Alt-8D would potentially trigger particulate standards if remedial construction is conducted during dry, dusty conditions.

Both the federal and state ambient air quality standards establish a limit for particulate matter. These standards are ARARs where excavation or invasive activities may generate dust and debris. The standards for suspended particulate matter is 150 $\mu g/m^3$, 24-hour average concentration. Compliance with this requirement can be achieved by conducting air monitoring when invasive work is likely to occur during dry, dusty conditions. If monitoring indicates that particulate levels are close to the maximum allowable level, dust suppression controls would be implemented.

Surface Water. Chemical-specific standards for surface water are promulgated under the Federal AWQC. Surface water data indicates that the concentration of lead, iron, and cyanide exceed AWQC; however, the presence of these contaminants in surface water is not attributable to Site 8. Treating surface water to attain AWQC is not addressed in this FS since the contamination is not associated with the soil contamination at the site. Treating surface water would require developing a separate engineering approach that would be inconsistent with the response objectives for this site.

2.3.2.2 Location-specific ARARs. Location-specific ARARs govern natural site features (e.g., wetlands, floodplains, and sensitive ecosystems) and man-made features (e.g., existing landfills, disposal ares, and places of historical or archeological significance). These ARARs generally restrict the concentration of hazardous substances or the conduct of activities based solely on the site's particular characteristics or location. Table 2-3 provides a synopsis of potential location-specific standards listed by site feature.

The surface water bodies of the western drainage area would be regulated by ARARs that pertain to streams and wetlands. These natural features are regulated under the Maine Natural Resources Protection Act (38 M.R.S.A. 480A-S). Specific standards affecting activities that take place in, or adjacent to, wetlands or water bodies are set forth in the Permit by Rule Standards (MEDEP Regulations, Chapter 305). The design of remedial alternatives conducted within 100 feet of the high-water mark of a wetlands, or other water body, would address the requirements of these rules.

The presence of endangered species and rare habitats in the vicinity of Site 8 requires consideration of ARARS that protect these natural resources. The Grasshopper Sparrow, a state endangered species, is located a half mile west of Site 8. The Horned Lark and Upland Sandpiper, two species classified in Main's Indeterminate Category, are found west of Site 8 adjacent to the runway. Rare habitats, including a sandplain grassland and rare

TABLE 2-3
LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
WETLANDS				
Federal	CWA Section 404	Applicable	Section 404 of the CWA regulates the discharge of dredged or fill material into U.S. waters, including wetlands. The purpose of Section 404 is to ensure that proposed discharges are evaluated with respect to impact on the aquatic ecosystem. If a remedial alternative involves dredged or fill material discharge to a wetland, a permit must be obtained from the U.S. Army Corps of Engineers.	During the identification, screening, and evaluation of alternatives, the effects on wetlands are evaluated.
	U.S. Army Corps of Engineers Permit Program Regulations (33 CFR 320-330)	Applicable	These regulations prescribe the statutory authorities, and general and special policies and procedures applicable to the review of applications for Department of Army permits for controlling certain activities in U.S. waters including discharge of dredged or fill material.	To obtain a Department of Army permit, it must be shown (1) dredging and filling of the wetlands will cause minimal adverse impacts, (2) a less environmentally damaging alternative does not exist, and (3) the project is in the overall public interest.
	Guidelines for Specification of Disposal Sites for Dredged or Fill Materials (40 CFR 230)	Applicable	These guidelines maintain that no dredged or fill material discharge will be permitted if there is a practicable alternative with less impact to the aquatic ecosystem. Discharge will also not be permitted unless steps are taken to minimize potential adverse impacts, or if it will cause or contribute to significant degradation of U.S. waters.	If a remedial alternative involves discharging dredged or fill material to a wetland, potential short- or long-term effects must be determined, based on various physical, chemical, and biological parameters. Effects on human use characteristics such as aesthetics and recreation also need to be addressed.
	Fish and Wildlife Coordination Act (16 U.S.C. 661)	Applicable	This act requires that any federal agency proposing to modify a body of water must consult with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and other related state agencies.	Notification is not required for actions taken on-site at a CERCLA site. However, actions will be taken to minimize impacts to wetlands.
FLOODPLAINS	RCRA - Location Standards (40 CFR 264.18)	Relevant and Appropriate	A facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout of any hazardous wastes by a 100-year flood.	The impact of hazardous constituents on the affected surface waters must be considered during remedial actions.

(continued)

TABLE 2-3
LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
WETLANDS/FLOODPLAINS				
	40 CFR Part 6, Appendix A	Applicable	Sets forth USEPA policy for carrying out the provisions of the Wetlands Executive Order (EO 11990) and Floodplains Executive Order (EO 11988). Under this order, federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands; and minimize potential harm to or within floodplains and to avoid the long- and short-term adverse impact with modifications to floodplains.	This requirement will be considered during the development of alternatives. If no practical alternative exists, potential harm must be minimized and action taken to restore the natural and beneficial values of the wetland or floodplain.
State	Maine Natural Resources Protection Act (38 MRSA, Section 480-A through S)	Applicable	This act outlines requirements for certain activities adjacent to any freshwater wetland greater than 10 acres or with an associated stream, brook, or pond or adjacent to a coastal wetland. The activities must not unreasonably interfere with certain natural features, such as natural flow or quality of any waters, nor harm significant aquatic habitat, freshwater fisheries, or other aquatic life.	Remedial activities regulated under this act must meet activity standards. Substantive requirements of these regulations must be met by any action taken within 100 feet of a wetland or stream.
	Natural Resources Protection Act, Permit by Rule Standards (MEDEP Regs, Chapter 305)	Applicable	This rule outlines prescribed standards for specific activities that may take place in or adjacent to wetlands and water bodies.	Proposed activities involving disturbance of soil material and discharge of treatment water, within 100 feet of the normal high water line, would be designed to incorporate all applicable standards.
	Maine Hazardous Waste Management Rules (MEDEP Regs, Chapters 800-802, 850, 851, 853-857)	Applicable	These rules correspond to and supplement RCRA hazardous waste requirements and outline the criteria for the siting of a new facility. No portion of a treatment facility may be located within a wetland or within 300 feet of any 100-year floodplain.	The siting rules will be considered when selecting a location if an on-site treatment facility is proposed that would handle hazardous waste.

(continued)

TABLE 2-3
LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
OTHER NATURAL RESOURCES				
Federal	Endangered Species Applicable Act	Applicable	This act requires action to avoid jeopardizing the continued existence of listed endangered or threatened species or notification of their habitat.	Endangered or threatened species in the site area will be identified. Activities must not impact such species.
State	Maine Standards for Classification of Groundwater (38 MRSA, Section 470)	Applicable	This law requires the classification of the state's groundwater to protect, conserve, and maintain groundwater resources in the interest of the health, safety, and general welfare of the people of the state.	Under the Maine standards, groundwater is classified as GW-A.
	Maine Standards for Classification of Minor Drainages (38 MRSA, Section 468)	Applicable	Mere Brook is classified as a Class B water under the state water quality standards. Class B waters are defined as suitable for drinking water (after treatment), fishing, recreation in and on the water, and as habitat for fish and other aquatic life.	Remedial actions should not result in the degradation of water quality classification.
	Maine Water Pollution Control Law: Solid Waste Disposal Areas; Location (38 MRSA, Section 421)	Applicable	No boundary of any public or private solid waste disposal area shall lie closer than 300 feet to any classified body of surface water; also known as the Three-Hundred-Foot Law.	During the development of alternatives, effects on the surface waters will be evaluated.
	Maine Site Location Development Law and Regulations (38 MRSA Sections 481-490; MEDEP Regs, Chapters 371-377)	Applicable	This act and regulations govern drilling for natural resources and includes hazardous activities that consume, generate, or handle hazardous wastes and oil. Activities cannot adversely affect existing uses, scenic character, or natural resources in the municipality or neighboring municipality.	Remedial alternatives will be developed considering these regulations. A permit will not be required if the activity is on-site.

(continued)

TABLE 2-3
LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
	Maine Solid Waste Management Rules: Landfill Disposal Facilities (38 MRSA, Section 1301 et seq.; MEDEP Regs, Chapters 400-406)	Applicable	These regulations outline landfill siting requirements including minimum distances to aquifers, bedrock, and geologic faults.	The standards outlined in this requirement will be incorporated into the design of any remedial alternative proposing construction of a land disposal facility.
	Maine Inland Fisheries and Wildlife Laws and Regulations (12 MRSA Chapter 713, Section 7751)	Applicable	The state of Maine has authority to research, list, and protect any species deemed endangered or threatened. These species are listed as either endangered or threatened in the state regulations. The Maine Department of Inland Fisheries and Wildlife has also developed the following administrative categories for species not considered endangered or threatened but considered important for research and further evaluation: Maine Watch List, Special Concern List, and Indeterminate Category. The Department determines appropriate use(s) of various habitats on a case-by-case basis. The Maine lists may differ from the federal lists of endangered species.	Endangered or threatened species in the site area will be identified. Activities must not impact an endangered or threatened species.
State Guidance and Criteria To Be Considered	Town Shoreland Zoning Ordinances and State Minimum Guidelines	To Be Considered	These minimum guidelines and town ordinances apply to activities proposed within 200 feet of a high-water mark of a stream or other body of water.	These guidelines will be considered in the siting of treatment facilities during the development and evaluation of remedial alternatives.
	Maine Critical Areas Program and Maine Natural Heritage Program	To Be Considered	These state programs issue policies and regulations governing special habitats or communities.	Where such special areas exist, these state programs will become involved in the project and/or permit review process.

(continued)

TABLE 2-3
LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
	Maine Critical Areas Act (5 MRSA 3310 through 3316)	To Be Considered	This nonregulatory legislation allows Maine agencies such as the Critical Areas Program and the Natural Heritage Areas Program to identify, research, and protect critical areas and endangered or threatened plants.	Where such special areas exist, these state programs will become involved in the project and/or permit review process.

Notes:

ARAR = Applicable or Relevant and Appropriate Requirements
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = Code of Federal Regulations
CWA = Clean Water Act
EO = Executive Order
MRSA = Maine Revised Statutes Annotated
MEDEP = Maine Department of Environmental Protection
NAS = Naval Air Station
RI/FS = Remedial Investigation/Feasibility Study
RCRA = Resource Conservation and Recovery Act
USC = United States Code

pitch pine heath barren, occur a half mile west of Site 8 at the end of the runway. Federal and state regulations protecting endangered species include the Endangered Species Act and the Maine Inland Fisheries and Wildlife Laws and Regulations. The State of Maine critical areas and Natural Heritage Program issues policies and regulations governing special habitats. The key provision to all of these regulations is that appropriate state and federal agencies be contacted and involved if any actions are likely to impact protected species and habitats.

The remedial actions proposed for Site 8 are centralized at the disposal site. Remedial activities are not likely to impact protected areas and species. While these regulations do apply to the alternatives proposed at Site 8, the small scale of any construction activity does not warrant any special approach to comply with these requirements.

2.3.2.3 Action-specific ARARs. Action-specific ARARs are usually technology- or activity-based limitations controlling action conducted at hazardous waste sites. As remedial alternatives are developed, action-specific ARARs (pertaining to proposed site remedies) provide a basis for assessing feasibility and effectiveness. Table 2-4 provide a synopsis of potential action-specific ARARs. During the detailed analysis of remedial alternatives, each alternative will be evaluated for compliance with the specific, applicable standards of each ARAR. There are a number of general action-specific ARARs that apply, or are relevant and appropriate, to any remedial action conducted at a hazardous waste site. These general requirements are discussed in the following paragraphs.

The Occupational Safety and Health Administration (OSHA) (29 CFR 1904, 1910, and 1926) are action-specific ARARs that apply to each alternative. OSHA is responsible for worker safety at CERCLA sites. These regulations set standards for exposure limits, safety training, protective equipment, and employer responsibility. OSHA requirements would be addressed during the development and implementation of the Health and Safety Plan for the chosen alternative.

A number of standards for the operation and safety of hazardous waste treatment facilities are promulgated under the Resource Conservation and Recovery Act (RCRA) and are relevant and appropriate to all remedial alternatives. RCRA General Facility Standards (40 CFR 264.10 - 264.18), Preparedness and Prevention (40 CFR 264.30 - 264.37), and Contingency Plan and Emergency Procedures (40 CFR 264.50 - 264.56) would apply to any remedial actions conducted at NAS Brunswick. The Maine Hazardous Waste Management Rules (MEDEP Regulations, Chapters 800-802, 850, 851, 853-857) supplement the RCRA general standards; therefore, would also apply. These regulations outline requirements for

TABLE 2-4
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
Federal		
RCRA - General Facility Standards (40 CFR 264.10-264.18)	General facility requirements outline general waste analysis, security measures, inspections, and training requirements.	Any facilities will be constructed, fenced, posted, and operated in accordance with this requirement. All workers will be properly trained.
RCRA - Preparedness and Prevention (40 CFR 264.30-264.37)	This regulation outlines requirements for safety equipment and spill-control requirements for hazardous waste facilities. Part of the regulation includes a requirement that facilities be designed, maintained, constructed, and operated to minimize the possibility of an unplanned release that could threaten human health or the environment.	Safety and communication equipment will be installed at the site; local authorities will be familiarized with site operations.
RCRA - Contingency Plan and Emergency Procedures (40 CFR 264.50-264.56)	This regulation outlines the requirements for emergency procedures to be used following explosions, fires, etc.	Plans will be developed and implemented during site work including installation of monitoring wells, and implementation of site remedies. Copies of the plans will be kept on-site.
RCRA - Releases from Solid Waste Management Units (40 CFR 264.90-264.109)	This regulation details groundwater monitoring requirements for hazardous waste treatment facilities. The regulation outlines general groundwater monitoring standards, as well as standards for detection monitoring, compliance monitoring, and corrective action monitoring.	General groundwater monitoring standards should be addressed as part of any proposed alternative. The need for any of the specific monitoring programs will depend on whether source materials are removed, treated, or left in place.
RCRA - Closure and Post-closure (40 CFR 264.110-264.120)	This regulation details general requirements for closure and post-closure of hazardous waste facilities, including installation of a groundwater monitoring program.	Those parts of the regulation concerned with long-term monitoring and maintenance of the site will be considered during remedial design.
RCRA - Waste Piles (40 CFR 264.250-264.269)	This regulation details procedures, operating requirements, and closure and post-closure for waste piles. If removal or decontamination of all contaminated subsoils is not possible, closure and post-closure requirements for landfills must be attained.	According to RCRA, waste piles used for treatment or storage of noncontainerized accumulation of solid, nonflowing hazardous waste may comply with either the waste pile or landfill requirements. The temporary storage of solid waste on-site, therefore, must comply with one or the other subpart.
RCRA - Landfills (40 CFR 264.300-264.339)	This regulation details the design, operation, monitoring, inspection, recordkeeping, closure, and permit requirements for a RCRA landfill. Two liners must be installed to prevent groundwater contamination. A leachate collection system must be placed above and between the liner systems.	Disposal of contaminated materials from NAS Brunswick must be to a facility that complies with all relevant and appropriate RCRA landfill regulations, including closure and post-closure.

(Continued)

TABLE 2-4
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
RCRA - Miscellaneous Units (40 CFR 264.600-264.999)	These standards are applicable to miscellaneous units not previously defined under existing RCRA regulations. Subpart X outlines performance requirements that miscellaneous units be designed, constructed, operated, and maintained to prevent releases to the subsurface, groundwater, surface water, and wetlands that may have adverse effects on human health and the environment.	The design of proposed treatment alternatives, not specifically regulated under other subparts of RCRA, will address the means of preventing the release of hazardous constituents and prevent further impact on the environment.
RCRA Land Disposal Restrictions (40 CFR 268)	Land disposal of RCRA hazardous wastes is restricted without specified treatment. It must be determined that the waste, beyond a reasonable doubt, meets the definition of one of the specified restricted wastes and the remedial action must constitute "placement" for the land disposal restrictions to be considered applicable. For each hazardous waste, the LDRs specify that the waste must be treated either by a treatment technology or to a concentration level prior to disposal in a RCRA Subtitle C permitted facility.	If it is determined that hazardous materials located at NAS Brunswick are considered wastes subject to the LDRs, the hazardous materials will be handled and treated in compliance with these regulations.
OSHA - General Industry Standards (29 CFR Part 1910)	These regulations specify the 8-hour time-weighted average concentration for various organic compounds. Training requirements for workers at hazardous wastes operations are specified in 29 CFR 1910.120.	Proper respiratory equipment will be worn if it is impossible to maintain the work atmosphere below the concentration. Workers performing activities would be required to have completed specific training requirements.
OSHA - Safety and Health Standards (29 CFR Part 1926)	This regulation specifies the type of safety equipment and procedures to be followed during site remediation.	All appropriate safety equipment will be on-site. In addition, safety procedures would be followed during on-site activities.
OSHA - Recordkeeping, Reporting, and Related Regulations (29 CFR 1904)	This regulation outlines the recordkeeping and reporting requirements for an employer under OSHA.	These requirements apply to all site contractors and subcontractors, and must be followed during all site work.
CAA - National Ambient Air Quality Standards (40 CFR Part 50)	This regulation specifies maximum annual arithmetic mean and maximum 24-hour concentrations for particulate matter.	Fugitive dust emissions from site excavation activities will be maintained below the 24-hour maximum of 150 $\mu g/m^3$ and the annual arithmetic mean of 50 $\mu g/m^3$ by dust suppressants, if necessary.
RCRA - Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262)	This requirement sets standards for generators of hazardous waste that address (1) accumulating waste, (2) preparing hazardous waste for shipment, and (3) preparing the uniform hazardous waste manifest. These requirements are integrated with DOT regulations.	If any alternative proposes shipping wastes off-site, the material must be shipped in proper containers that are accurately marked and labeled, and the transporter must display proper placards. All waste shipments must be accompanied by an appropriate manifest.

(Continue

TABLE 2-4
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
DOT Rules for Transportation of Hazardous Materials (49 CFR Parts 107, 171.1-172.558)	This regulation outlines procedures for the packaging, labeling, manifesting, and transporting of hazardous materials.	Contaminated materials will be packaged, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations.
CWA - Regulations on Disposal Site Determinations Under the CWA (40 CFR 231)	These regulations apply to all existing, proposed, or potential disposal sites for discharges of dredged or fill material into U.S. waters, which include wetlands.	The dredged or fill material should not be discharged unless it can be demonstrated that such a discharge will not have an unacceptable impact on the wetlands.
State		
Maine Landfill Disposal Regulations (MEDEP Regs, Chapter 401)	These regulations outline the permitting requirements for solid waste disposal by landfill. Chapter 401 specifies closure and post-closure maintenance requirements.	Design of a solid waste cover system would have to meet minimum standards and specifications (401.7[c]). Institutional controls would need to include providing appropriate record information to the Registry of Deeds (401.7[f]).
Maine Landfill Disposal Regulations for Construction/Demolition Debris, Inert Fill, Land Clearing Debris, and Woodwaste (MEDEP Regs, Chapter 404)	These regulations outline requirements for permitting, siting, design, operation, and closure of landfills to be used for the disposal of construction/demolition debris, inert fill, land clearing debris, and woodwaste.	Site 8 can be classified as a construction/demolition debris landfill; therefore, the final cover system would have to meet minimum standards and specifications outlined in Chapter 404.5(4).
Management, Testing, and Disposal of Special Wastes (MEDEP Regs, Chapter 405)	Section 405.4 sets forth requirements that apply to the storage and disposal of asbestos wastes.	These requirements apply to alternatives that propose removing wastes or leaving the wastes in place. Site restrictions and monitoring requirements would need to be included in these types of alternatives.
Maine Hazardous Waste Management Rules (MEDEP Regs, Chapters 800-802, 850, 851, 853-857)	The rules provide a comprehensive program for handling, storage, and recordkeeping at hazardous waste facilities. They supplement the RCRA regulations.	Because these requirements supplement RCRA hazardous waste regulations, they must also be considered.
Maine Emission License Regulations (38 MRSA, Section 585, 590; MEDEP Regs, Chapter 115)	These requirements specify who must obtain an air emissions license, application information, and standards and criteria that must be met.	New sources must be in compliance with all applicable emissions limitations under the Clean Air Act. Emissions of pollutants with no standards should not exceed interim guidelines values.
Maine Growth Offset Regulations (38 MRSA, Section 590; MEDEP Regs, Chapter 113)	This rule applies to new licenses for facilities in non attainment areas. They require Reasonably Available Control Technology (RACT) or better for the base case emission, and offset reductions from other facilities.	RACT will be considered for air treatment if applicable.

(Continued)

TABLE 2-4
POTENTIAL ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

REQUIREMENT	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
Maine Water Pollution Control Law: Certain Deposits and Discharges Prohibited (38 MRSA, Section 420)	No person, firm, corporation, or other legal entity shall place, deposit, discharge, or spill mercury or toxic or hazardous substances, either directly or indirectly, into the inland groundwater or surface waters, tidal waters, on the ice, or on the banks thereof, so that the same may flow or be washed into such waters, or in such manner that the drainage therefrom may flow into such waters.	Best Management Practices will be used when handling wastes.

NOTES:

AHERA = Asbestos Hazard Emergency Response Act
CAA = Clean Air Act
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = Code of Federal Regulations
CMR = Code of Maine Regulations
CWA = Clean Water Act
DOT = Department of Transportation (U.S.)
FS = feasibility study
MEDEP = Maine Department of Environmental Protection
MEG = Maximum Exposure Guidelines
MRSA = Maine Revised Statutes Annotated
NAS = Naval Air Station
NESHAP = National Emission Standards for Hazardous Air Pollutants
NPDES = National Pollutant Discharge Elimination System
OSHA = Occupational Safety and Health Administration
POTW = publicly owned treatment works
RACT = Reasonably Available Control Technology
RI = remedial investigation
RCRA = Resource Conservation and Recovery Act
SDWA = Safe Drinking Water Act
$\mu g/m^3$ = micrograms per cubic meter
VOC = volatile organic compound

general operation and maintenance, safety, and emergency procedures for hazardous waste treatment facilities and remedial actions.

RCRA Subpart F (40 CFR Part 264.90 - 264.109) Releases from Hazardous Waste Units outlines standards for groundwater monitoring to be conducted at treatment facilities. The standards for general groundwater monitoring would be relevant and appropriate to monitoring conducted as part of the five-year review process. Compliance with this ARAR is easily attained as monitoring wells are already in place from site studies conducted during the RI.

2.4 Summary Of Remedial Action Objectives: Site 8

Remedial action objectives for Site 8 include media-specific goals established to provide an adequate level of protection to human and ecological receptors based on the results of the baseline risk assessment. Target Clean-up Levels were proposed only for contaminants in surface water and were set at the chemical-specific ARAR (i.e., AWQC). Contaminant concentrations in all other media were below levels considered to present a human health or ecological risk.

Remedial action objectives, however, are not being developed to reduce contaminant concentrations in surface water. Iron, lead, cyanide, and aluminum were detected at elevated concentrations (compared to background) in both upstream and downstream sampling locations, suggesting that other nonpoint source areas (i.e., salt pile, site soils, surface runoff, and off-base salting activities) are contributing to the current levels of contamination detected around Site 8 (see E.C. Jordan Co., 1990a). Specific remedial actions taken to reduce contaminant concentrations would therefore not be effective in reducing potential exposure concentrations.

2.5 Rationale For No Remedial Action

The baseline risk assessments do not indicate a risk to either human or ecological receptors. The estimated incremental cumulative carcinogenic risk to an individual under both current and assumed future residential exposure scenarios was within or below 10^{-4} and the noncarcinogenic HIs were below 1.0. One contaminant, cadmium, was detected in the groundwater at concentrations (i.e., ND to 12 μg/L) in excess of its federal MCL (i.e., 5 μg/L). However, there is no current exposure to groundwater and no downgradient

receptors, and it is unlikely that the shallow aquifer would be used for future domestic or potable purposes. No other soil contaminants (i.e., PAHs and pesticides) were detected in the groundwater. The risk assessments did not identify any unacceptable risks to human health or the environment. Based on USEPA guidance, a no action decision is appropriate for this site (USEPA, 1991b).

2.6 SUMMARY OF REMEDIAL ALTERNATIVES

Six remedial alternatives were described and presented in the Phase I FS (E.C. Jordan Co., 1990b). These alternatives were developed to achieve the remedial action objectives developed for contamination at Site 8 in the Phase I FS based on the original risk assessment. The site alternatives are as follows:

- No Action
- Soil Cover
- In Situ Solidification
- Removal/Treatment/Solidification
- Removal/Soil Washing
- Removal/Incineration

The first alternative is the baseline alternative used to compare the cost and effectiveness of the other alternatives. It is based on actual conditions and calls for no additional work at this site. The second, third and fourth alternatives focus on reducing contaminant mobility and/or exposure through institutional controls, cover material, or treatment options. Waste material is not removed from the site under any of these alternatives. The fifth and sixth alternatives involve removal and treatment of contaminated soil and sediment.

Each alternative was screened based on the clean-up standards described in Section 121 of the SARA and the NCP. The objective of the screening process was to eliminate from further consideration any alternative(s) that may have undesirable results regarding effectiveness, implementability, and cost, while still preserving a range of options.

The following three alternatives were retained for the detailed evaluation (E.C. Jordan Co., 1990b):

- No Action
- Soil Cover
- Excavation/Solidification

These three alternatives were developed and screened based on the risk calculations presented in Appendix Q of the Draft Final RI (E.C. Jordan Co., 1990a) and the response objectives in the Phase I FS (E.C. Jordan Co., 1990b). Additional risk estimates have been developed for this FFS based on recent USEPA guidance and the response objectives were adjusted accordingly. The three alternatives retained in the Phase I FS were reevaluated based on the changes to the response objectives.

The No Action Alternative described in the Phase I FS was renamed the Minimal Action Alternative because it included institutional controls and environmental monitoring. A true No Action alternative was added and is used in Section 3.0 as the baseline alternative. The soil cover alternative was revised to include a cover to meet the requirements for closure of a construction/demolition debris landfill. The Excavation/Solidification Alternative was eliminated because treatment of the Site 8 soils is no longer necessary based on the revised risk estimates and the response objectives.

2.7 TREATABILITY STUDY RESULTS

Following the Phase I FS a treatability study for Solidification/Stabilization (S/S) was conducted to better evaluate the effectiveness of this technology. This treatability study was performed by Williams Environmental Services, Inc., and their report is presented in Appendix A. The study was originally intended to help evaluate the Excavation/Solidification Alternative; however, the revision to the risk assessment shows that remediation is not required and the Excavation/Solidification alternative was dropped from consideration. The treatability study did help demonstrate the limited mobility of PAHs.

Raw soil from the PAH-contaminated area and sediment from the DDT-contaminated area were mixed at a ratio of 150 parts soil to 1 part sediment (150:1). This ratio is based on the preliminary estimated volume of contaminated soil (750 cy) and sediment (5 cy) (E.C. Jordan 1990b). After the soil and sediment were blended, "raw" samples were collected and analyzed for total PAHs, DDT, and other constituents. However, subsequent evaluation has shown that DDT is no longer a chemical of interest; therefore, sediment remediation is not required (see Subsection 2.2.2). The raw samples were also subjected to the Toxicity Characteristic Leachate Procedure (TCLP) to determine the leachability of contaminants, especially PAHs. The raw sample contained measurable amounts of PAHs; however, PAHs were not detected in the TCLP extract at a detection limit of 0.050 milligrams per liter (mg/L) (see Appendix A). This suggests that leaching of PAHs from soils at Site 8 is not likely to be significant.

The "raw" soil/sediment blend was mixed with varying amounts and kinds of S/S agents. After curing, permeability, unconfined compressive strength (UCS), and TCLP tests were performed on several combinations. The "best" combination (as determined by Williams Environmental Services, Inc.) was identified based on the highest UCS and lowest permeability. This "best" combination was recreated then subjected to the same tests. The TCLP test did not detect PAHs (detection limit = 0.050 mg/L).

In summary, the treatability did not prove that S/S decreases leachability of PAHs. TCLP tests of untreated soil did not reveal any leaching of PAHs; therefore, it was not possible to prove any reduction in leachability following treatment. The treatability study did show that S/S could improve properties such as structural stability and permeability.

3.0 DETAILED EVALUATION OF REMEDIAL ALTERNATIVES

The purpose of the detailed evaluation of alternatives, as stated in the NCP, is to present decision-makers with relevant information to select a site remedy by objectively assessing the remedial alternatives. The alternatives are assessed in this section for nine criteria that address regulatory, health, and feasibility issues. The alternatives are then compared in Section 4.0.

In response to statutory mandates for remedy selection in Section 121 of the SARA, USEPA developed nine evaluation criteria to evaluate each remedial alternative (USEPA, 1990). Table 3-1 lists and briefly describes these criteria. Elements of each criteria are addressed in this section and also in Section 4.0.

In this section, the four remedial alternatives summarized in Table 3-2 are described and evaluated according to the first seven criteria listed in Table 3-1. The state acceptance criterion will not be addressed until comments on the RI/FS and Proposed Plan have been received from the state. State review and comments on this FFS are part of this process. Similarly, community acceptance will be addressed upon receipt of public comments on the RI/FS and Proposed Plan (USEPA, 1990).

A detailed description of the technologies or processes used is provided for each alternative. Where appropriate, the description includes preliminary site layouts, process flow diagrams, preliminary design calculations, sizing of key components, and a discussion of the limitations, assumptions, and uncertainties associated with each alternative. This description is followed by the criteria evaluation process. The alternatives are compared relative to these criteria in Section 4.0.

3.1 ALTERNATIVE 8A: NO ACTION

The No Action Alternative does not include any remedial actions and provides a baseline for comparing alternatives. In the No Action Alternative, existing contaminated areas would remain undisturbed. Because no remedial actions would be implemented, long-term human health risks for the site would essentially be the same as those identified in the baseline risk assessment (E.C. Jordan Co., 1990a). Environmental monitoring and five-year site reviews would be included as part of this alternative.

TABLE 3-1
CRITERIA FOR COMPARATIVE ANALYSIS OF ALTERNATIVES: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

CRITERIA	DESCRIPTION
Overall Protection of Human Health and the Environment	Describes how each alternative, as a whole, protects and maintains protection of human health and the environment.
Compliance with ARARs	Describes how the alternative complies with ARARs, or if a waiver is required and how it is justified. The assessment also addresses other information from advisories, criteria, and guidance that the lead and support agencies have agreed is "to be considered".
Long-term Effectiveness and Permanence	Evaluates the long-term effectiveness of alternatives in maintaining protection of human health and the environment after response objectives have been met.
Reduction of Toxicity, Mobility, or Volume Through Treatment	Evaluates the anticipated performance of the specific treatment technologies.
Short-term Effectiveness	Examines the effectiveness of alternatives in protecting human health and the environment during the construction and implementation period until response objectives are met.
Implementability	Evaluates the technical and administrative feasibility of alternatives and the availability of required resources.
Cost	Evaluates the capital and operation and maintenance costs of each alternative.
State Acceptance *	Reflects the state's (or support agencies) apparent preferences among or concerns about alternatives.
Community Acceptance *	Reflects the community's apparent preferences among or concerns about alternatives.

NOTES:
* This criterion will be addressed once comments on the FFS and proposed plan have been received.
ARARs = Applicable or Relevant and Appropriate Requirements
FFS = Focused Feasibility Study

TABLE 3-2
SUMMARY OF REMEDIAL ALTERNATIVES; SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

ALTERNATIVE	COMPONENTS
No Action	No Remedial Action Environmental Monitoring Five-year Reviews
Minimal Action	Land-Use Restrictions Fencing/ Sign Posting Environmental Monitoring Five-year Reviews
Soil Cover	Land-Use Restrictions Cover System Maintenance Environmental Monitoring Five-year Reviews
Excavation / Solidification	Land-Use Restrictions Excavate Soil Stabilize Soil Backfill Stabilized Material Maintenance Environmental Monitoring Five-year Reviews

Environmental Monitoring. Because no remedial actions would be taken and contaminants would remain present at the site, environmental monitoring would be performed to identify any changes in site contamination that may occur over time. Proposed monitoring would include surface soil samples and five groundwater samples. The proposed surface soil samples would be collected in the area of TP-804, TP-805, and TP-806 and analyzed for PAHs. Groundwater samples would be collected from MW-803, MW-807, MW-808, MW-810, and MW-811 and analyzed for Target Compound List (TCL) organic compounds. Based on the site conditions and contaminants, environmental monitoring would be performed annually. This environmental monitoring program could be adjusted in the future if appropriate and would be subject to regulatory approval. For cost estimating purposes it was assumed that environmental monitoring would be conducted annually for 30 years.

Five-year Site Review. A five-year site review would be conducted to review monitoring data and to evaluate if any changes in response to site conditions is necessary. USEPA guidance is under development to define the five-year review process; however, it is expected to focus on evaluating whether the remedial alternative continues to provide adequate protection of human health and the environment (USEPA, 1990). The five-year site review could recommend further remedial actions at the site or that no further action is necessary and that another site review should be conducted in five years. For cost estimating purposes it is assumed that five-year site reviews would be conducted every five years for 30 years. The five-year review would be reviewed by the MEDEP and the USEPA.

3.1.1 Overall Protection of Human Health and the Environment

The No Action Alternative takes no action to treat, remove, reduce, or contain contaminated soil. However, contaminant levels in this medium are not present at levels considered to present a risk to either human health and/or the environment.

3.1.2 Compliance with ARARs

There are no chemical-specific ARARs for carcinogenic PAH compounds in soil. The location-specific ARARs identified for Site 8 would not apply since no action would be conducted at the site that could potentially impact the adjacent streams. Because remedial construction is not proposed, there are no action specific ARARs associated with this alternative.

3.1.3 Long-term Effectiveness and Permanence

This alternative provides no exposure control or long-term management, however, naturally occurring degradative processes may reduce contamination.

3.1.4 Reduction in Mobility, Toxicity, and Volume Through Treatment

Alternative 8A would not result in any reduction in the mobility, toxicity, or volume of contaminants because quantities of contaminated soil would remain untreated on-site. TCLP tests conducted during the treatability study indicated that PAHs existing in the soil matrix are not mobile, because the contaminants did not leach from soils prior to treatment (see Subsection 2.7). Therefore, contaminants are not expected to migrate into the groundwater.

3.1.5 Short-term Effectiveness

There would be no additional risks posed to the community, the workers, or the environment because no action would be taken at the site. Response objectives would be achieved by this alternative. A health and safety plan (HASP) would be developed and followed for monitoring activities.

3.1.6 Implementability

There would be no implementability concerns associated with this alternative because no action would be taken at the site.

3.1.7 Cost

The only costs associated with this alternative are for environmental monitoring and five-year site reviews. The costs for this alternative are presented in Table 3-3. The total present worth cost of the alternative is estimated at $161,000. Detailed back-up costs are included in Appendix B.

3.2 ALTERNATIVE 8B: MINIMAL ACTION

The treatability test conducted on soil from Site 8 demonstrated that PAHs are not leachable via the TCLP test (see Appendix A). Therefore, these compounds do not pose a contamination threat to groundwater. Because the PAHs are not considered mobile, and

TABLE 3-3
NO ACTION (8A) COST SUMMARY: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

	COST	PRESENT WORTH
CAPITAL COSTS		
Total Capital Costs:	$0	$0
INDIRECT COSTS		
Health & Safety (@ 25% of Capital Cost)	$0	
Legal, Administration, Permitting (@ 5% of Capital Cost)	$0	
Engineering (@ 10% of Capital Cost)	$0	
Services During Construction (@ 5% of Capital Cost)	$0	
Total Indirect Costs:	$0	$0
ANNUAL COSTS		
Environmental Monitoring	$6,000	
Total Operating Costs:	$6,000	$57,000
Five-Year Site Review	$31,000	$77,000
SUBTOTAL:		$134,000
Contingency (@ 20%)		$27,000
TOTAL COST:		$161,000

NOTES:
1. Discount Rate of 10% is used for present worth analyses.
2. Environmental monitoring is assumed to continue for 30 years.
3. Five-year reviews are assummed every five years for thirty years.
4. Assumes no trailer or office set-up is necessary.

because the concentrations and risk levels are low, a Minimal Action Alternative was developed for Site 8. The Minimal Action Alternative would use institutional controls to limit future activity at the site and the potential for invasive activities.

Five-year site reviews would be conducted for this alternative because the waste remains untreated on-site. Monitoring to support these five-year reviews would also be conducted. These components are described in the following paragraphs.

Institutional Controls. Deed and land-use restrictions can be used to restrict future site use, thereby limiting the potential for human exposure to site contaminants. The legal implications of instituting property land-use restrictions would be coordinated with appropriate Navy officials and state and local governments. Because the base does not have a deed, land-use restrictions would be implemented. If NAS Brunswick ever closed these restrictions would be incorporated into the deed during the transfer of property. Fencing and warning signs would be posted around the site to reduce public access and potential exposure to soil contaminants. The fence would be an 800-foot-long, 6-foot-high chain-link fence with three-strand barbed wire. Warning signs would be posted every 100 feet and there would be one access gate. The proposed fence location is shown in Figure 3-1. The final design for restricting site access would be submitted to the MEDEP and the USEPA for review and approval.

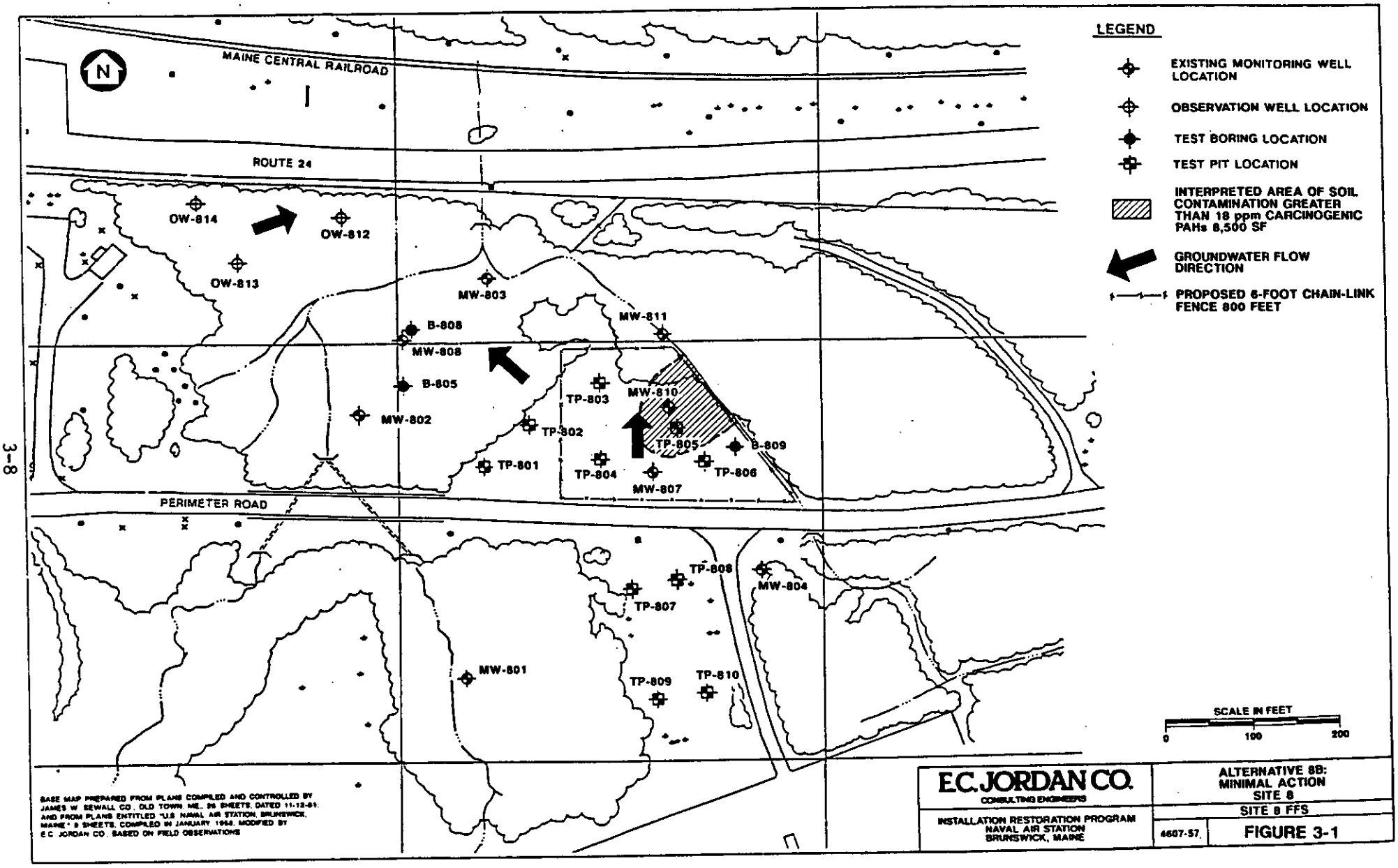
Environmental Monitoring and Five-Year Site Reviews. Environmental Monitoring would be conducted at Site 8 to identify any changes in contaminant levels and risk. Monitoring would be conducted as described in Subsection 3.1. Five-Year Site Reviews would be required for this alternative and would be conducted as described in Subsection 3.1.

3.2.1 Overall Protection of Human Health and the Environment

Similar to the No Action Alternative, the Minimal Action Alternative takes no action to treat, remove, reduce, or contain contaminated soil. However, no unacceptable risk is posed by the site and contaminant exposure by direct contact and/or incidental ingestion of soil is expected to decrease as a result of institutional controls (i.e., fencing and deed restrictions). The decrease in contaminant exposure would result in a decrease in potential risk associated with the site.

3.2.2 Compliance with ARARs

There are no chemical-specific ARARs for carcinogenic PAH compounds in soil. The location-specific ARARs identified for Site 8 would not apply since minimal action activities


MAINE CENTRAL RAILROAD
ROUTE 24
PERIMETER ROAD
N
OW-814
OW-812
OW-813
MW-803
B-808
MW-808
B-805
MW-802
MW-811
TP-803
MW-810
TP-802
TP-805
B-809
TP-801
TP-804
TP-806
MW-807
TP-808
MW-804
TP-807
MW-801
TP-809
TP-810
LEGEND
EXISTING MONITORING WELL LOCATION
OBSERVATION WELL LOCATION
TEST BORING LOCATION
TEST PIT LOCATION
INTERPRETED AREA OF SOIL CONTAMINATION GREATER THAN 18 ppm CARCINOGENIC PAHs 8,500 SF
GROUNDWATER FLOW DIRECTION
PROPOSED 6-FOOT CHAIN-LINK FENCE 800 FEET
SCALE IN FEET
0
100
200
BASE MAP PREPARED FROM PLANS COMPILED AND CONTROLLED BY JAMES W SEWALL CO., OLD TOWN, ME., 26 SHEETS, DATED 11-12-81; AND FROM PLANS ENTITLED "U.S. NAVAL AIR STATION, BRUNSWICK, MAINE" 8 SHEETS, COMPILED IN JANUARY 1954, MODIFIED BY E.C. JORDAN CO., BASED ON FIELD OBSERVATIONS
E.C. JORDAN CO.
CONSULTING ENGINEERS
INSTALLATION RESTORATION PROGRAM
NAVAL AIR STATION
BRUNSWICK, MAINE
ALTERNATIVE 8B:
MINIMAL ACTION
SITE 8
SITE 8 FFS
4607-57
FIGURE 3-1

would not impact the tributaries on-site. Construction of the fence and collection of surface soil and groundwater samples during environmental monitoring would be subject to OSHA regulations presented in Subsection 2.3.

3.2.3 Long-term Effectiveness and Permanence

The Minimal Action Alternative would not reduce the nature and magnitude of contamination at Site 8. Some reduction of contamination could occur through naturally occurring degradative processes.

3.2.4 Reduction in Mobility, Toxicity, and Volume Through Treatment

Because no treatment processes are employed, this alternative would not result in a reduction in mobility, toxicity, or volume of contaminated soil. However, mobility of PAHs at Site 8 is not a concern because TCLP tests conducted for the treatability study demonstrated that the PAHs in soil matrices at Site 8 are not mobile (see Subsection 2.7).

3.2.5 Short-term Effectiveness

Because of the limited activity associated with this alternative, no threats to workers or the local community are expected. A HASP would be implemented for workers installing the fence and conducting sampling. This plan would contain sampling and handling details and specify the level of protection. The Minimal Action Alternative would achieve the remedial response objectives.

3.2.6 Implementability

Installation of fencing and warning signs are simple construction tasks. Local contractors and materials are readily available. The fence would not interfere with implementing a future remedial action, if necessary. Fence maintenance and an environmental monitoring program are easily implemented. The Minimal Action Alternative would require long-term institutional management because of the five-year reviews. The Navy, and local governments must coordinate the land-use restrictions to ensure they are properly implemented. Land-use restrictions would be incorporated into a base master plan and information for incorporation into a deed would be prepared for the contingency that the base closes and the land is sold. Implementation of these actions is not anticipated to be a problem.

3.2.7 Cost

The cost incurred would include five-year reviews, environmental monitoring, and institutional controls. The total 30-year present-worth cost of the Minimal Action Alternative is estimated at $197,000. This includes capital costs of $14,000, indirect costs of $7000, and operation and maintenance costs of $143,000. These costs are summarized in Table 3-4. Detailed back-up costs are included in Appendix B.

3.3 ALTERNATIVE 8C: SOIL COVER

Alternative 8C addresses Site 8 with a soil cover that conforms to Maine regulations for construction debris landfills. This soil cover would be designed and constructed to accomplish the following:

- prevent contact with contaminants under the cover
- promote drainage and minimize erosion of the soil cover
- meet Maine regulations for construction debris landfills

A soil cover consisting of a 6-inch vegetative layer was selected based on a review of the State regulations.

This alternative includes the following components:

- site preparation
- cover construction
- site inspections/maintenance

Components of this remedial alternative are described in the following paragraphs.

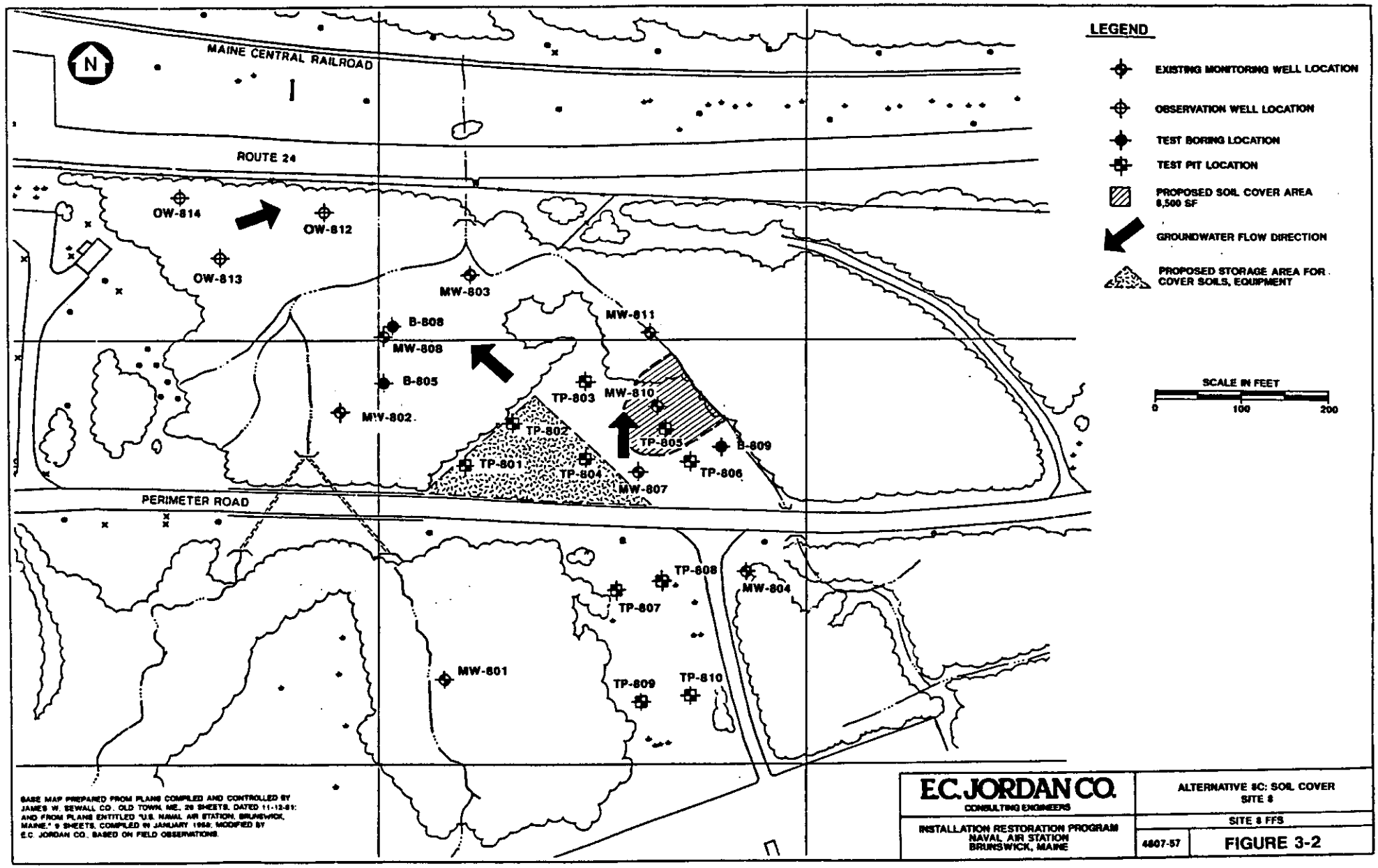
Site Preparation. Site preparation would be minimal. No clearing or road construction would be necessary because the site is open and accessible. A proposed area for storing cover soil (i.e., vegetative cover material) would be identified (Figure 3-2). An area would be identified and prepared as necessary for parking heavy equipment. The site would be cleared, grubbed, graded, and proofrolled to provide the proper contours for the final cover. This site preparation work would be accomplished before covering the contaminated area and would require approximately two days to complete.

TABLE 3-4
MINIMAL ACTION (8B) COST SUMMARY: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

	COST	PRESENT WORTH
CAPITAL COSTS		
Fencing/Warning Signs	$9,000	
Institutional Controls	$5,000	
Total Capital Costs:	$14,000	$14,000
INDIRECT COSTS		
Health & Safety (@ 25% of Capital Cost)	$4,000	
Legal, Administration, Permitting (@ 5% of Capital Cost)	$1,000	
Engineering (@ 10% of Capital Cost)	$1,000	
Services During Construction (@ 5% of Capital Cost)	$1,000	
Total Indirect Costs:	$7,000	$7,000
ANNUAL COSTS		
Environmental Monitoring	$6,000	
Site Inspection and Maintenance	$1,000	
Total Operating Costs:	$7,000	$66,000
Five-Year Site Review	$31,000	$77,000
SUBTOTAL:		$164,000
Contingency (@ 20%)		$33,000
TOTAL COST:		$197,000

NOTES:
1. Discount Rate of 10% is used for present worth analyses.
2. Environmental monitoring is assumed to continue for 30 years.
3. Five-year reviews are assummed every five years for thirty years.
4. Assumes no trailer or office set-up is necessary.


MAINE CENTRAL RAILROAD
ROUTE 24
PERIMETER ROAD
N
OW-814
OW-812
OW-813
MW-803
B-808
MW-808
B-805
MW-802
MW-811
MW-810
TP-803
TP-802
TP-801
TP-804
TP-805
B-809
TP-806
MW-807
TP-808
MW-804
TP-807
MW-801
TP-809
TP-810
LEGEND
EXISTING MONITORING WELL LOCATION
OBSERVATION WELL LOCATION
TEST BORING LOCATION
TEST PIT LOCATION
PROPOSED SOIL COVER AREA 8,500 SF
GROUNDWATER FLOW DIRECTION
PROPOSED STORAGE AREA FOR COVER SOILS, EQUIPMENT
SCALE IN FEET
0
100
200
BASE MAP PREPARED FROM PLANS COMPILED AND CONTROLLED BY JAMES W. SEWALL CO., OLD TOWN, ME., 26 SHEETS, DATED 11-12-81; AND FROM PLANS ENTITLED "U.S. NAVAL AIR STATION, BRUNSWICK, MAINE," 9 SHEETS, COMPILED IN JANUARY 1968; MODIFIED BY E.C. JORDAN CO., BASED ON FIELD OBSERVATIONS.
E.C. JORDAN CO.
CONSULTING ENGINEERS
INSTALLATION RESTORATION PROGRAM
NAVAL AIR STATION
BRUNSWICK, MAINE
ALTERNATIVE 5C: SOIL COVER
SITE 8
SITE 8 FFS
4807-57
FIGURE 3-2

Cover Construction. The cover system is designed to provide a soil cover with vegetative cover that does not leave any debris or contaminated soil exposed. The geotextile fabric filter would be placed over the site. Cover soil would be placed directly on the fabric filter. The cover system would consist of 6 inches of vegetative soil that would be seeded to reestablish vegetative cover. Figure 3-3 illustrates a typical cover system cross section. Cover soil would be delivered to Site 8 by a subcontractor. The cover soil would be spread, compacted, and graded using conventional construction equipment (e.g., a tracked bulldozer). To promote runoff, the cover would be sloped no less than 3 percent. To provide a sufficient soil cover for the proposed area, approximately 200 cy of vegetative soil would be needed. This volume is based on 8,500 square feet of surface area with a 6-inch total depth and a 3:1 slope volume.

Site Inspection and Maintenance. Periodic visual inspections of remediated areas would identify if maintenance is necessary. If maintenance is necessary, additional work or repairs to support erosion control or to revegetate covered areas would be performed. This could be incorporated into NAS Brunswick's regular maintenance program.

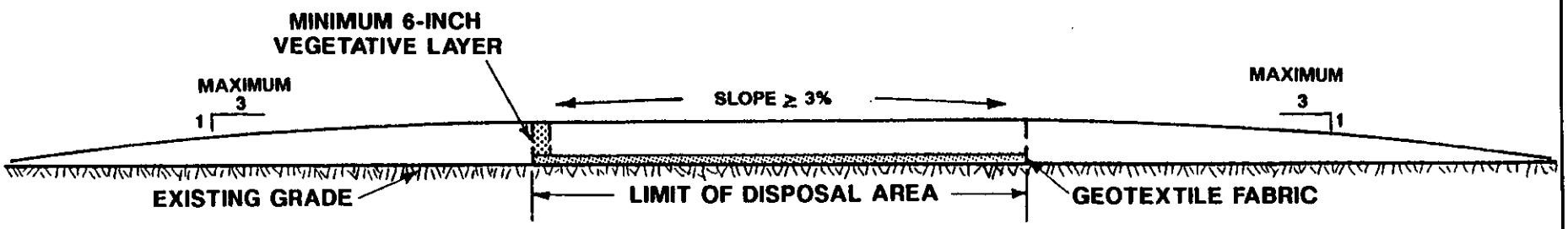
3.3.1 Overall Protection of Human Health and the Environment

Although risks to human health and the environment are currently within acceptable ranges, the soil cover would decrease human health risks over baseline conditions by effectively reducing potential exposure to contaminated soil. PAH concentrations on the ground surface would be below levels considered to present a health risk to older children that may access Site 8 or be exposed to soil under the future residential scenario described in the revised risk assessment (E.C. Jordan, Co., 1990a and Appendix E).

3.3.2 Compliance With ARARs

There are no chemical-specific ARARs for soils that pertain to Site 8. The Maine Alteration of Rivers, Streams and Brooks (38 M.R.S.A., Chapter 3, Section 425 et seq.), a location-specific ARAR, may be applicable to Alternative 8C. This requirement specifies that any dredging, filling, or erecting activity on land adjacent to any river, stream, or brook shall not unreasonably interfere with the natural flow or lower the quality of any waters. Soil cover activities at Site 8 should not lower the quality of the unnamed tributary.

The State of Maine Solid Waste Management Regulations (38 M.R.S.A. Section 1304 Chapter 404) for Construction/Demolition Debris, Inert Fill, Land Clearing Debris, and Woodwaste may be relevant and appropriate. The closure portion specifies that a facility subject to the requirements shall be graded, covered with soil suitable to grow vegetation,



NOT TO SCALE

E.C. JORDAN CO. CONSULTING ENGINEERS	PROPOSED COVER CROSS SECTION
INSTALLATION RESTORATION PROGRAM NAVAL AIR STATION BRUNSWICK, MAINE	SITE 8 FFS
	4607-57 FIGURE 3-3

and seeded with an effective groundcover within one growing season of the completed disposal. The cover proposed in this alternative would comply with these regulations.

Maine Landfill Disposal Regulations, while primarily focused for new or expanding facilities, do outline some minimum standards and specifications for closure and post-closure care. The existing groundwater data indicates that Site 8 is not impacting groundwater. Standards for an attenuation landfill, which does not require an impermeability cover system may be the most relevant standards for consideration.

The Clean Air Act - National Primary and Secondary Ambient Air Quality Standards (NAAQS) for Particulate Matter less than 10 microns in diameter (40 CFR 50, Appendix J) and the Maine Ambient Air Quality Standard (38 M.R.S.A., Section 584, Chapter 110) may be applicable. These regulations specify the 24-hour maximum concentrations for particulate material. During implementation of this alternative, real-time dust monitoring would be performed. If regulatory levels are exceeded, fugitive dust emissions from site activities will be maintained below 150 micrograms per cubic meter ($\mu g/m^3$) (24-hour maximum standard) by water sprays and other dust suppressants.

3.3.3 Long-term Effectiveness and Permanence

Contaminated material would remain untreated at the site after covering operations are complete. Covering contaminated soil on-site would effectively close the site as a construction debris landfill. Long-term management would be required to maintain cover soil. If the cover system is failing or if excavation is necessary in this area, the potential for exposure exists.

3.3.4 Reduction in Mobility, Toxicity, and Volume Through Treatment

Because no treatment would be employed, the containment alternative does not reduce the mobility, toxicity, or volume of contaminants in the soil through treatment. However, a soil cover can minimize erosion and air dispersion, thus reducing the mobility of surface contamination. It also provides a barrier that reduces threats to human receptors associated with incidental ingestion or direct contact exposure. Additionally, the TCLP tests conducted during the treatability study demonstrated that PAHs are immobile contaminants in untreated Site 8 soils (see Subsection 2.7).

3.3.5 Short-term Effectiveness

No risks to the community or environment would be expected during construction of the soil cover. This remedial alternative would not involve invasive activity. Any risks to workers would be controlled by providing personal protection equipment (Level D) and applying safe work practices as outlined in a HASP developed for the site. Dust monitoring wold be conducted and if necessary dust suppression controls would be used. No adverse environmental impacts are anticipated. Instead, the soil cover is anticipated to be beneficial because the common borrow and topsoil would support vegetation. It is estimated that placement of the soil cover will take two weeks.

3.3.6 Implementability

No special techniques, materials, permits, or labor would be required for the Soil Cover Alternative. Approximately 200 cy of soil would be necessary to construct the soil cover.

3.3.7 Cost

The total 30-year present-worth cost of Alternative 8C is estimated at $42,000. This includes capital costs of $10,000, indirect costs of $6,000, and total operation and maintenance costs of $19,000. These costs are summarized in Table 3-5.

TABLE 3-5
SOIL COVER (8C) COST SUMMARY: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

	COST	PRESENT WORTH
CAPITAL COSTS		
Mobilization/Demobilization	$2,000	
Cover Materials	$4,000	
Cover Construction	$4,000	
Total Capital Costs:	$10,000	$10,000
INDIRECT COSTS		
Health & Safety (@ 25% of Capital Cost)	$3,000	
Legal, Administration, Permitting (@ 5% of Capital Cost)	$1,000	
Engineering (@ 10% of Capital Cost)	$1,000	
Services During Construction (@ 5% of Capital Cost)	$1,000	
Total Indirect Costs:	$6,000	$6,000
ANNUAL COSTS		
Site Inspection and Maintenance	$2,000	
Total Operating Costs:	$2,000	$19,000
SUBTOTAL:		$35,000
Contingency (@ 20%)		$7,000
TOTAL COST:		$42,000

NOTES:
1. Discount Rate of 10% is used for present worth analyses.
2. Assumes no trailer or office set-up is necessary.

4.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

In this section, the alternatives are compared for each of the evaluation criteria. State and community acceptance will be addressed in the ROD following comments on the RI/FS report and the proposed plan. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another to aid in the selection of a remedy for Site 8. The following subsections highlight differences between the alternatives for each criterion. The criteria analysis is summarized in Table 4-1 at the end of this section.

4.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternatives 8A, 8B, and 8C provide adequate protection to human health and the environment. The current risk at the site is within USEPA acceptable levels. Alternatives 8B and 8C provide some additional reduction in risk by limiting exposure to contaminated soils.

4.2 COMPLIANCE WITH ARARS

There are no known chemical-specific ARARs associated with Site 8. Alternatives 8A and 8B would comply with any location- or action-specific ARARs. Alternative 8C was specifically designed to comply with Maine regulations for construction debris landfills. It is also expected to comply with location specific ARARs for alteration of rivers, streams and brooks.

4.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

No unacceptable risk currently exists at the site; therefore, all three alternatives would be equally effective over the long-term. Alternatives 8B and 8C would effectively limit site access and cover the site respectively but would require inspection and maintenance over the long-term.

4.4 Reduction in Mobility, Toxicity, and Volume Through Treatment

Alternatives 8A, 8B, and 8C do not use treatment technologies that reduce mobility, toxicity or volume. TCLP tests conducted as part of the treatability study showed that the Site 8 contaminants have a very low mobility in the present state.

4.5 Short-Term Effectiveness

There would be no effects on workers or the community for Alternative 8A except those associated with environmental monitoring. Alternatives 8B and 8C pose some risk to workers and would require adherence to a site HASP. Alternatives 8B and 8C would only pose minimal risks to workers because no invasive actions would occur. Alternative 8C may also effect the community through the generation of dust; however dust suppression techniques would be used.

Environmental impacts for the remedial alternatives are associated with removal of trees and brush and surface water run-off. Alternative 8A would have no effects. Alternative 8B would require minor clearing of brush. Alternative 8C would require more extensive clearing and some engineering controls to handle surface water run-off.

4.6 Implementability

Alternative 8A would be difficult to implement only because it does not meet the response objectives and it would be difficult to obtain approval. Alternative 8B would be the simplest to implement. Alternative 8C also would be easily implementable. Common borrow and loam would require minimal transportation and handling. Periodic inspection of the soil cover should ensure its integrity.

4.7 Cost

The present-worth cost of Alternative 8C is only $42,000. The estimated present-worth cost of Alternative 8B is $197,000. The present-worth cost for Alternative 8A is $161,000. This includes only environmental monitoring and five-year review costs.

The comparative analysis is summarized in Table 4-1.

TABLE 4-1
SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

CRITERION	8A NO ACTION	8B MINIMAL ACTION	8C SOIL COVER
Overall Protection of Human Health and the Environment			
How risks are eliminated, reduced, or controlled.	No unacceptable risks currently exist at the site.	No unacceptable risks currently exist at the site.	Would provide an increased level of protection by covering site, reducing exposure to contaminated soils.
Short-term or cross-media impact.	No short-term or cross- media impacts are associated with this alternative.	There are no cross-media or short-term impacts associated with this alternative.	There are no cross-media impacts associated with this alternative. Clearing, grubbing, surface water run-off, and dust generation are possible short-term impacts.
Compliance with ARARs			
Chemical-specific ARARs	There are no ARARs for carcingenic PAHs.	There are no ARARs for carcingenic PAHs.	There are no ARARs for carcingenic PAHs.
Location-specific ARARs	Not applicable.	Not applicable.	Not applicable.
Action-specific ARARs	No action is taken, therefore not applicable.	There are no action-specific ARARs associated with this alternative.	Would comply with State of Maine Waste Management Regulations.
Criteria, advisories, and guidances	None	None	None

TABLE 4-1
SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

CRITERION	8A NO ACTION	8B MINIMAL ACTION	8C SOIL COVER
Long-term Effectiveness and Permanence			
Magnitude of residual risk	No unacceptable risk currently exists. No change in magnitude is expected.	No unacceptable risk currently exists. Risk would be further reduced by limiting exposure.	No unacceptable risk currently exists. Risk would be further reduced by limiting exposure.
Adequacy of controls	No controls taken.	Land use restrictions would limit future use of the site. soils.	The soil cover would prevent contact with contaminated soils.
Reliability of controls	No controls taken.	Institutional controls and land use restrictions are reliable as long as the base is in operation. Proper maintenance and enforcement of land-use restrictions following closure of the base may be unreliable.	A soil cover would reliably contain contaminated soils provided erosion or human activities do not disrupt the cover. Regular maintenance may be necessary.
Reduction of Mobility, Toxicity, or Volume			
Treatment process and remedy	No treatment employed.	No treatment employed.	No treatment employed.
Amount of hazardous material destroyed or treated	None.	None.	None.
Reduction in mobility, toxicity, or volume through treatment	None. Applies to treatment alternatives.	None. Applies to treatment alternatives.	None. Applies to treatment alternatives.
Irreversibility of treatment	Not applicable. Applies to treatment alternatives.	Not applicable. Applies to treatment alternatives.	Not applicable. Applies to treatment alternatives.

TABLE 4-1
SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

CRITERION	8A NO ACTION	8B MINIMAL ACTION	8C SOIL COVER
Type and quantity of treatment residual	Not applicable. Applies to treatment alternatives.	Not applicable. Applies to treatment alternatives.	Some protective clothing would be used.
Short-term Effectiveness			
Protection of community during remedial actions	No impact to community.	No impact to community.	Dust control techniques would minimize impacts to the community
Protection of workers during remedial actions	Workers collecting samples would be required to follow HASP.	Minimal risk because few invasive actions would be required. All workers would be required to follow HASP.	Minimal risk because few invasive actions would be required. All workers would be required to follow HASP.
Environmental impacts	None	Minimal impacts such as brush removal prior to installing fence.	Some minor impacts from brush removal and use of heavy equipment on-site.
objectives are achieved		in less than one week.	in about two weeks.
Implementability			
Ability to construct technology	Nothing to construct	Fencing and warning signs are easily installed.	Cover construction techniques are well developed and easy to implement.
Reliability of technology	Environmental monitoring is reliable.	Environmental monitoring, fencing, and institutional controls are reliable.	Soil cover can reliably prevent exposure to contaminated soils provided that it is properly maintained.
Ease of undertaking additional remedial action, if necessary	Easy to undertake additional remedial actions.	Easy to undertake additional remedial actions.	Easy to undertake additional remedial actions. Soil cover could be removed if further treatment of the soils was considered necessary.

TABLE 4-1
SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

CRITERION	8A NO ACTION	8B MINIMAL ACTION	8C SOIL COVER
Monitoring considerations	Groundwater and surface soils would be monitored to identify changes in risk.	Groundwater and surface soils would be monitored to identify changes in risk. Site inspections would be conducted to identify maintenance needs.	Site inspections would be conducted to identify maintenance needs.
Coordination with other agencies	Coordination with NAS Brunswick personnel required for a long period of time for monitoring of groundwater and surface soils.	Coordination with NAS Brunswick personnel required for a long period of time for monitoring of groundwater and surface soils.	Coordination with NAS Brunswick personnel required for a long period of time for inspection and maintenance of soil cover.
Availability and capacity of treatment, storage, and disposal services	None required.	Facilities that accept contaminated protective clothing are available.	Facilities to handle the waste residuals are available but the details would be addressed during design of the alternative.
Availability of technologies, equipment, and specialists	Monitoring services are readily available.	Materials and services to construct a fence and post warning signs are readily available.	Materials and construction services for for construction of a soil cover are readily available.
Cost			
Capital Costs	$0	$14,000	$16,000
Operation and Maintena (Annual and 5-Year Review Costs)	$57,000	$21,000	$19,000
Total Present Worth	$161,000	$197,000	$42,000

A.H. Harris & Sons, 1991. Verbal communication. A.H. Harris & Sons. Griffin Road, Portsmouth, New Hampshire; April 1991.

Doerner, John., 1991. Verbal communication between John Doerner of Williams Environmental Services and E.C. Jordan Co; January 1991.

E.C. Jordan Co., 1990a. *NAS Brunswick Remedial Investigation Report*; Draft Final; E.C. Jordan Co., Portland, Maine; August 1990.

E.C. Jordan Co., 1990b. *NAS Brunswick Phase I Feasibility Study, Development and Screening of Alternatives*; Draft Final; E.C. Jordan Co., Portland, Maine; August 1990.

E.C. Jordan Co., 1991. *NAS Brunswick Supplemental Remedial Investigation Report*; Draft; E.C. Jordan Co., Portland, Maine; March 1991.

Edwards, N.T., 1983. "Polycyclic Aromatic Hydrocarbons (PAHs) in the Terrestrial Environment - a Review"; *Journal of Environmental Quality*; Volume 12; pp 472; 1979.

R.F. Weston, Inc., 1983. *Initial Assessment Study of Naval Air Station Brunswick, Maine*; Westchester, Pennsylvania; June 1983.

U.S. Environmental Protection Agency (USEPA), 1988 "Interim Sediment Criteria Values for Nonpolar Hydrophobic Organic Contaminants"; USEPA Office of Water Regulations and Standards. SCD #17.

U.S. Environmental Protection Agency (USEPA), 1988a. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*; Interim Final; USEPA Office of Solid Waste and Emergency Response Directive OSWER 9335.3-01; Washington, D.C.; March 1988.

U.S. Environmental Protection Agency (USEPA), 1988b. *Lining of Waste Containment and Other Impoundment Facilities*; EPA/600/2-88/052. September 1988.

U.S. Environmental Protection Agency (USEPA), 1990. "National Oil and Hazardous Substances Pollution Contingency Plan"; 40 CFR Part 300; *Federal Register* Vol 55, No. 46., Washington, D.C.; March 8, 1990.

U.S. Environmental Protection Agency (USEPA), 1991a. *Human Health Evaluation Manual, Supplement Guidance*; "Standard Default Exposure Factors"; Memorandum From:

Timothy Fields, Jr. and Bruce Diamond; Office of Solid Waste and Emergency Response; OSWER Directive 9285.6-03; March 1991.

U.S. Environmental Protection Agency (USEPA), 1991b. *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*; Memorandum From: Don R. Clay; Office of Solid Waste and Emergency Response; OSWER Directive 9355.0-30; April 1991.

ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
CFR	Code of Federal Regulations
cy	cubic yard(s)
DDT	dichlorodiphenyltrichloroethane
EP	Equilibrium Partitioning
FFA	Federal Facility Agreement
FS	Feasibility Study
FFS	Focused Feasibility Study
HASP	Health and Safety Plan
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NAS	Naval Air Station
NCP	National Contingency Plan
PAC	Pollution Abatement Confirmation
PAH	polycyclic aromatic hydrocarbons
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
S/S	Stabilization/Solidification
TCLP	Toxicity Characteristic Leachate Procedure
UCS	Unconfined Compressive Strength
USEPA	United States Environmental Protection Agency
$\mu g/m^3$	micrograms per cubic meter

TREATABILITY STUDY RESULTS

Williams Project No. 0130-003-310

Solidification/Stabilization Treatability Study
for
Contaminated Soils and Sediments

Brunswick Naval Air Station
Brunswick, Maine

Prepared For

E.C. Jordan Company
261 Commercial Street
Portland, Maine 04112

Preparation Date: **January 7, 1991**

Williams Environmental Services, Inc.
5221 Militia Hill Road / Plymouth Meeting, Pennsylvania 19462
(215) 825-8877 ◆ FAX (215) 825-5623
Remediation Through Proven Technology

Table of Contents

	Page
OVERVIEW	1
SCOPE OF WORK	2
RAW WASTE CHARACTERIZATION	2
STABILIZATION FORMULATION SCREENING	6
CONFIRMATION/MIX OPTIMIZATION	8
SUMMARY/DISCUSSION OF RESULTS/RECOMMENDATIONS	10
ESTIMATED FIELD IMPLEMENTATION COSTS	11
DATA VALIDATION	11

List of Tables

1	Raw Soil and Sediment and Soil/Sediment Blend Physical Characteristics	3
2A	Raw Soil/Sediment Blend Chemical Characterization - Semivolatile Organics	4
2B	Raw Soil/Sediment Blend Chemical Characterization - RCRA Metals	5
3	Stabilization Formulation Screening Phase	7
4A	Stabilization Confirmation Phase, Selected Formula Performance Testing - Physical Characteristics	8
4B	Stabilization Confirmation Phase, Selected Formula Performance Testing	9

List of Appendices

A ANALYTICAL DATA REPORTS

B LABORATORY DOCUMENTATION LOG

Solidification/Stabilization Treatability Study for Contaminated Soils and Sediments

Brunswick Naval Air Station, Brunswick, Maine

OVERVIEW

Williams Environmental Services, Inc. (WILLIAMS) conducted a benchscale treatability study for E.C. Jordan Company (Jordan) involving the solidification/stabilization (S/S) of organic contaminants found in soils and sediments from Site 8 of the Brunswick Naval Air Station (NAS), Brunswick, Maine. Jordan supplied WILLIAMS with representative site soil, as well as affected stream sediment for use in the laboratory program.

The objective of this S/S treatability study test was to evaluate the technical feasibility of chemically solidifying and stabilizing polynuclear aromatic hydrocarbons (PAH) and chlorinated pesticide (DDT) contamination detected at the site. Inorganics (e.g., RCRA metals) were found only at low background levels. Analytic confirmation tests were performed by WILLIAMS to measure the degree of actual contamination in the wastes provided by Jordan.

This laboratory investigation simulates field-proven technology for on-site soils/sediment treatment. WILLIAMS selected representative test methods for predicting and evaluating the physical and chemical characteristics of the treated soil/sediment, relative to the structural integrity of the compacted in-place materials and to the protection of ground and surface waters. The laboratory effort simulated our HSS™ (high-solids stabilization) process or pugmill batch treatment system, using various solidification reagents. The additives used were primarily cementitious or pozzolanic, and the chemistry of each is well known.

Most alkaline S/S processes using cementitious or pozzolanic reagents will give rise to inorganics fixation due to formation of insoluble metal hydroxides or oxides. Fixation of organic constituents can also occur due to assimilation of the compounds in the cementitious gel matrix. Physical encapsulation, as opposed to fixation, is often the dominant S/S mechanism for organic constituents, such as oil and grease, PCBs, and pesticides. Control of pH is also a factor for metals and certain BNA compounds (such as

PAH), whose solubilities can be pH-dependent. Generally, S/S processes decrease the hydraulic conductivity of the waste matrix and increase the structural properties.

WILLIAMS found that the NAS waste can be easily solidified and compacted into a material that exhibits high strength and density, with nominal volume increase when compared to the "as received" condition. The solidification process required nominal water addition. TCLP leaching tests on selected mix designs yielded favorable results with respect to contaminant fixation.

WILLIAMS believes that physical/chemical stabilization, combined with soil cover for the treated materials, will meet all required cleanup response objectives for the Brunswick site.

SCOPE OF WORK

The laboratory investigation was conducted in various phases as follows:

- Raw waste identification characterization;
- Stabilization formulation screening; and
- Confirmation testing of an optimum formulation.

RAW WASTE CHARACTERIZATION

WILLIAMS was provided with a large sample of site soil and one small sample of stream sediment. The soils were drum-blended to form a grand composite and the aqueous sediment material was thoroughly homogenized; each waste type was subjected to selected physical tests (density, solids content, and pH). Thereafter, a measured quantity of soil (44 lbs) was combined with a small amount of sediment (1/2 lb) and batch-mixed to form a soil/sediment blend. This weight-to-weight ratio corresponds to the approximate ratio of soil (~750 yd^3) and sediment (~5 yd^3) found at NAS Site 8.

All raw waste samples were kept in sealed inert containers at $4^{o}C$ to minimize volatilization of the organic species. Subsamples of the raw soil/sediment blend were tested immediately for the following parameters:

- Total Base Neutral Semivolatiles and DDT
- Leachable Base Neutral Semivolatiles and DDT
- Total and Leachable RCRA Metals
- Total Solids Content
- Unit Weight Density
- USACE Permeability
- pH

Tables 1, 2A and 2B present the physical and chemical test results on untreated waste materials.

Table 1

Raw Soil and Sediment and Soil/Sediment Blend Physical Characteristics

DESCRIPTION	SOIL	SEDIMENT	BLEND
	Moist Sandy Loam; Dark Brown with Scattered Pebbles	*Gritty Brown Sludge; Settles Quickly, Scattered Pebbles*	*Same as Soil*
SOLIDS, wgt.%	93.8	46.2	93.8
LOOSE BULK DENSITY (wet), pcf	66.8	87.8	89.6
LOOSE BULK DENSITY (dry), pcf	62.9	57.1	84.4
COMPACTED DENSITY (dry), pcf	116.9	--	121.8
COMPACTED DENSITY (dry), pcf	110.0	--	114.7
pH	8.0	6.4	8.4
PERMEABILITY, cm/sec	--	--	7.0×10^{-6}

Table 2A

Raw Soil/Sediment Blend Chemical Characterization - Semivolatile Organics

PARAMETER	TOTAL (ppb)	LEACHABLE (mg/L)
Base Neutral Compounds		
Acenaphthene	<7000	<0.050
Acenaphthylene	690J	<0.050
Anthracene	640J	
Benzidine	<56000	
Benzo(a)Anthracene	3900J	<0.050
Benzo(a)pyrene	3000J	<0.050
Benzo(b)fluoranthene	<7000	<0.050
3,4-Benzofluoranthene	3300J	<0.050
Benzo(g,h,i)perylene	1800J	<0.050
Benzo(k)Fluoranthene	3000J	<0.050
bis(2-Chloroethoxy) methane	<7000	
bis(2-Chloroethyl) ether	<7000	
bis(2-chloroisopropyl)ether	<7000	
bis(2-Ethylhexyl) phthalate	12000	<0.050
4-Bromophenyl-phenyl-ether	<7000	
Butylbenzylphthalate	<7000	
2-Chloronaphthalene	<7000	
4-Chlorophenyl-phenyl ether	<7000	
Chrysene	4100J	<0.050
Dibenz(a,h)anthracene	370J	<0.050
1,2-Dichlorobenzene	<7000	
2,3-Dichlorobenzene	<7000	
1,4-Dichlorobenzene	<7000	
3,3'-Dichlorobenzidine	<14000	
Diethyl Phthalate	<7000	
Dimethylphthalate	<7000	
Di-n-butylphthalate	<7000	
2,4-Dinitrotoluene	<7000	
2,6-Dinitrotoluene	<7000	
Di-n-octylphthalate	<7000	
1,2-Diphenylhydrazine	<7000	
Fluoranthene	6400J	<0.050
Fluorene	<7000	
Hexachlorobenzene	<7000	
Hexachlorobutadiene	<7000	
Hexachlorocyclopentadiene	<7000	
Hexachloroethane	<7000	
Indeno(1,2,3-cd)pyrene	1600J	<0.050

J = An estimated value when compound is detected, but is below the laboratory established practical quantitation limit (PQL).

Table 2A

Raw Soil/Sediment Blend Chemical Characterization - Semivolatile Organics (Continued)

PARAMETER	TOTAL (ppb)	LEACHABLE (mg/L)
Base Neutral Compounds (Contd)		
Isophorone	<7000	
Naphthalene	<7000	
Nitrobenzene	<7000	
N-Nitrosodimethylamine	<7000	
N-Nitrosodi-N-Propylamine	<7000	
N-Nitrosodiphenylamine	<7000	
Phenanthrene	2300J	<0.050
Pyrene	7300J	<0.050
1,2,4-Trichlorobenzene	<7000	
Pesticides		
DDT	<110	<0.000050

J = An estimated value when compound is detected, but is below the laboratory established practical quantitation limit (PQL).

Table 2B

Raw Soil/Sediment Blend Chemical Characterization - RCRA Metals

PARAMETER	TOTAL (ppm)	LEACHABLE (mg/L)
Arsenic	4.5	<0.20
Barium	20.0	<1.0
Cadmium	<0.45	<0.010
Chromium	11.0	<0.050
Lead	9.8	<0.20
Selenium	<0.92	<0.50
Silver	<0.90	<0.010
Mercury	<0.011	<0.020

STABILIZATION FORMULATION SCREENING

Various nonplastic (compactible) compositions were explored with the raw soil/sediment blend. These mix designs involved the combination of small quantities of raw waste (nominally 500 grams per batch) with selected stabilization reagents (these additives were determined in advance to be readily available, cost effective, and in sufficient supply to proceed with field application for stabilization). Two to three ratios of each additive system were used, at not less than 1:10 (additive:waste). Slight moisture was added to each mixture to visually approximate the correct moisture addition to maximize the compacted in-place density of the waste/admixture blends. Specific moisture density relationships were not determined at this time. All mix designs were prepared using a Hobart laboratory paddle mixer. The resultant damp compositions were compacted into stainless steel cylindrical molds, using a standard compactive effort which replicates expected field compaction for full-scale placement at the site. Unit weights (densities) of each mix were recorded. All screening test specimens were ejected from their molds and allowed to cure in sealed glass containers at ambient temperature for a period of seven days. Each mix was tested for relative hardening rates using a Soil Test Model CL-700 pocket penetrometer through seven days of curing. Unconfined compressive strength (UCS) was performed on each formula at seven days' age. TCLP leaching tests were performed on selected compositions from each additive system, testing the extracts for base neutral semivolatiles (including PAH) and DDT. Table 3 presents the screening phase test results.

Table 3

Stabilization Formulation Screening Phase

MIX DESIGN	AHG	ATA	ATG	BLG	BHG
ADDITIVE SYSTEM	A	A	A	B	B
TYPE	Cementitious	Cementitious	Cementitious	Pozzolanic	Pozzolanic
CONSISTENCY	Moist Soil	Moist Soil	Moist Soil	Moist Soil	Moist Soil
DENSITY (pcf) as produced	131.4	130.2	125.8	126.4	125.6
PENETRATION RESISTANCE; 3-DAY	>4.5 tsf	>4.5 tsf	>4.5 tsf	3.0 tsf	2.5 tsf
PENETRATION RESISTANCE; 7-DAY	>4.5 tsf	>4.5 tsf	>4.5 tsf	3.0 tsf	>4.5 tsf
UCS; 7-DAY	955 psi	1026 psi	564 psi	40 psi	157 psi

TCLP LEACH RESULTS (mg/L)	SELECTED MIXES		
PARAMETER	ATA*	ATG	BHG
Semivolatile Organics (8270)			
Naphthalene	<0.050	<0.050	<0.050
Acenaphthylene	<0.050	<0.050	<0.050
Acenaphthene	<0.050	<0.050	<0.050
Fluorene	<0.050	<0.050	<0.050
Phenanthrene	<0.050	<0.050	<0.050
Anthracene	<0.050	<0.050	<0.050
Fluoranthene	<0.050	<0.050	<0.050
Pyrene	<0.050	<0.050	<0.050
Chrysene	<0.050	<0.050	<0.050
Benzo(a)Anthracene	<0.050	<0.050	<0.050
Benzo(b)fluoranthene	<0.050	<0.050	<0.050
Benzo(k)Fluoranthene	<0.050	<0.050	<0.050
Benzo(a)pyrene	<0.050	<0.050	<0.050
Indeno(1,2,3-cd)pyrene	<0.050	<0.050	<0.050
Dibenz(a,h)anthracene	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene	<0.050	<0.050	<0.050
2-Methylnaphthalene	<0.050	<0.050	<0.050
Cl-Pesticides/PCB (8080)			
4,4'-DDT	<0.0025	<0.0025	<0.0025

** Formula selected for confirmation tests*

CONFIRMATION/MIX OPTIMIZATION

Selection of a final stabilization mix design was made primarily from the analytical results obtained during the screening phase. After selection of the appropriate formula, WILLIAMS prepared large-size batches (approximately 4000 grams each, of raw waste blended with solidification reagent. Each waste/ additive batch was prepared with a large Hobart (10-quart bowl) laboratory paddle mixer. The resultant mixtures were compacted into cylindrical (Proctor) molds for curing and subsequent tests. These evaluations included:

- Mix density in pounds/cubic foot (pcf);
- Penetration resistance through seven days;
- Unconfined compressive strength (UCS) at seven days;
- Hydraulic conductivity at seven days (USACE EM-1110-2-1906);
- Volume increase; and
- TCLP leaching at seven days (USEPA Method 1311).

Tables 4A and 4B present the confirmation phase findings.

Table 4A

Stabilization Confirmation Phase Selected Formula Performance Testing - Physical Characteristics

Mix Design	ATA
Consistency	Moist Soil
Density, pcf	
Wet	132
Dry	120
Soils Content	91%
Penetration Resistance, tsf 7 Days	>4.5
UCS, psi; 7 days	1131
Permeability	7.8×10^{-7}
Volume Increase	+6%

Table 4B

Stabilization Confirmation Phase
Selected Formula Performance Testing

PARAMETER	LEACHABLE (mg/L)
Semivolatile Organics (8270)	
1,3-Dichlorobenzene	<0.050
1,4-Dichlorobenzene	<0.050
Hexachloroethane	<0.050
bis(2-Chicroethyl)ether	<0.050
1,2-Dichlorobenzene	<0.050
Bis(2-chloroisopropyl)ether	<0.050
N-Nitrosodi-N-Propylamine	<0.050
Nitrobenzene	<0.050
Hexachlorobutadiene	<0.050
1,2,4-Trichlorobenzene	<0.050
Isophorene	<0.050
Naphthalene	<0.050
bis(2-Chloroethoxy)methane	<0.050
Hexachlorocyclopentadiene	<0.050
2-Chloronaphthalene	<0.050
Acenaphthylene	<0.050
Acenaphthene	<0.050
Dimethylphthalate	<0.050
2,6-Dinitrotoluene	<0.050
Fluorene	<0.050
4-Chlorophenyl-phenyl ether	<0.050
2,4-Dinitrotoluene	<0.050
Diethylphthalate	<0.050
N-Nitrosodiphenylamine/Diphenylamine	<0.050
Hexachlorobenzene	<0.050
4-Bromophenyl-phenyl-ether	<0.050
Phenanthrene	<0.050
Anthracene	<0.050
Di-n-butylphthalate	<0.050
Fluoranthene	<0.050
Pyrene	<0.050
Benzidine	<0.40
Butylbenzylphthalate	<0.050
bis(2-Ethylhexyl)phthalate	<0.050
Chrysene	<0.050
Benzo(a)Anthracene	<0.050
3,3,-Dichlorobenzidine	<0.10
Di-n-octylphthalate	<0.050
Benzo(b)fluoranthene	<0.050
Benzo(k)fluoranthene	<0.050
Benzo(a)pyrene	<0.050
Indeno(1,2,3-cd)pyrene	<0.050
Dibenz(a,h)anthracene	<0.050
Benzo(g,h,i)perylene	<0.050

Table 4B

Stabilization Confirmation Phase
Selected Formula Performance Testing
(Continued)

PARAMETER	LEACHABLE (mg/L)
Semivolatile Organics (Continued)	
N-Nitrosodimethylamine	<0.050
2-Methylnaphthalene	<0.050
Dibenzofuran	<0.050
Pesticides in TCLP Extract (8060)	
Chlordane (TCLP)	<0.0050
Endrin (TCLP)	<0.0010
Heptachlor (& hydroxide) (TCLP)	<0.00050
Lindane (g-BHC) (TCLP)	<0.0050
Methoxychlor (TCLP)	<0.025
Toxaphene (TCLP)	<0.050
DDT	<0.0025
Metals in TCLP Extract	
Chromium	0.25
Lead	<0.20

SUMMARY/DISCUSSION OF RESULTS/RECOMMENDATIONS

WILLIAMS Stabilization Laboratory will normally focus on the treatability of worst-case contamination levels (such as those reported initially by Jordan). The composite soil profile provided for this program appears to have nominal target PAH and DDT concentrations, with correspondingly low TCLP leachate levels, prior to S/S treatment. WILLIAMS did find additional PAH compounds not listed in Jordan's initial RFP, several of which were estimated at significant concentrations (see Table 2A).

The selected additive dosage (1.5:10, additive:waste) more than adequately treated the raw waste, and probably could have been reduced to a more economic ratio (e.g., 1.0:10) to affect similar treatment. Reduction in dosage of additive would have little economic effect due to the small size of the project.

Overall, significant improvements in the final disposal properties of the NAS wastes were demonstrated in this benchscale stabilization program. The advantages of solidification/stabilization are the production of a stable material with structural integrity, low permeability, and low leachability of the constituents of concern. Nominal volume increases (less than 10 percent of the original volume with selected formulations) were also realized from HSS treatment. WILLIAMS recommends their HSS system for on-site batch treatment of the contaminated materials at Site 8.

ESTIMATED FIELD IMPLEMENTATION COSTS

Typically, the range of costs associated with stabilization treatment can be estimated at eighty to one-hundred dollars per cubic yard of waste for small projects. These costs are obviously impacted by site conditions, additive rate, and process(es) required (e.g., excavation of contaminated stream sediment may add ten to fifteen dollars per yard to the processing costs.

DATA VALIDATION

Appendix A presents certified analytical data reports from the subcontractor laboratory. Appendix B presents a copy of the documented laboratory proceedings (lab log book).

Appendix A

Analytical Data Reports

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-12780

Received: 09 OCT 90

John Doerner
Harmon Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

Purchase Order: 2292-PM/Brunswick NAS

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
12780-1	Raw Soil/Sediment Blend (10.04.90)	Client

PARAMETER	12780-1
Semivolatile Organics (8270)	
Chrysene, ug/kg dw	<7000
Benzo(a)Anthracene, ug/kg dw	<7000
Benzo(b)fluoranthene, ug/kg dw	<7000
Benzo (k) Fluoranthene, ug/kg dw	<7000
Benzo(a)pyrene, ug/kg dw	<7000
Indeno (1,2,3-cd)pyrene, ug/kg dw	<7000
Dibenz (a,h)anthracene, ug/kg dw	<7000
Cl-Pesticides/PCB (8080)	
4,4'-DDT, ug/kg dw	<110
Arsenic, mg/kg dw	4.5
Barium, mg/kg dw	20
Cadmium, mg/kg dw	<0.45
Chromium, mg/kg dw	11
Lead, mg/kg dw	9.8
Selenium, mg/kg dw	<0.92
Silver, mg/kg dw	<0.90
Mercury, mg/kg dw	<0.011
Percent Solids, %	94 %

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-12780

Received: 09 OCT 90

John Doerner
Harmon Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

Purchase Order: 2292-PM/Brunswick NAS

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
12780-2	Method Blank	Client
12780-3	Accuracy (Mean % Recovery)	
12780-4	Precision (% RPD)	
12780-5	Date Extracted	
12780-6	Date Analyzed	

PARAMETER	12780-2	12780-3	12780-4	12780-5	12780-6
Semivolatile Organics (8270)					
1,4-Dichlorobenzene, ug/kg dw	<330	99 %	6.6 %	10.16.90	10.26.90
N-Nitrosodi-N-Propylamine, ug/kg dw	<330	109 %	3.1 %	10.16.90	10.26.90
1,2,4-Trichlorobenzene, ug/kg dw	<330	102 %	2.2 %	10.16.90	10.26.90
Acenaphthene, ug/kg dw	<330	96 %	0.1 %	10.16.90	10.26.90
2,4-Dinitrotoluene, ug/kg dw	<330	92 %	2.6 %	10.16.90	10.26.90
Pyrene, ug/kg dw	<330	96 %	12.5 %	10.16.90	10.26.90
Chrysene, ug/kg dw	<330	---	---	10.16.90	10.26.90
Benzo(a)Anthracene, ug/kg dw	<330	---	---	10.16.90	10.26.90
3,3'-Dichlorobenzidine, ug/kg dw	<670	---	---	10.16.90	10.26.90
Di-n-octylphthalate, ug/kg dw	<330	---	---	10.16.90	10.26.90
Benzo(b)fluoranthene, ug/kg dw	<330	---	---	10.16.90	10.26.90
Benzo (k) Fluoranthene, ug/kg dw	<330	---	---	10.16.90	10.26.90
Benzo(a)pyrene, ug/kg dw	<330	---	---	10.16.90	10.26.90
Indeno (1,2,3-cd)pyrene, ug/kg dw	<330	---	---	10.16.90	10.26.90
Dibenz (a,h)anthracene, ug/kg dw	<330	---	---	10.16.90	10.26.90
2-Chlorophenol, ug/kg dw	<330	94 %	4.8 %	10.16.90	10.26.90
Phenol, ug/kg dw	<330	90 %	4.8 %	10.16.90	10.26.90
4-Chloro-3-methylphenol, ug/kg dw	<330	86 %	1.0 %	10.16.90	10.26.90
Pentachlorophenol, ug/kg dw	<1700	106 %	0.6 %	10.16.90	10.26.90
4-Nitrophenol, ug/kg dw	<1700	76 %	2.8 %	10.16.90	10.26.90

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-12780

Received: 09 OCT 90

John Doerner
Harmon Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

Purchase Order: 2292-PM/Brunswick NAS

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
12780-2	Method Blank	Client
12780-3	Accuracy (Mean % Recovery)	
12780-4	Precision (% RPD)	
12780-5	Date Extracted	
12780-6	Date Analyzed	

PARAMETER	12780-2	12780-3	12780-4	12780-5	12780-6
Cl-Pesticides/PCB (8080)					
4,4'-DDT, ug/kg dw	<10	105 %	5.7 %	10.11.90	10.12.90
Arsenic, mg/kg dw	<1.0	106 %	0.94 %	---	10.26.90
Barium, mg/kg dw	<1.0	84 %	1.2 %	---	10.23.90
Cadmium, mg/kg dw	<0.50	86 %	0 %	---	11.01.90
Chromium, mg/kg dw	<1.0	99 %	1.0 %	---	11.01.90
Lead, mg/kg dw	<0.50	79 %	1.3 %	---	10.22.90
Selenium, mg/kg dw	<1.0	87 %	2.3 %	---	10.30.90
Silver, mg/kg dw	<1.0	107 %	0 %	---	11.01.90
Mercury, mg/kg dw	<0.015	104 %	1.9 %	---	10.15.90

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-12780

Received: 09 OCT 90

John Doerner
Harmon Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

Purchase Order: 2292-PM/Brunswick NAS

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
12780-7	Raw Soil/Sediment Blend (Analysis in TCL P Extract)	Client

PARAMETER	12780-7
Semivolatile Organics (8270)	
Chrysene, mg/l	<0.050
Benzo(a)Anthracene, mg/l	<0.050
Benzo(b)fluoranthene, mg/l	<0.050
Benzo (k) Fluoranthene, mg/l	<0.050
Benzo(a)pyrene, mg/l	<0.050
Indeno (1,2,3-cd)pyrene, mg/l	<0.050
Dibenz (a,h)anthracene, mg/l	<0.050
Cl-Pesticides/PCB (8080)	
4,4'-DDT, mg/l	<0.000050
Metals in TCLP Extract (6010)	
Arsenic (TCLP), mg/l	<0.20
Barium (TCLP), mg/l	<1.0
Cadmium (TCLP), mg/l	<0.010
Chromium (TCLP), mg/l	<0.050
Lead (TCLP), mg/l	<0.20
Selenium (TCLP), mg/l	<0.50
Silver (TCLP), mg/l	<0.010
Mercury (TCLP), mg/l	<0.020

pH (7.1.4.2) = 8.6 pH (7.1.4.4) = 1.9 pH (7.2.14) = 5.3

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-12780

Received: 09 OCT 90

John Doerner
Harmon Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

Purchase Order: 2292-PM/Brunswick NAS

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
12780-8	Fluid Extract Method Blank (mg/l)	Client

PARAMETER	12780-8
Semivolatile Organics (8270)	
Chrysene, mg/l	<0.050
Benzo(a)Anthracene, mg/l	<0.050
Benzo(b)fluoranthene, mg/l	<0.050
Benzo (k) Fluoranthene, mg/l	<0.050
Benzo(a)pyrene, mg/l	<0.050
Indeno (1,2,3-cd)pyrene, mg/l	<0.050
Dibenz (a,h)anthracene, mg/l	<0.050
Cl-Pesticides/PCB (8080)	
4,4'-DDT, mg/l	<0.000050
Metals in TCLP Extract (6010)	
Arsenic (TCLP), mg/l	<0.20
Barium (TCLP), mg/l	<1.0
Cadmium (TCLP), mg/l	<0.010
Chromium (TCLP), mg/l	<0.050
Lead (TCLP), mg/l	<0.20
Selenium (TCLP), mg/l	<0.50
Silver (TCLP), mg/l	<0.010
Mercury (TCLP), mg/l	<0.020

Methods: EPA SW-846. TCLP results which are above quantitation limits have been corrected for analytical bias per in- structions in Section 8.2.5 of Method 1311 (Federal Register-June 29,1990). The first number reported is the corrected TCLP value and the value in parenthesis () is the uncorrected raw data.

Janette D. Long

Janette D. Long

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-12908

Received: 16 OCT 90

John Doerner
Harmon Environmental Services, Inc. Purchase Order: 2300-PM/Brunswick N.A.S.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
12908-1	ATA (Analysis in TCLP Extract)	Client
12908-2	ATG (Analysis in TCLP Extract)	
12908-3	BHG (Analysis in TCLP Extract)	

PARAMETER	12908-1	12908-2	12908-3
Semivolatile Organics (8270)			
Naphthalene, mg/l	<0.050	<0.050	<0.050
Acenaphthylene, mg/l	<0.050	<0.050	<0.050
Acenaphthene, mg/l	<0.050	<0.050	<0.050
Fluorene, mg/l	<0.050	<0.050	<0.050
Phenanthrene, mg/l	<0.050	<0.050	<0.050
Anthracene, mg/l	<0.050	<0.050	<0.050
Fluoranthene, mg/l	<0.050	<0.050	<0.050
Pyrene, mg/l	<0.050	<0.050	<0.050
Chrysene, mg/l	<0.050	<0.050	<0.050
Benzo(a)Anthracene, mg/l	<0.050	<0.050	<0.050
Benzo(b)fluoranthene, mg/l	<0.050	<0.050	<0.050
Benzo (k) Fluoranthene, mg/l	<0.050	<0.050	<0.050
Benzo(a)pyrene, mg/l	<0.050	<0.050	<0.050
Indeno (1,2,3-cd)pyrene, mg/l	<0.050	<0.050	<0.050
Dibenz (a,h)anthracene, mg/l	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene, mg/l	<0.050	<0.050	<0.050
2-Methylnaphthalene, mg/l	<0.050	<0.050	<0.050
Cl-Pesticides/PCB (8080)			
4,4'-DDT, mg/l	<0.0025	<0.0025	<0.0025
Percent Solids, %	95	95	93

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-12908

Received: 16 OCT 90

John Doerner
Harmon Environmental Services, Inc. Purchase Order: 2300-PM/Brunswick N.A.S.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
12908-4	Fluid Extract Method Blank (mg/l)	Client

PARAMETER	12908-4
Semivolatile Organics (8270)	
Naphthalene, mg/l	<0.050
Acenaphthylene, mg/l	<0.050
Acenaphthene, mg/l	<0.050
Fluorene, mg/l	<0.050
Phenanthrene, mg/l	<0.050
Anthracene, mg/l	<0.050
Fluoranthene, mg/l	<0.050
Pyrene, mg/l	<0.050
Chrysene, mg/l	<0.050
Benzo(a)Anthracene, mg/l	<0.050
Benzo(b)fluoranthene, mg/l	<0.050
Benzo (k) Fluoranthene, mg/l	<0.050
Benzo(a)pyrene, mg/l	<0.050
Indeno (1,2,3-cd)pyrene, mg/l	<0.050
Dibenz (a,h)anthracene, mg/l	<0.050
Benzo(g,h,i)perylene, mg/l	<0.050
2-Methylnaphthalene, mg/l	<0.050
Cl-Pesticides/PCB (8080)	
4,4'-DDT, mg/l	<0.0025

Methods: EPA SW-846.
TCLP results which are above quantitation limits have been corrected for analytical bias per instructions in Section 8.2.5 of Method 1311 (Federal Register-June 29, 1990). The first number reported is the corrected TCLP value and the value in parenthesis () is the uncorrected raw data.

Janitta O. Hong

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: 00-12780

Received: 09 NOV 90

Mr. John Doerner
Harmon Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
12780-1	Raw Soil Sediment/Blend (10.04.90)	Client

PARAMETER	12780-1
Base Neutral Compounds	
Acenaphthene, ug/kg dw	<7000
Acenaphthylene, ug/kg dw	690J
Anthracene, ug/kg dw	640J
Benzidine, ug/kg dw	<56000
Benzo(a)Anthracene, ug/kg dw	3900J
Benzo(a)pyrene, ug/kg dw	3000J
3,4-Benzofluoranthene, ug/kg dw	3300J
Benzo(g,h,i)perylene, ug/kg dw	1800J
Benzo (k) Fluoranthene, ug/kg dw	3000J
bis(2-Chloroethoxy) methane, ug/kg dw	<7000
bis(2-Chloroethyl) ether, ug/kg dw	<7000
Bis(2-chloroisopropyl)ether, ug/kg dw	<7000
bis(2-Ethylhexyl) phthalate, ug/kg dw	12000
4-Bromophenyl-phenyl-ether, ug/kg dw	<7000
Butylbenzylphthalate, ug/kg dw	<7000
2-Chloronaphthalene, ug/kg dw	<7000
4-Chlorophenyl-phenyl ether, ug/kg dw	<7000
Chrysene, ug/kg dw	4100J
Dibenz(a,h)anthracene, ug/kg dw	370J
1,2-Dichlorobenzene, ug/kg dw	<7000
1,3-Dichlorobenzene, ug/kg dw	<7000
1,4-Dichlorobenzene, ug/kg dw	<7000
3,3'-Dichlorobenzidine, ug/kg dw	<14000

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: 00-12780

Received: 09 NOV 90

Mr. John Doerner
Harmon Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
12780-1	Raw Soil Sediment/Blend (10.04.90)	Client

PARAMETER	12780-1
Diethylphthalate, ug/kg dw	<7000
Dimethylphthalate, ug/kg dw	<7000
Di-n-butylphthalate, ug/kg dw	<7000
2,4-Dinitrotoluene, ug/kg dw	<7000
2,6-Dinitrotoluene, ug/kg dw	<7000
Di-n-octylphthalate, ug/kg dw	<7000
1,2-Diphenylhydrazine, ug/kg dw	<7000
Fluoranthene, ug/kg dw	6400J
Fluorene, ug/kg dw	<7000
Hexachlorobenzene, ug/kg dw	<7000
Hexachlorobutadiene, ug/kg dw	<7000
Hexachlorocyclopentadiene, ug/kg dw	<7000
Hexachloroethane, ug/kg dw	<7000
Indeno (1,2,3-cd)pyrene, ug/kg dw	1600J
Isophorone, ug/kg dw	<7000
Naphthalene, ug/kg dw	<7000
Nitrobenzene, ug/kg dw	<7000
N-Nitrosodimethylamine, ug/kg dw	<7000
N-Nitrosodi-N-Propylamine, ug/kg dw	<7000
N-Nitrosodiphenylamine/Diphenylamine, ug/kg dw	<7000
Phenanthrene, ug/kg dw	2300J
Pyrene, ug/kg dw	7300J
1,2,4-Trichlorobenzene, ug/kg dw	<7000

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: 00-12780

Received: 09 NOV 90

Mr. John Doerner
Harmon Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
12780-2	Method Blank	Client
12780-3	Accuracy (Mean % Recovery)	
12780-4	Precision (% RPD)	
12780-5	Date Extracted	
12780-6	Date Analyzed	

PARAMETER	12780-2	12780-3	12780-4	12780-5	12780-6
Base Neutral Compounds					
Acenaphthene, ug/kg dw	<330	89 %	0.4 %	10.16.90	10.25.90
Acenaphthylene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Anthracene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Benzidine, ug/kg dw	<2700	---	---	10.16.90	10.25.90
Benzo(a)Anthracene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Benzo(a)pyrene, ug/kg dw	<330	---	---	10.16.90	10.25.90
3,4-Benzofluoranthene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Benzo(g,h,i)perylene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Benzo (k) Fluoranthene, ug/kg dw	<330	---	---	10.16.90	10.25.90
bis(2-Chloroethoxy) methane, ug/kg dw	<330	---	---	10.16.90	10.25.90
bis(2-Chloroethyl) ether, ug/kg dw	<330	---	---	10.16.90	10.25.90
Bis(2-chloroisopropyl)ether , ug/kg dw	<330	---	---	10.16.90	10.25.90
bis(2-Ethylhexyl) phthalate, ug/kg dw	<330	---	---	10.16.90	10.25.90
4-Bromophenyl-phenyl-ether, ug/kg dw	<330	---	---	10.16.90	10.25.90
Butylbenzylphthalate, ug/kg dw	<330	---	---	10.16.90	10.25.90

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: 00-12780

Received: 09 NOV 90

Mr. John Doerner
Harmon Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
12780-2	Method Blank	Client
12780-3	Accuracy (Mean % Recovery)	
12780-4	Precision (% RPD)	
12780-5	Date Extracted	
12780-6	Date Analyzed	

PARAMETER	12780-2	12780-3	12780-4	12780-5	12780-6
2-Chloronaphthalene, ug/kg dw	<330	---	---	10.16.90	10.25.90
4-Chlorophenyl-phenyl ether, ug/kg dw	<330	---	---	10.16.90	10.25.90
Chrysene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Dibenz(a,h)anthracene, ug/kg dw	<330	---	---	10.16.90	10.25.90
1,2-Dichlorobenzene, ug/kg dw	<330	---	---	10.16.90	10.25.90
1,3-Dichlorobenzene, ug/kg dw	<330	---	---	10.16.90	10.25.90
1,4-Dichlorobenzene, ug/kg dw	<330	88 %	2.2 %	10.16.90	10.25.90
3,3'-Dichlorobenzidine, ug/kg dw	<670	---	---	10.16.90	10.25.90
Diethylphthalate, ug/kg dw	<330	---	---	10.16.90	10.25.90
Dimethylphthalate, ug/kg dw	<330	---	---	10.16.90	10.25.90
Di-n-butylphthalate, ug/kg dw	<330	---	---	10.16.90	10.25.90
2,4-Dinitrotoluene, ug/kg dw	<330	85 %	7.4 %	10.16.90	10.25.90
2,6-Dinitrotoluene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Di-n-octylphthalate, ug/kg dw	<330	---	---	10.16.90	10.25.90
1,2-Diphenylhydrazine, ug/kg dw	<330	---	---	10.16.90	10.25.90
Fluoranthene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Fluorene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Hexachlorobenzene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Hexachlorobutadiene, ug/kg dw	<330	---	---	10.16.90	10.25.90

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: 00-12780

Received: 09 NOV 90

Mr. John Doerner
Harmon Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
12780-2	Method Blank	Client
12780-3	Accuracy (Mean % Recovery)	
12780-4	Precision (% RPD)	
12780-5	Date Extracted	
12780-6	Date Analyzed	

PARAMETER	12780-2	12780-3	12780-4	12780-5	12780-6
Hexachlorocyclopentadiene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Hexachloroethane, ug/kg dw	<330	---	---	10.16.90	10.25.90
Indeno (1,2,3-cd)pyrene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Isophorone, ug/kg dw	<330	---	---	10.16.90	10.25.90
Naphthalene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Nitrobenzene, ug/kg dw	<330	---	---	10.16.90	10.25.90
N-Nitrosodimethylamine, ug/kg dw	<330	---	---	10.16.90	10.25.90
N-Nitrosodi-N-Propylamine, ug/kg dw	<330	99 %	0.9 %	10.16.90	10.25.90
N-Nitrosodiphenylamine/Diphenylamine, ug/kg dw	<330	---	---	10.16.90	10.25.90
Phenanthrene, ug/kg dw	<330	---	---	10.16.90	10.25.90
Pyrene, ug/kg dw	<330	88 %	1.2 %	10.16.90	10.25.90
1,2,4-Trichlorobenzene, ug/kg dw	<330	91 %	4.2 %	10.16.90	10.25.90

Methods: EPA SW-846.
J = Estimated Value.

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: 00-12780

Received: 09 NOV 90

Mr. John Doerner
Harmon Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
12780-7	Raw Soil Sediment/Blend (10.04.90)	Client

PARAMETER	12780-7
Semivolatiles in TCLP Extract (8270)	
Acenaphthene (TCLP), mg/l	<0.050
Acenaphthylene (TCLP), mg/l	<0.050
3,4-Benzofluoranthene, mg/l	<0.050
Benzo(g,h,i)perylene, mg/l	<0.050
bis(2-Ethylhexyl) phthalate, mg/l	<0.050
Fluoranthene (TCLP), mg/l	<0.050
Phenanthrene (TCLP), mg/l	<0.050
Pyrene (TCLP), mg/l	<0.050

Janette D. Long

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-15084

Received: 14 DEC 90

John Doerner
Williams Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

Purchase Order: 2348-PM

Project: 0130-003-310

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
15084-1	ATA (Analysis on TCLP Extract)	Client

PARAMETER	15084-1
Semivolatile Organics (8270)	
1,3-Dichlorobenzene, ug/l	<50
1,4-Dichlorobenzene, ug/l	<50
Hexachloroethane, ug/l	<50
bis(2-Chloroethyl) ether, ug/l	<50
1,2-Dichlorobenzene, ug/l	<50
Bis(2-chloroisopropyl)ether, ug/l	<50
N-Nitrosodi-N-Propylamine, ug/l	<50
Nitrobenzene, ug/l	<50
Hexachlorobutadiene, ug/l	<50
1,2,4-Trichlorobenzene, ug/l	<50
Isophorone, ug/l	<50
Naphthalene, ug/l	<50
bis(2-Chloroethoxy) methane, ug/l	<50
Hexachlorocyclopentadiene, ug/l	<50
2-Chloronaphthalene, ug/l	<50
Acenaphthylene, ug/l	<50
Acenaphthene, ug/l	<50
Dimethylphthalate, ug/l	<50
2,6-Dinitrotoluene, ug/l	<50
Fluorene, ug/l	<50
4-Chlorophenyl-phenyl ether, ug/l	<50
2,4-Dinitrotoluene, ug/l	<50
Diethylphthalate, ug/l	<50

SL SAVANNAH LABORATORIES & ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-15084

Received: 14 DEC 90

John Doerner
Williams Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

Purchase Order: 2348-PM

Project: 0130-003-310

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
15084-1	ATA (Analysis on TCLP Extract)	Client

PARAMETER	15084-1
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<50
Hexachlorobenzene, ug/l	<50
4-Bromophenyl-phenyl-ether, ug/l	<50
Phenanthrene, ug/l	<50
Anthracene, ug/l	<50
Di-n-butylphthalate, ug/l	<50
Fluoranthene, ug/l	<50
Pyrene, ug/l	<50
Benzidine, ug/l	<400
Butylbenzylphthalate, ug/l	<50
bis(2-Ethylhexyl) phthalate, ug/l	<50
Chrysene, ug/l	<50
Benzo(a)Anthracene, ug/l	<50
3,3'-Dichlorobenzidine, ug/l	<100
Di-n-octylphthalate, ug/l	<50
Benzo(b)fluoranthene, ug/l	<50
Benzo (k) Fluoranthene, ug/l	<50
Benzo(a)pyrene, ug/l	<50
Indeno (1,2,3-cd)pyrene, ug/l	<50
Dibenz(a,h)anthracene, ug/l	<50
Benzo(g,h,i)perylene, ug/l	<50
N-Nitrosodimethylamine, ug/l	<50
2-Methylnaphthalene, ug/l	<50
Dibenzofuran, ug/l	<50

SL *SAVANNAH LABORATORIES*
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-15084

Received: 14 DEC 90

John Doerner
Williams Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

Purchase Order: 2348-PM

Project: 0130-003-310

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , SOLID OR SEMISOLID SAMPLES	SAMPLED BY
15084-2	ATA (12.13.90)	Client

PARAMETER	15084-2
Pesticides in TCLP Extract (8080)	
Chlordane (TCLP), mg/l	<0.0050
Endrin (TCLP), mg/l	<0.0010
Heptachlor (& hydroxide) (TCLP), mg/l	<0.00050
Lindane (g-BHC) (TCLP), mg/l	<0.00050
Methoxychlor (TCLP), mg/l	<0.025
Toxaphene (TCLP), mg/l	<0.050
DDT, mg/l	<0.0025
Lead (TCLP), mg/l	<0.20
Chromium (TCLP), mg/l	0.26

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-15084

Received: 14 DEC 90

John Doerner
Williams Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

Purchase Order: 2348-PM

Project: 0130-003-310

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
15084-3	Fluid Extract Method Blank (mg/l)	Client

PARAMETER	15084-3
Semivolatile Organics (8270)	
1,3-Dichlorobenzene, ug/l	<50
1,4-Dichlorobenzene, ug/l	<50
Hexachloroethane, ug/l	<50
bis(2-Chloroethyl) ether, ug/l	<50
1,2-Dichlorobenzene, ug/l	<50
Bis(2-chloroisopropyl)ether, ug/l	<50
N-Nitrosodi-N-Propylamine, ug/l	<50
Nitrobenzene, ug/l	<50
Hexachlorobutadiene, ug/l	<50
1,2,4-Trichlorobenzene, ug/l	<50
Isophorone, ug/l	<50
Naphthalene, ug/l	<50
bis(2-Chloroethoxy) methane, ug/l	<50
Hexachlorocyclopentadiene, ug/l	<50
2-Chloronaphthalene, ug/l	<50
Acenaphthylene, ug/l	<50
Acenaphthene, ug/l	<50
Dimethylphthalate, ug/l	<50
2,6-Dinitrotoluene, ug/l	<50
Fluorene, ug/l	<50
4-Chlorophenyl-phenyl ether, ug/l	<50
2,4-Dinitrotoluene, ug/l	<50
Diethylphthalate, ug/l	<50

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-15084

Received: 14 DEC 90

John Doerner
Williams Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

Purchase Order: 2348-PM

Project: 0130-003-310

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
15084-3	Fluid Extract Method Blank (mg/l)	Client

PARAMETER	15084-3
N-Nitrosodiphenylamine/Diphenylamine, ug/l	<50
Hexachlorobenzene, ug/l	<50
4-Bromophenyl-phenyl-ether, ug/l	<50
Phenanthrene, ug/l	<50
Anthracene, ug/l	<50
Di-n-butylphthalate, ug/l	<50
Fluoranthene, ug/l	<50
Pyrene, ug/l	<50
Benzidine, ug/l	<400
Butylbenzylphthalate, ug/l	<50
bis(2-Ethylhexyl) phthalate, ug/l	<50
Chrysene, ug/l	<50
Benzo(a)Anthracene, ug/l	<50
3,3'-Dichlorobenzidine, ug/l	<100
Di-n-octylphthalate, ug/l	<50
Benzo(b)fluoranthene, ug/l	<50
Benzo (k) Fluoranthene, ug/l	<50
Benzo(a)pyrene, ug/l	<50
Indeno (1,2,3-cd)pyrene, ug/l	<50
Dibenz(a,h)anthracene, ug/l	<50
Benzo(g,h,i)perylene, ug/l	<50
N-Nitrosodimethylamine, ug/l	<50
2-Methylnaphthalene, ug/l	<50
Dibenzofuran, ug/l	<50

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

5102 LaRoche Avenue • Savannah, GA 31404 • (912) 354-7858 • Fax (912) 352-0165

LOG NO: S0-15084

Received: 14 DEC 90

John Doerner
Williams Environmental Services, Inc.
5221 Militia Hill Road
Plymouth Meeting, PA 19462

Purchase Order: 2348-PM

Project: 0130-003-310

REPORT OF RESULTS

LOG NO	SAMPLE DESCRIPTION , QC REPORT FOR SOLID/SEMISOLID	SAMPLED BY
15084-3	Fluid Extract Method Blank (mg/l)	Client

PARAMETER	15084-3
Pesticides in TCLP Extract (8080)	
Chlordane (TCLP), mg/l	<0.0050
Endrin (TCLP), mg/l	<0.0010
Heptachlor (& hydroxide) (TCLP), mg/l	<0.00050
Lindane (g-BHC) (TCLP), mg/l	<0.00050
Methoxychlor (TCLP), mg/l	<0.025
Toxaphene (TCLP), mg/l	<0.050
DDT, mg/l	<0.0025
Lead (TCLP), mg/l	<0.20
Chromium (TCLP), mg/l	<0.050

Methods: EPA SW-846.
Reported TCLP results have not been corrected for analytical bias per client request.

Janette D. Long

Appendix B

Laboratory Documentation Log

①

The program for the Naval Air Station (NAS) is to stabilize soil + sediments contaminated with polynuclear aromatic hydrocarbons (PAH's) + DDT. The samples will be from Hotspot areas. The stabilization will be tested by the Toxicity Characteristics Leaching Procedure (TCLP). There is approximately .6 acres of affected soil at the site.

DOIC TO SEDIMENT RATIO

150 : 1

755 cu yds

750 soil — 5 sediment

CHARACTERIZATION

(3)

Rec'd 2 SOILS AND 1 SEDIMENT SMPL
All BUCKETS SHAKEN AND ROLLED VIGORIOUSLY BEFORE OPENING

SOIL BUCKET #1

Desc: Brown, Moist, Sandy Loam, Soil, small + large rocks - 2" √,

% Solids

TOD 1950 tare = 9.2

A	B
in wt. ___	in wt. 121.3
out wt. ___ = ___%	out wt. 113.6 = 93.7%
out wt. ___ = ___%	out wt. ___ = ___%

Density - Loose Bulk

$\frac{121.3\ g}{113.6\ ml}$ = 1.07 specific gravity X 62.4 = 66.6 pcf

Density - TAMPED

$\frac{189.0\ g}{113.6\ ml}$ = 1.664 specific gravity X 62.4 = 103.8 pcf

Density - COMPACTED

Length of cylinder = 1.502 " — wt. / vol. 182.1 / 5.970 = 116.5 pcf

"No water squeezed out - cylinder - soft - falls easily apart" - "Very Moist - overwet",

pH = 8.0 (Corning pH meter)

6.35%
6.20

CHARACTERIZATION

SOIL - BUCKET #2

Desc: Same

% Solids

TOD ___ : ture = 9.2

A	B
in wt. ___	in wt. 127.4
out wt. ___ = ___%	out wt. 119.5 = 93.8%
out wt. ___ = ___%	out wt. ___ = ___%

Density - Loose Bulk

$\frac{178.0\ g}{113.6\ ml} = 1.07$ specific gravity X 62.4 = 67.0 pcf

Density - Tamped

$\frac{188.0\ g}{113.6\ ml} = 1.655$ specific gravity x 62.4 = 103.3 pcf = 1.66 = s.g.

Density - Compacted

Length of cylinder = 1.419 " — $\frac{Wt.}{178.9} / \frac{Vol.}{5.641}$ = 119.3 pcf

"Same"

pH = 8.0 (pH meter)

CHARACTERIZATION

SEDIMENT

Desc: Brown, lumpy sludge - settles easily, has very much grit + roc

% Solids

TOD 21.90 % tare = 9.2

A	B
in wt. ___	in wt. 150.6
out wt. ___ = ___%	101.0 out wt. 69.6 = 46.2 %
out wt. ___ = ___%	out wt. ___ = ___%

$\frac{81}{69.6} = 1.16$

Density

$\frac{159.8 \text{ g}}{113.6 \text{ ml}} = 1.41$ specific gravity X 62.4 = 87.8 pcf = 1.41 g/cm³

pH ≈ 7.0 (PAPER)

pH = 6.4 (Corning pH meter)

1.655 gm / cm^3

1.66 gm / cm^3 avg.
s.g.

1.407 gm / cm^3
(1.407)

1500

∴ 176 : 1 wgt basis
(soil to sediment)

Assume $\frac{15,000 \text{ gm}}{1.66}$ = 9036 cc ÷ 150 = 60 cc

60 cc × 1.41 g/cc = 85 gm

CHARACTERIZATION

COMPOSITE

Desc: 150 to 1 by vol
(soil) (sediment)
176 to 1 by wgt

% Solids
TOD ___ tare = 1.6

A	B
in wt. ___	in wt. 24.3g
out wt. ___ = ___%	10/5' out wt. 22.8 = 93.8%
out wt. ___ = ___%	out wt. ___ = ___%

Density - Loose Bulk (Volumeter)
$\frac{163.1\ g}{113.6\ ml} = 1.44$ specific gravity x 62.4 = 89.6 pcf

Density - Tamped (Volumeter)
$\frac{\quad g}{113.6\ ml} =$ specific gravity x 62.4 = pcf

Density - COMPACTED (CARVER 1500 psi)
Length of cylinder - 1.774" " - 225.0 / 7.05 = 121.87 pcf
V = 7.05

Density - Proctor cyl ($\frac{1}{30}$ cuft vol) TARE 1993 gm

$\frac{1830.2\ gm \times 30}{454} = 120.9$ pcf wet den D_w

pH = 8.4 (Corning pH meter) pcf dry den. d

Proctor will be sent out for 7 day permeability
Permeability 7M x 10-6 cm/sec

"150:1" by volume

(Blend wgts)

10,000 gm 10,000 gm

Bucher A B

Sel. 113.3 gm

NOTE → (176:1 by wgt)

Possible Additive Ratios

Additive A — Cementitous — not less than 10% by wgt

Additive B — Pozzolanic — not less than 10% by wgt

KJ/4

(13)

SOIL/SEDIMENT MIX

2000g batches of soil
mixed with
11.36 g sediment

176 : 1 by weight

5 batches totalling 10,056.8 g composite
in 5 gal drum
labled WAS SOIL MIX

SCREENING MIXES WITH CEMENTITOUS ADDITIVE 15

MIX AHG 1210 HRS

gr soil - 450

gr cementitous additive

added H_2O - 4%

consistency moist soil

Approx. Optimum H_2O

3.6

4%

5%

MAXI cyls

L	1.939	L	1.638
W	261.5	W	228.7
V	7.708	V	6.511
D_w	129.12	D_w	133.69

AVERAGE D_w = 131.41

MIX % Solids 1.3

TOD ___

A	B
in wt. ___	in wt. 15.7
out wt. ___ = ___%	105° out wt. 14.3 = 91.0%
out wt. ___ = ___%	out wt. ___ = ___%

MIX ATA

1320 HRS.

Approx optimum H_2O

3%

4%

5%

gr soil 500

gr cementitous additive

added H_2O - 4%

consistency - moist soil

MAXI cyls.

L	1.629	L	1.638
W	222.9	W	221.4
V	6.475	V	6.511
D_w	131.02	D_w	129.42

AVERAGE D_w = 130.22

$V = 3.975 \times L$

$D_w = W/V \times 3.806$

% Solids

TOD 1.4

A	B
in wt. ___	in wt. 12.5
out wt. ___ = ___%	105° out wt. 11.4 = 91.2%
out wt. ___ = ___%	out wt. ___ = ___%

mix AHC - PR/STR

~~1~~

~~2~~

3 > 4.5

~~4~~

7 >> 4.5

7 DAY UCS 4750 UCS

1195 x .8 = 955.9

956 psi

mix ATA PR/STR

~~1~~

~~2~~

3 > 4.5

~~4~~

7 >> 4.5

7 DAY UCS - 5100# LOAD

1283.0 x .8 = 1026 psi

10/5

(17)

MIX ATG

Approx. Optimum H_2O

2 %

3 %

x 4 ~~7~~

5 %

gr soil 50

gr Cementitous additive

ADDED H_2O 3%

consistency ~~moist~~ soil

% Solids .1.5 T

TOD ___

A	B
in wt. ___	in wt. ~~12.5~~ 26.4
out wt. ___ = ___%	10/10 out wt. 24.0 = 90.1 %
out wt. ___ = ___%	out wt. ___ = ___%

MAXI cyl

L ~~1.629~~" 1.686

W ~~222.9~~ 221.0

V 6.702

D 125.50

AVERAG 125.75

MAXI cyl

1.740

~~229.0~~ ~~223.8~~ 229.0

V: 6.917

D: 126.00

7 DAY UCS

2800# LOAD

704 x .8 = 563.5

PR / STR

~~1~~

~~2~~

3 ~~>1.5~~

NT

7

gr 100+% moist

1.6/5

BLG

(19)

mix

Additive pozzolanic

% 40%

Approx. Optimum H_2O

x → 67%

g soil 500g

% pozzolanic additive

Add H_2O 67%

Consistency moist soil

Max Cyl.

% Solids Take 1.3

TOD ___

				A	B
L	1.694	1.769	1.545	in wt. ___	in wt. 25.0
W	225g	234.6	201.7	out wt. ___ = ___%	10/10 cut wt 22.8 = 91.2
V	6.734	7.032	6.141	cut wt. ___ = ___%	cut wt. ___ = ___
Dw	127.17	126.97	125.01		

Average Density = 126.38

PR

Day 3 = 3.0 Sample fractured

Day 7 = 3.0 Sample fractured

UCS - 200 lbs. load

40 psi

* Specimens expanded (poor integrity) to friable state

10/2 MIXES WITH POZZOLANIC ADDITIVE

mix BHC (21)

Advenitus pozzolanic

% 20%

g soil 500

g pozzolanic additive

Approx optimum moisture H_2O

x 4%

x 9%

Added H_2O

Consistency joint soil

Maxi Cyl

L	1.689	1.684	1.200
W	222.6	219.8	168.7
V	6.634	6.694	5.168
D	127.71	124.97	124.24

AVERAGE
D = 125.64

% Solids tare 1.4

TOD ___

A	B
in wt. ___	in wt. 9.5
out wt. ___ = ___%	10/10 out wt. 8.8 = 93.6%
out wt. ___ = ___%	out wt. ___ = ___%

LOAD = 780 lbs
157 psi

PR
Day 3 = 2.5 sample fractured
Day 7 = >4.5

11/29/90

SELECTED MIX DESIGN
(SCALE-UP)

(23)

MIX ATA

ADDITIVE Cementitous

gm soil/sed. 3500

% H_2O : 4% by wt of additive + soil

V. MOIST

Proctor

wgt 1998.5 g net

D_w 132.1 pcf

D_d 120.0 pcf

% Solids

TOD 1.7

A	B
in wt. ___	in wt. 35.5
out wt. ___ = ___%	out wt. 32.2 = 90.7%
out wt. ___ = ___%	out wt. ___ = ___%

UCS LOAD = 10,000+ Reading beyond gauge capability No noticible failure at max. reading.

796.18 psi minimum
57.3 tsf minimum

NOTE WILL SEND TO CONCRETE TESTING LAB WITH HIGH CAPACITY UCS APPARATUS.

GRIFFIN CO. conducted a UCS test on cylinder with unit of sufficient capacity.

Results → 1131 psi

Permeability
7.8×10^{-7} cm/sec.

12/13/90

Raw Composite Proctor Cylinder (25)

Cylinder Tare = 1983.3 g

Cylinder wt. = 1818.6 g

$$\frac{1818.6 \times 30}{454} = 120.17 \text{ pcf } D_N$$

WILLIAMS ENVIRONMENTAL SERVICES, INC.

CHAIN OF CUSTODY RECORD

PROJ. NO.: 0130-003-310

PROJECT NAME: E.C. JORDAN/BRUNSWICK N.A.S.

SAMPLERS: (Signature) [signature]

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	TCLP - NON VOA EXT	TCLP BASE NEUTRALS	TCLP Cl-PESTICIDES	TCLP Pb	TCLP Cr (total Cr)		REMARKS
	12/13	1600	X		Solidified Soil (MIX ATA)	1	X	X	X	X	X		[redacted]
15084													

A-51

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
[signature]	12/13 1600				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature) [signature]	Date / Time 12/14/90 9:45 am	Remarks SENT FED X 12/13/90 TO SAVANNAH LABS	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

CHAIN OF CUSTODY RECORD

Client: E.C. Jordan N.A.S.

Site Location: Brunswick Maine

HES Project No.:

Please Print - Sampler's Name : John B. Good

Company: WES

Signature: John B. Good

Collectors Sample No.	Station No.	Sample Description (ie. Name, Location, etc.)	Samples Collected Date	Samples Collected Time	Sample Type Comp.	Sample Type Grab	Sample Type Other (Specify)	Preservative	No. of Containers	Lab ID No.(s)	Non-vol. Extraction (TCLP)	PAH	Pesticides (DDT)			Remarks
ATA		Solidified Soil	10/5		✓			—	1	—	✓	✓	✓			
ATG		"	10/5		✓			—	1	—	✓	✓	✓			
BHG		"	10/5		✓			—	1	—	✓	✓	✓			
D908																

A-52

Additional Field Comments: Standard turn-around.

Relinquished by:		Received by:		Date	Time
Print Name: John B. Good Signature: John B. Good	Company: WES	Print Name: Llona Bonds Signature: Llona Bonds	Company: Sauh. Labs	10/16/90	9:25 am
Print Name: Signature:	Company:	Print Name: Signature:	Company:		
Print Name: Signature:	Company:	Print Name: Signature:	Company:		
COOLERS:		Received for laboratory by: Print Name: Signature:			

CHAIN OF CUSTODY RECORD

Client: Brunswick N.A.S.
Site Location: Maine

HES Project No.:
Please Print - Sampler's Name : John B. Good
Company: WES
Signature: John B. Good
P.O. 2292-PM

Collectors Sample No.	Station No.	Sample Description (ie. Name, location, etc.)	Samples Collected		Sample Type			Sample Information			Analyses Required						
			Date	Time	Comp.	Grab	Other (Specify)	Preser-vative	No. of Containers	Lab ID No.(s)	Total PAH	Total Pesticides	Total Metals	TCLP PAH	TCLP Pesticides	TCLP Metals	Remarks
—	—	Raw Soil/Sediment Blend	10/4/90	—	✓			—	1	—	X	X	X	X	X	X	—

Additional Field Comments:

Relinquished by:		Received by:		Date	Time
Print Name: John Good Signature: John B. Good	Company: WES	Print Name: Signature:	Company:		
Print Name: Signature:	Company:	Print Name: Signature:	Company:		
Print Name: Signature:	Company:	Print Name: Signature:	Company:		
COMMENTS: Sent to Savannah Labs 10/8/90		Received for laboratory by: Print Name: Signature:			

COST BACK-UP TABLES

TABLE B-1 (BACKUP COSTS)
NO ACTION (8A) COST SUMMARY: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

COST ELEMENT	UNIT COST	UNIT	QUANT.	TOTAL COST
ENVIRONMENTAL MONITORING				
Equipment and Personnel				
Photovac Tip	$37	day	2	$74
Temp/Cond/Redox/DO	$35	day	2	$70
Water Level Meter	$3	day	2	$6
Cooler	$2	event	1	$2
Peristaltic Pump	$10	day	2	$20
Miscellaneous	$280	event	1	$280
Field Sampling Technician	$13	hr	16	$208
Analytical Services				
TCL Organics (water)	$910	sample	5	$4,550
PAHs (soil)	$160	sample	4	$640
TOTAL				$5,849.50
FIVE-YEAR SITE REVIEWS				
Data validation	$3,200	year	5	$16,000
Report	$15,000	ls	1	$15,000
TOTAL				$31,000

TABLE B-2 (BACKUP COSTS)
MINIMAL ACTION (8B) COST SUMMARY: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

	UNIT COST	UNIT	QUANT.	TOTAL COST
CAPITAL COSTS				
FENCING/WARNING SIGNS				
Materials	$12	lf	575	$6,900
Gates	$800	each	1	$800
Warning Signs	$100	each	8	$800
TOTAL				$8,500
INSTITUTIONAL CONTROLS	$5,000	ls	1	$5,000
ENVIRONMENTAL MONITORING				
Equipment and Personnel				
Photovac Tip	$37	day	2	$74
Temp/Cond/Redox/DO	$35	day	2	$70
Water Level Meter	$3	day	2	$6
Cooler	$2	event	1	$2
Peristaltic Pump	$10	day	2	$20
Miscellaneous	$280	event	1	$280
Field Sampling Technician	$13	hr	16	$208
Analytical Services				
TCL Organics (water)	$910	sample	5	$4,550
PAHs (soil)	$160	sample	4	$640
TOTAL				$5,849.50
SITE INSPECTION AND MAINTENANCE				
Site inspection	$200	ls	1	$200
Maintenance-fence and signs	$1	lf	575	$575
TOTAL				$775
FIVE-YEAR SITE REVIEWS				
Data validation	$3,200	year	5	$16,000
Report	$15,000	ls	1	$15,000
TOTAL				$31,000

TABLE B-3 (Back-up for 18 mg/kg)
SOIL COVER (8C) COST SUMMARY: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

CAPITAL COSTS	UNIT COST	UNIT	QUANT.	TOTAL COST
MOBILIZATION/DEMOBILIZATION				
Dozer (300 HP)	$1,500	ls	1	$1,500
TOTAL				$1,500
COVER MATERIALS				
Top Soil	$15.00	cy	200	$3,000
Geotextile Fabric	$0.65	sy	944	$614
TOTAL				$3,614
COVER CONSTRUCTION				
Foreman	$300	day	5	$1,500
Pickup	$75	day	5	$375
Dozer (300 HP)	$1,200	day	1	$1,200
Seed, Fertilize, Mulch	$2,000	acre	0.5	$1,000
TOTAL				$4,075
SITE INSPECTION AND MAINTENANCE				
Site inspection	$500	ls	1	$500
Maintenance-cover	$1,000	ls	1	$1,000
TOTAL				$1,500

TABLE B-4

COVER (8C) SENSITIVITY ANALYSIS COST SUMMARY: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

	COST	PRESENT WORTH
CAPITAL COSTS		
Mobilization/Demobilization	$1,000	
Cover Materials	$30,000	
Cover Construction	$20,000	
Institutional Controls[2]	$5,000	
Total Capital Costs:	$56,000	$56,000
INDIRECT COSTS		
Health & Safety (@ 25% of Capital Cost)	$14,000	
Legal, Administration, Permitting (@ 5% of Capit	$3,000	
Engineering (@ 10% of Capital Cost)	$6,000	
Services During Construction (@ 5% of Capital C	$3,000	
Total Indirect Costs:	$26,000	$26,000
ANNUAL COSTS		
Environmental Monitoring	$6,000	
Site Inspection and Maintenance		
Total Operating Costs:	$6,000	$57,000
Five-Year Site Review	$31,000	$77,000
SUBTOTAL:		$216,000
Contingency (@ 20%)		$43,000
TOTAL COST:		$259,000

Note:
1. Discount Rate of 10% is used for present worth analyses.
2. Environmental monitoring is assumed to continue for 30 years.
3. Five-year reviews are assummed every five years for thirty years.
4. Assumes no trailer or office set-up is necessary.

TABLE B-5 (Back-up for 1.8 mg/kg)
SOIL COVER (8C) COST SUMMARY: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

	UNIT COST	UNIT	QUANTITY	TOTAL COST
CAPITAL COSTS				
MOBILIZATION/DEMOBILIZATION				
Dozer (300 HP)	$1,300	ls	1	$1,300
TOTAL				$1,300
COVER MATERIALS				
Common Borrow	$5.00	cy	2650	$13,250
Top Soil	$15.00	cy	925	$13,875
Geotextile Fabric	$0.65	sy	5100	$3,315
TOTAL				$30,440
COVER CONSTRUCTION				
Foreman	$300	day	10	$3,000
Pickup	$75	day	10	$750
Dozer (300 HP)	$1,200	day	10	$12,000
Seed, Fertilize, Mulch	$2,000	acre	2	$4,000
TOTAL				$19,750
INSTITUTIONAL CONTROLS	$5,000	ls	1	$5,000
ENVIRONMENTAL MONITORING				
Equipment and Personnel				
Photovac Tip	$37	day	2	$74
Temp/Cond/Redox/DO	$35	day	2	$70
Water Level Meter	$3	day	2	$6
Cooler	$2	event	1	$2
Peristaltic Pump	$10	day	2	$20
Miscellaneous	$280	event	1	$280
Field Sampling Technician	$13	hr	16	$208
Analytical Services				
TCL Organics (water)	$910	sample	5	$4,550
PAHs (soil)	$160	sample	4	$640
TOTAL				$5,849.50
SITE INSPECTION AND MAINTENANCE				
Site inspection	$200	ls	1	$200
Maintenance-cover	$2,000	ls	1	$2,000
TOTAL				$2,200
FIVE-YEAR SITE REVIEWS				
Data validation	$3,200	year	5	$16,000
Report	$15,000	ls	1	$15,000
TOTAL				$31,000

TABLE B-6 (Back-up for 18 mg/kg)
EXCAVATION / SOLIDIFICATION (8D) COST SUMMARY: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

	UNIT COST	UNIT	QUANTITY	TOTAL COST
CAPITAL COSTS				
MOBILIZATION/DEMOBILIZATION				
Dozer (300 HP)	$1,300	ls	1	$1,300
TOTAL				$1,300
EXCAVATION AND SOLIDIFICATION	$100	cy	630	$63,000
REGRADE AND REVEGETATE				
Top Soil	$15.00	cy	200	$3,000
Seed, Fertilize, Mulch	$2,000	acre	0.5	$1,000
TOTAL				$4,000
INSTITUTIONAL CONTROLS	$5,000	ls	1	$5,000
ENVIRONMENTAL MONITORING				
Equipment and Personnel				
Photovac Tip	$37	day	2	$74
Temp/Cond/Redox/DO	$35	day	2	$70
Water Level Meter	$3	day	2	$6
Cooler	$2	event	1	$2
Peristaltic Pump	$10	day	2	$20
Miscellaneous	$280	event	1	$280
Field Sampling Technician	$13	hr	16	$208
Analytical Services				
TCL Organics (water)	$910	sample	5	$4,550
PAHs (soil)	$160	sample	4	$640
TOTAL				$5,849.50
SITE INSPECTION AND MAINTENANCE				
Site inspection	$200	ls	1	$200
Maintenance-solidified area	$500	ls	1	$500
TOTAL				$700
FIVE-YEAR SITE REVIEWS				
Data validation	$3,200	year	5	$16,000
Report	$15,000	ls	1	$15,000
TOTAL				$31,000

TABLE B-7

SOLIDIFICATION (8D) SENSITIVITY ANALYSIS COST SUMMARY: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

	COST	PRESENT WORT
CAPITAL COSTS		
Mobilization/Demobilization	$1,000	
Excavation and Solidification	$340,000	
Regrade and Revegetate	$17,000	
Institutional Controls	$5,000	
Total Capital Costs:	$363,000	$363,000
INDIRECT COSTS		
Health & Safety (@ 25% of Capital Cost)	$91,000	
Legal, Administration, Permitting (@ 5% of Capit	$18,000	
Engineering (@ 10% of Capital Cost)	$36,000	
Services During Construction (@ 5% of Capital C	$18,000	
Total Indirect Costs:	$163,000	$163,000
ANNUAL COSTS		
Environmental Monitoring	$6,000	
Site Inspection and Maintenance	$1,000	
Total Operating Costs:	$7,000	$66,000
Five-Year Site Review	$31,000	$77,000
SUBTOTAL:		$669,000
Contingency (@ 20%)		$134,000
TOTAL COST:		$803,000

Note:
1. Discount Rate of 10% is used for present worth analyses.
2. Environmental monitoring is assumed to continue for 30 years.
3. Five-year reviews are assummed every five years for thirty years.
4. Assumes no trailer or office set-up is necessary.

TABLE B-8 (Back-up for 1.8 mg/kg)
EXCAVATION / SOLIDIFICATION (8D) COST SUMMARY: SITE 8

FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

	UNIT COST	UNIT	QUANTITY	TOTAL COST
CAPITAL COSTS				
MOBILIZATION/DEMOBILIZATION				
Dozer (300 HP)	$1,300	ls	1	$1,300
TOTAL				$1,300
EXCAVATION AND SOLIDIFICATION	$100	cy	3400	$340,000
REGRADE AND REVEGETATE				
Top Soil	$15.00	cy	925	$13,875
Seed, Fertilize, Mulch	$2,000	acre	1.5	$3,000
TOTAL				$16,875
INSTITUTIONAL CONTROLS	$5,000	ls	1	$5,000
ENVIRONMENTAL MONITORING				
Equipment and Personnel				
Photovac Tip	$37	day	2	$74
Temp/Cond/Redox/DO	$35	day	2	$70
Water Level Meter	$3	day	2	$6
Cooler	$2	event	1	$2
Peristaltic Pump	$10	day	2	$20
Miscellaneous	$280	event	1	$280
Field Sampling Technician	$13	hr	16	$208
Analytical Services				
TCL Organics (water)	$910	sample	5	$4,550
PAHs (soil)	$160	sample	4	$640
TOTAL				$5,849.50
SITE INSPECTION AND MAINTENANCE				
Site inspection	$200	ls	1	$200
Maintenance-solidified area	$1,000	ls	1	$1,000
TOTAL				$1,200
FIVE-YEAR SITE REVIEWS				
Data validation	$3,200	year	5	$16,000
Report	$15,000	ls	1	$15,000
TOTAL				$31,000

RESPONSE TO REGULATORY AND TRC COMMENTS: DRAFT FOCUSED FEASIBILITY STUDY: SITE 8

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

June 17, 1991

Mr. James Shafer (Code 1421)
Northern Division
Naval Facilities Engineering Command
U.S. Naval Base, Bldg. 77 Low
Philadelphia, PA 19112-5094

Subj: U.S. EPA Comments
Draft Focused Feasibility Study
Site 8
Naval Air Station Brunswick
Brunswick, Maine

Dear Mr. Shafer:

The United States Environmental Protection Agency (EPA) has received and reviewed the document entitled "Draft Focused Feasibility Study (FFS), Site 8" dated May 1991, for the Naval Air Station Brunswick in Brunswick, Maine. The comments provided are divided into two attachments.

Attachment I contains general comments on the FFS. Attachment II outlines specific comments regarding the report. Also attached are two sets of tables, which serve as examples, and are discussed further in the comments. A letter containing comments from the National Oceanic and Atmospheric Administration (NOAA) is also included with the comment package. NOAA's comments should be addressed and the Navy's responses included with EPA 's responses.

EPA requests that the Navy submit a comment by comment response, as well as incorporate the necessary changes into the Draft Final Focused Feasibility Study. Pursuant to Section 6.7(e)of the Federal Facility Agreement (FFA), the response to comments and Draft Final Focused Feasibility Study for this site will be due no later than August 12, 1991.

PRINTED ON RECYCLED PAPER

If you have any questions regarding the enclosed comments or would like to discuss the comments further, please contact me at (617)573-5785.

Sincerely,

Meghan F. Cassidy

Meghan F. Cassidy
Remedial Project Manager

Enclosure

cc: Eileen Curry/NASB
Mel Dickenson/E.C. Jordan
Ted Wolfe/ME DEP
Ann Johnson/SAIC
Mary Jane O'Donnell/US EPA
Bob DiBiccaro/US EPA
Richard Willey/US EPA
Jui-yu Hsieh/US EPA
Ken Finkelstein/NOAA

ATTACHMENT I

The general comments provided below pertain to the report entitled "Draft Focused Feasibility Study, Site 8" (May 1991). This report was submitted by the U.S. Department of the Navy for the Naval Air Station Brunswick in Brunswick, Maine. The report was prepared for the Navy by E.C. Jordan.

1. The narrative for each alternative in Section 3 and the presentation in Table 4-1 (page 4-5) do not adequately address the specific elements of each of the nine criteria. Figure 6-2 of the RI/FS Guidance lists all of the elements. Each of these elements should be addressed for each alternative. This should be done in a table, with discussion of significant issues in the narrative. Attachment A to these comments is an example of a table which contains sufficient information.

2. The narrative discussion for the ARARs is not adequate. All of the ARARs for each alternative should be identified in a table and there should be a statement of how each ARAR is or is not attained. Significant issues should be discussed in the narrative. Attachment B to these comments is an example of a table which contains sufficient information.

3. Action specific ARARs are not adequately addressed. The action specific ARAR table (Table 2-5) from the Supplemental RI Report (April 1991) should be reviewed to determine which ARARs should be included for each of the alternatives. For example, the OSHA requirements on page 2-19 of Table 5 in the Supplemental RI should be included as ARARs for Alternatives 8C and 8D.

4. Table 2-3 (page 2-9) of the Supplemental RI Report references rare and endangered plants and animals in connection with Site 8. This information should be discussed in the Focused Feasibility Study including an explanation of how these ARARs are to be met or not met in connection with each of the alternatives.

5. In the ARAR discussion for each alternative, the report states that there are no chemical specific and no location specific ARARs for Site 8 (in connection with PAH). However, chemical specific and location specific ARARs in connection with iron, lead, cyanide and aluminum have not been addressed.

ATTACHMENT II

The comments provided below pertain to the report entitled "Draft Focused Feasibility Study, Site 8" (May 1991). This report was submitted by the U.S. Department of the Navy for the Naval Air Station Brunswick in Brunswick, Maine. The report was prepared for the Navy by E.C. Jordan.

Section 2.0 - Summary of Response Objectives and Remedial Alternatives

1. Page 2-1, Paragraph 2: This paragraph should include a statement regarding the reported disposal of solvent at the site as part of the historical information. Subsequent discussion can indicate that there is no data to substantiate the disposal of solvents.

2. Page 2-1, Paragraph 3: This paragraph mentions the Jordan Avenue Wellfield (JAW). Show the JAW on either Figure 2-1 or 2-2.

3. Page 2-5, Paragraph 2: This paragraph should summarize the findings of lead and 4,4-DDT in the soils at Site 8 since these compounds were detected. Discuss the risks associated with these compounds which indicate that remedial objectives need not address lead and 4,4-DDT.

4. Page 2-6, Paragraph 1: Indicate whether all contaminants found in groundwater had MCLs or MCLGs to use for comparison.

5. Page 2-6, 2-9 and 2-15: The remedial action objectives are not sufficiently specific. The contaminants of concern and the exposure routes, and the receptors should be clearly specified. See discussion at page 4-7 of the Guidance for Conducting Remedial Investigations and Feasibility Studies (October 1988) (RI/FS Guidance) and Table 4-1 of the guidance. Also, all media are not covered in the remedial action objectives.

6. Page 2-7, Paragraph 1: This paragraph states "no contaminant was detected in the groundwater, downgradient of the site, above its respective drinking water standard or criteria." Were any contaminants detected at Site 8 above their respective drinking water standards or criteria?

7. Page 2-7, Paragraph 3: Discuss whether the detection of DDT in leachate sediments during Rounds II and III only could have been a result of seasonal fluctuations.

8. Page 2-7, Paragraph 3: Include, in the text, the risk associated with 0.003 mg/kg of DDT.

9. Page 2-7, Paragraph 3: Indicate in the text how the average DDT concentration was calculated (i.e., were only positive results used, etc.).

10 Page 2-8, Paragraph 2: Provide the expected range of background levels for DDT in leachate and indicate how these background levels were established.

11 Page 2-10, Paragraph 2: What is the background concentration range for carcinogenic PAHs only.

12. Page 2-10, Paragraph 2: Clarify where background samples were collected, both location and matrix, which had concentrations ranging from 1.8 to 21.9 mg/kg.

13. Page 2-10, Paragraph 2: Discuss the use of background concentrations derived from surface water/sediment samples for comparison to surface soils. Since several test pits in and around Site 8 had no detectable concentrations of PAHs, EPA considers that this better represents "background".

14 Page 2-13, Paragraph 2: This paragraph states that remedial action objectives were not developed to reduce concentrations of iron, lead, cyanide and aluminum in surface water because these contaminants were detected at elevated concentrations at sampling locations both upstream and downstream of the site. Since AWQC for these contaminants will not be met, a discussion regarding the need for an ARAR waiver should be included in the ARARs analysis.

15. Page 2-13, Paragraph 2: This paragraph states that "Iron, lead, cyanide and aluminum were detected (compared to background) in both upstream and downstream sampling locations, suggesting that other nonpoint source areas... are contributing to the current levels of contamination...". Indicate what is considered background. Also, describe what is being done to characterize and alleviate the nonpoint source areas.

16. Page 2-13, Paragraph 2: The paragraph indicates that elevated levels of some compounds were detected in surface water at both upstream and downstream sampling locations. The paragraph then states "Specific remedial actions taken to reduce contaminant concentrations would therefore not be effective in reducing potential exposure concentrations". This statement is somewhat misleading and must be clarified. The statement should indicate that remedial actions taken at Site 8 only may not be effective in reducing potential exposure concentrations, however actions could be taken by

the Navy to decrease the elevated concentrations of iron, lead, cyanide and aluminum in the surface water.

17. Page 2-13, Paragraph 2: If the salt pile is the source of cyanide, as has been stated in previous reports, state this in the text. Also, indicate what steps are being taken to alleviate cyanide from the salt pile from impacting the environment.

18. Page 2-14, Figure 2-3: Provide further discussion regarding how the contaminated area was interpreted. It seems like contamination over 18 ppm should include the area of TP-803 and TP-806.

19. Page 2-17, Paragraph 1: The fourth alternative (removal/ solidification) also includes removal and treatment of contaminated soil and sediment. Indicate this in the text.

20. Page 2-17, Paragraph 2: A short discussion providing the rationale for excluding alternatives 3, 5, and 6 is necessary in the discussion of remedial alternatives.

Section 3.0 - Detailed Evaluation of Remedial Alternatives

21. Page 3-1, Paragraph 1: The purpose of the detailed evaluation is not adequately stated. The purpose as stated under the "Proposed Rule" in the NCP at page 8719 should either be quoted or paraphrased.

22. Page 3-1, Paragraph 2: Add a reference to the newly developed table setting forth the elements of each criterion. See comment number 1 in Attachment I.

23. Page 3-1, Paragraph 2: After the "RI/FS" in line 3, insert "and proposed plan" and replace "by" with "from". In line 5 insert "RI/FS and" before "proposed plan". See RI/FS Guidance, page 6-13.

    Also, since the state is a party to the Federal Facility Agreement (FFA) and is reviewing and commenting on this Focused Feasibility Study, there should be a statement to that effect in regard to this criterion on page 3-1 and in a footnote to Table 3-1 on page 3-2.

24. Page 3-2, Table 3-1: This table should conform to the descriptions contained in the RI/FS Guidance on page 6-6. For example, the fourth criterion should include "through treatment" and the descriptions for criteria 2, 3, 8 and 9 should match the guidance descriptions.

25. Page 3-4, Paragraph 1: Provide examples, in the text, of the kind of geographic information which was used to determine the lateral extent of PAH contamination.

26. Page 3-4, Paragraph 1: Indicate how the lateral distribution of contamination will be plotted in the field. Will a survey be performed? Discuss this issue in the text.

27. Page 3-4, Paragraph 1: Initially, it is stated that the "vertical distribution of contamination was...assumed to extend 2 feet below the surface." However, in the conclusion of the paragraph, the volume of soil subject to remediation will be based on a depth of 1 foot below the surface. Provide a more detailed explanation why a depth of 1 foot was selected.

28. Page 3-5, Figure 3-1. This figure and accompanying text do not provide sufficient supporting data to justify the boundary of the proposed area for contaminated soil greater than 18 ppm of carcinogenic PAHs (carc. PAHs), which is subject to remediation. From Figure 2-3 (Page 2-14), soils in the vicinity of TP-805 (carc. PAHs = 3 ppm at 0 ft.) will be remediated while soils in the vicinity of TP-806 (carc. PAHS = 19 ppm at 0 ft.) and TP-803 (carc. PAHs = 13 ppm at 0 ft.), both outside of the proposed treatment area, will remain untreated. Provide a more detailed explanation of how the proposed area subject to remediation was determined. Also, extend the area which will be remediated to include, at a minimum, TP-806.

29. Page 3-7, Paragraph 2: Is this paragraph attempting to say that the solidification/stabilization technique does not reduce leachability for these site conditions? Provide additional discussion in the text regarding this issue.

30. Page 3-9, Section 3.3: Alternative 8B must include an environmental monitoring program to ensure that risk levels do not increase over time. Include an environmental monitoring program in both the narrative and cost analysis for this alternative.

31. Page 3-12, Paragraph 1: Indicate how long it was estimated (for costing purposes) that 5 year reviews would continue.

32. Page 3-13, Paragraph 3: Indicate that a health and safety plan will need to be followed for installation of the fence and environmental monitoring as well as for conducting the five-year sampling.

33. Page 3-13, Paragraph 4: How easily implementable will it be to impose deed and land-use restrictions for future site use? Provide additional details regarding the procedures.

34. Page 3-14, Section 3.4: An environmental monitoring program must be a component of Alternative 8C. Include such a program in both the narrative and costs for this alternative.

35. Page 3-14, Section 3.4: The following comments pertain to Alternative 8C, Soil Cover. Inclusion of these comments will help to ensure overall long-term reliability of the soil cover.

- The ground surface should be cleared, grubbed and graded (proofrolled to minimize the potential for differential settlements). This site prep work should be included in the discussion and costs.

- A non-woven filter fabric layer should be placed, below the maximum depth of frost penetration in the area of interest, on a graded surface (nominal 3% slope). Use of the filter fabric as discussed provides the functions of separation, reinforcement, drainage, and capillary breaks to reduce frost-heaving damages.

- The thickness of the cover should be greater than the greatest frost penetration depth to minimize the disruption and upward migration of contaminants due to freezing. Indicate in the text the frost penetration depth in this area.

- When the surface drainage plan is developed it must accommodate runoff from both covered and non-covered areas.

36. Page 3-15, Table 3-3: The following comments pertain to this table.

- Operating costs should include costs for inspecting and maintaining the fence as well as sign replacement.

- The discount rate used, 5%, is incorrect. The Office of Management and Budget (OMB) in Circular A-94 has established a 10% discount rate which must be used to determine the net present value of a remedy (see page 8722 of the Preamble to the NCP). Revise the costs in the table to reflect the 10% discount rate.

37. Page 3-18, Paragraph 1: The sentence starting with, "To achieve the 18 mg/kg [ppm] target clean-up level" should read, "to provide a sufficient cover for the proposed target clean-up area..." No Treatment of contaminated soil will be performed in alternative 8C, therefore the target clean-up level will not be attained.

38. Page 3-18, Paragraph 1: This paragraph indicates that a cover system was suggested by the ME DEP. Indicate when this suggestion was made and be which division of the DEP.

39. Page 3-18, Paragraph 3: The word "can" which appears in the first sentence of this paragraph must be changed to "will". Deed and land-use restrictions would definitely need to be used in conjunction with this alternative.

40. Page 3-20, Paragraph 2: Indicate to which area of Site 8 the statement, "the residual PAH would be below levels..." refers.

41. Page 3-22, Paragraph 2: This paragraph states that the treatability study demonstrated that PAHs are immobile contaminants. Clarify that this statement refers to PAHs in soil.

42. Page 3-22, Paragraph 3: This paragraph must include a statement indicating that all work performed at Site 8 in conjunction with the soil cover will be carried out according to a Health and Safety Plan.

43. Page 3-23, Section 3.5: The EPA guidance document entitled "Technology Screening Guide for Treatment of CERCLA Soils and Sludges" (EPA/540/2-88/004) states that the long-term reliability of the solidification technology is unknown. Leachate that may be produced as a result of the curing process should be collected before disposal. Alternative 8D does not mention the collection or analysis of leachate to determine the necessity for treatment before disposal. Discuss how leachate collection might be achieved.

44. Page 3-24, Table 3-4: The following comments pertain to Table 3-4:

- Health and Safety costs must reflect costs during construction of the soil cover in addition to the five-year review.

- The discount rate used to calculate present worth should be 10 percent. See comment number 36 above.

45. Page 3-26, Paragraph 1: The volume increase of 6 percent seems low for a cementation addition. Provide a more detailed discussion or calculations to substantiate this information.

46. Page 3-26, Paragraph 1: Indicate how the 6 percent increase in solidified material will be handled during backfilling.

47. Page 3-26, Bullet Section: A compliance testing step should be included after the curing of solidified soil.

48. Page 3-27, Figure 3-6: If possible, the curing area should be located north of the perimeter road near the target clean-up area as opposed to that shown on Figure 3-6. PAHs were not detected in the proposed curing area, but this area may become contaminated during the implementation of this alternative.

49. Page 3-28, Paragraph 1. Provide a more descriptive location of the area referred to as "the hill leading down to the stream."

50. Page 3-28, Paragraph 3: Provide additional information in the text regarding the stabilization additives. What is the composition of these additives? Also, explain in more detail the type of equipment used to homogenize the mixture.

51. Page 3-28, Paragraph 3: Provide an estimate of the amount of time needed to complete the stabilization mixing process.

52 Page 3-28, Paragraph 4: Clarify whether it has been determined that the PAH contamination at Site 8 is not subject to RCRA via classification as a listed waste.

53. Page 3-28, Paragraph 4: Provide more detail regarding how it will be determined that the curing process in complete.

54. Page 3-29, Paragraph 1: EPA <u>would</u> require that testing be performed prior to backfilling. Indicate this in the text.

55. Page 3-29, Paragraph 4: Provide further discussion regarding any monitoring necessary to ensure that the integrity of the stabilized material is maintained over time.

56. Page 3-31, Figure 3-7: A post-treatment soil TCLP testing step must be included in the process diagram as well as a contingency pathway for failure of the TCLP test.

57. Page 3-32, Paragraph 2: Include a discussion in the text addressing possible environmental impacts during the implementation of alternative 8D.

58. Page 3-34, Table 3-5: The discount rate used to calculate present worth should be 10 percent. See comment number 36 above.

Section 4.0 - Comparative Analysis of Alternatives

59. General: Alternative 8A must be discussed under each criteria.

60. Page 4-1, Paragraph 2: Explain how each of the alternatives reduces exposure.

61. Page 4-1, Paragraph 3: Include a reference to the proposed target clean-up level for PAHs.

62. Page 4-2, Paragraph 1: Do not use the word capping when discussing Alternative 8C, soil cover, since this may lead to confusion regarding the kind of cover system.

63. Page 4-2, Paragraph 1: The statement "It is sometimes considered less reliable than treatment to remove or fix contaminants in soil because if treatment is not used,..." is inaccurate since soil covers do not treat or fix contaminants. This sentence should be removed or rewritten.

64. Page 4-3, Paragraph 2: Provide a more detailed discussion of the difference between alternatives 8B and 8C with respect to their short-term effectiveness. Additionally, include a discussion on the environmental impacts of the implementation of alternatives 8C and 8D.

65. Page 4-3, Paragraph 2: Include a statement that Alternatives 8B, 8C and 8D all pose some short-term risk to workers during implementation.

66. Page 4-4, Paragraph 2: Clarify whether the cost presented for alternative 8D is the present-worth cost.

67. Page 4-5, Table 4-1: The following comments pertain to this table.

    - The table should conform to Attachment B to these comments.

- The descriptions presented for alternatives 8B, 8C and 8D under the heading "Overall Protection of Human Health and the Environment" need more detail. Specifically, indicate how each alternative decreases human health risks.

- The text under the heading "Long-Term Effectiveness and Performance" for alternative 8C is misleading. Contaminant levels in the surface soils would remain the same under this alternative. Exposure to this soil would be minimized by placing it under a cover. Rewrite the text to clarify this matter.

- The column heading "Reduction of Mobility, Toxicity and Volume Through Treatment" should be rewritten to say "Reduction of Mobility, Toxicity <u>or</u> Volume Through Treatment" (see page 8720 of the preamble to the NCP).

- Alternative 8C does not decrease mobility as described under the criteria of "Reduction of Mobility, Toxicity or Volume Through Treatment" since there is no treatment involved. Rewrite the this statement to reflect this.

68. Reference page: The last reference listed on this page lists a specific page of the NCP. However, the NCP was referenced numerous times throughout this document and the references were not limited to page 8851. Correct this discrepancy.

<u>Appendix A - Treatability Study Results</u>

69. Page A-9, Bullet Section: A freeze/thaw characteristic for durability testing should be conducted (ASTM D560-89) especially considering the extreme cold in Maine.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OCEAN ASSESSMENTS DIVISION
HAZARDOUS MATERIALS RESPONSE BRANCH
c/o U.S. Environmental Protection Agency
Waste Management Division - HEE-6
J.F. Kennedy Federal Building
Boston, MA 02203
5 June 1991

Ms. Meghan Cassidy
U.S. EPA Waste Management Division
J.F. Kennedy Federal Office Building
Boston, MA 02203

Dear Meghan:

Thank you for the Draft Feasibility Study, Detailed Analysis of Alternatives, Site 8, Brunswick Naval Air Station. A total of four remedial actions addressing soil contamination have been proposed for Site 8. The alternatives under consideration are:

1. No action.

2. Minimal action, including institutional controls and five-year site reviews.

3. Soil cover composed of geotextile fabric, soil, and vegetative layers.

4. Soil excavation, layering, conditioning, and solidification; and on-site backfilling, regrading, and revegetating of treated soils.

Comments

As noted in earlier reviews, concentrations of some contaminants are migrating downstream in the unnamed tributary to the Androscoggin River at levels which may pose potential threats to NOAA trustee habitats and species. Trace elements were detected in soils, groundwater, and seeps from Site 8 at concentrations exceeding applicable screening criteria. Concentrations of lead and PAHs detected in sediments collected from the unnamed tributary to the Androscoggin River downstream of the site exceeded ER-L values. Lead, zinc, and cyanide were detected in surface waters from the unnamed tributary at and downstream of the site at concentrations exceeding freshwater chronic and/or acute AWQC. Although clear gradients of contamination could not be fully established, the results of the data collected during the remedial investigation indicated that contamination is limited primarily to areas near the site, marginally decreases away from the site, and is unlikely to be present at high concentrations in habitats used extensively by NOAA trust resources. However, high levels of lead and cyanide warrant further additional sampling of surface waters and sediments in the vicinity of Site 8.

A target clean-up level of 18 mg/kg for PAHs in soils was proposed in the feasibility study. This target level would be protective of aquatic resources. Approximately 280 cubic meters of contaminated soils would be remediated at the site. Target clean-up levels for trace elements in soils were not proposed in the study.

Although Alternatives 3 and 4 would limit the migration of contaminants to nearby surface waters via erosion control, the proposed remedial actions do not include reducing the concentrations of contaminants detected in groundwater. Since groundwater discharge to the unnamed tributary is one of the primary mechanisms for the off-site transport of contaminants, NOAA is concerned that this discharge to the tributary would continue. Further review should be made regarding the likelihood that removal of contaminated soils will quickly eliminate the groundwater contamination.

Please contact me if you have any questions concerning this review.

Sincerely,

Kenneth Finkelstein

SITE 8
FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

RESPONSE TO USEPA COMMENTS

ATTACHMENT 1

1. The narrative and Table 4-1 have been revised to address the specific elements of each of the nine criteria.

2. A subsection addressing ARARs and ARAR identification has been inserted into Section 2.0 of the document. This subsection includes three tables identifying the chemical-, location-, and potential action-specific ARARs for Site 8. The section also includes narrative identifying the ARARs that apply to the site, how they will impact remedial activities, and what actions will be required to comply with applicable requirements.

3. Potential action-specific ARARs have been identified and presented in Section 2.0 of the report. General action-specific requirements, including OSHA regulations, are identified and discussed in this section. Action-specific ARARs discussed under the "Compliance with ARARs" criteria, during detailed evaluation of alternatives, has been reviewed and revised to provide a more specific, and concise narrative of these ARARs.

4. The areas of rare and endangered plants and animals identified in the Supplemental RI report have been discussed as part of location-specific ARARs. A general discussion of location-specific ARARs, and whether remedial action at the site will or will not comply with these requirements has been included in Section 2.0.

5. The chemical- and location-specific ARARs for iron, lead, cyanide, and aluminum have been included in the text.

ATTACHMENT 2

Section 2.0

1. Page 2-1, Paragraph 2: A statement regarding the disposal of solvents has been included.

2. Page 2-1, Paragraph 3: JAW has been identified on Figures 2-1 and 2-2.

3. Page 2-5, Paragraph 2: A discussion of the risks associated with exposure to lead and DDT has been included in the text.

4. Page 2-6, Paragraph 1: The statement ". . . or health based criteria" has been added. Cadmium was the only inorganic compound detected in downgradient wells above either MCL(G) or RfD. This has been included in the text.

5. Pages 2-6, 2-9 and 2-15: The remedial action objectives have been revised to be consistent with the discussion of the RI/FS guidance (page 4-7).

6. Page 2-7, Paragraph 1: Some contaminants (i.e., sodium, cadmium) were detected at concentrations in excess of their respective MCL. These contaminants have been identified in the text.

7. Page 2-7, Paragraph 3: There is insufficient data available to correlate DDT concentrations to seasonal fluctuations. The text has not been modified.

8. Page 2-7, Paragraph 3: The average DDT concentration should be 0.008 mg/kg. This typographical error has been corrected. The ecological Hazard Index (HI) associated with exposure to the average DDT concentration of 0.008 mg/kg DDT is 0.9. This has been included in the text.

9. Page 2-7, Paragraph 3: The average DDT concentration is 0.008 mg/kg and was calculated by dividing the total concentration of all detects by the number of samples. This has been added to the text.

10. Page 2-8, Paragraph 2: The background levels of DDT were estimated from the range of total DDT, DDD, and DDE concentrations detected at NAS Brunswick. A table has been added to Section 2.0 summarizing these data.

11. Page 2-10, Paragraph 2: The background concentration of carcinogenic PAHs has been included in the text. The concentrations range from ND to approximately 4 mg/kg.

12. Page 2-10, Paragraph 2: The background samples were collected upstream of Sites 1 and 3. This information has been included in the text.

13. Page 2-10, Paragraph 2: PAH compounds have been detected in surface soils from most sites under study at NAS Brunswick.

14. Page 2-13, Paragraph 2: Ambient Water Quality Criteria have been discussed as part of chemical-specific ARARs. When standards will be exceeded, the concept and reasons for ARAR waivers have been presented and discussed in the text.

15. Page 2-13, Paragraph 2: Section 5.2.4 of the Draft Final RI includes a discussion of background concentrations in surface water. Background levels of iron and aluminum average 180 μg/L and 113 μg/L, respectively. A stormwater runoff characterization is being conducted and may address the issue of nonpoint source discharge to the streams at Site 8.

16. Page 2-13, Paragraph 2: The text has been changed as suggested in this comment.

17. Page 2-13, Paragraph 2: The salt pile is mentioned in the text and appropriate reference to the Draft Final RI is included. The text has not been modified.

18. Page 2-14, Figure 2-3: Additional information has been included in the text and Figure 2-3 has been modified.

19. Page 2-17, Paragraph 1: The text has been modified as suggested in the comment.

20. Page 2-17, Paragraph 2: The rationale for excluding alternatives 3.5 and 6 has been included in the text.

Section 3.0

21. Page 3-1, Paragraph 1: The purpose of the detailed evaluation has been restated.

22. Page 3-1, Paragraph 2: Reference to the table was added.

23. Page 3-1, Paragraph 3: Changes made as suggested.

24. Page 3-2, Table 3-1: The table has been revised to conform to the descriptions in the RI/FS guidance.

25. Page 3-4, Paragraph 1: The text on soil volume estimates has been moved to the section on human health Target Clean-Up Levels. The reference to the use of geographic information has been removed.

26. Page 3-4, Paragraph 1: Plotting the lateral distribution of contamination in the field for remedial actions will be addressed during the design of the remedial alternative.

27. Page 3-4, Paragraph 1: The volume of soil subject to remediation has been revised to include the full 2 feet.

28. Page 3-5, Figure 3-1: Figure 2-3 has been revised. Figure 3-1 has been removed. Discussion of lateral extent of contamination has been moved to the section on human health Target Clean-Up Levels. TP-805 should have indicated a carcinogenic PAH level of 29.7 ppm. This has been corrected. The 13 ppm of carcinogenic PAHs at TP-803 is below the Target Clean-Up Level. The 19 ppm PAHs at TP-806 is the total PAHs, carcinogenic PAHs at TP-806 are 9 ppm, which is below the target clean-up level.

29. Page 3-7, Paragraph 2: The treatability test did not demonstrate any improvement in leachability. It is possible that leachability was reduced; however, it was not measurable. This has been clarified in the text.

30. Page 3-9, Section 3.3: Environmental monitoring has been added to the alternative.

31. Page 3-12, Paragraph 1: Indication added to text.

32. Page 3-13, Paragraph 3: Indication added to text.

33. Page 3-13, Paragraph 4: Information added to text concerning implementation of land-use restrictions.

34. Page 3-14, Section 3.4: Environmental monitoring has been added to the alternative.

35. Page 3-14, Section 3.4:
    - This site preparation work has been added to the text and cost estimates.
    - The main purposes of the filter fabric is to separate during construction activities and mark the covered area for future reference. The effect of frost penetration on the filter fabric is not a concern.
    - Given the site conditions, the frost penetration depth is estimated to be 18 to 30 inches; however, upward migration of contaminants due to freezing is not anticipated to be a problem and is not a major concern.
    - The surface drainage plan will address runoff from both covered and non-covered areas when it is developed.

36. Page 3-15, Table 3-3: The comments have been incorporated into Table 3-3.

37. Page 3-18, Paragraph 1: Change made as suggested.

38. Page 3-18, Paragraph 1: No formal suggestion of a cover system was made. The statement has been removed from the text.

39. Page 3-18, Paragraph 3: "can" changed to "would".

40. Page 3-20, Paragraph 2: Indication added to text.

41. Page 3-22, Paragraph 2: Statement has been clarified.

42. Page 3-22, Paragraph 3: Statement added to text.

43. Page 3-23, Section 3.5: A description of how leachate would be handled has been added to the text. A statement was also added under the long-term effectiveness and permanence criteria concerning the unknown reliability of solidification over the long-term.

44. Page 3-24, Table 3-4: The comments have been incorporated into Table 3-4.

45. Page 3-26, Paragraph 1: "6 percent" has been changed to "less than 10 percent" and

a reference to the treatability study has been added.

46. Page 3-26, Paragraph 1: An indication of how the increase in volume would be handled has been added to the description of the alternative under the heading Stockpile then Backfill On-Site.

47. Page 3-26, Bullet Section: Compliance testing is described under the heading Stockpile then Backfill On-Site.

48. Page 3-27, Figure 3-6: The equipment storage area and the soil stockpile area on the figure have been switched. The actual site layout used during implementation of the alternative would be reevaluated during the design phase.

49. Page 3-28, Paragraph 1: Additional description added to text.

50. Page 3-28, Paragraph 3: Different vendors use different types of additives. Vendors also consider the composition of additives proprietary information. For these reasons, the specific additives that would be used can not be specified.

51. Page 3-28, Paragraph 3: An estimate of the time required has been added to the description.

52. Page 3-28, Paragraph 4: There is no historical information that provides accurate description, manifests, or other documentation as to the sources of wastes disposed at Site 8. Without specific information as to the processes which generated the wastes, a determination cannot be made as to whether any of the material at Site 8 is a listed waste. Since the waste material did not fail TCLP, and there is no information as to the exact source of waste, this alternative is being designed based on the assumption that these materials are not a RCRA listed or characteristic hazardous waste.

53. Page 3-28, Paragraph 4: The specifics of determining when the curing process is complete is a design issue and will be dealt with in the design phase.

54. Page 3-29, Paragraph 1: The text has been changed to indicate that testing would be required.

55. Page 3-29, Paragraph 4: Direct monitoring of the stabilized materials would not be conducted. Failure of the integrity of the stabilized material would not be investigated unless significant changes in the site conditions, such as settling or increase soil and groundwater contamination occur.

56. Page 3-31, Figure 3-7: A post treatment soil TCLP testing step has been added to the figure. A contingency pathway has also been added for the case that the material fails the TCLP test.

57. Page 3-32, Paragraph 2: Description of environmental impacts added to the text.

Section 4.0

59. General: Alternative 8A has been added to the discussion under each criteria.

60. Page 4-1, Paragraph 2: Explanations have been added.

61. Page 4-1, Paragraph 3: Reference to target clean-up levels has been added.

62. Page 4-2, Paragraph 1: The word "capping" has been removed.

63. Page 4-2, Paragraph 1: The sentence has been rewritten to remove reference to treating or fixing contaminants.

64. Page 4-3, Paragraph 2: The short-term effectiveness section has been rewritten to include a more detailed description of the differences between the alternatives and to include environmental impacts.

65. Page 4-3, Paragraph 2: Statement has been added.

66. Page 4-4, Paragraph 2: The cost is a present-worth cost and has been clarified in the text.

67. Page 4-5, Table 4-1: Table 4-1 has been revised to address each of the bullet items.

68. Reference page: The page number has been removed from the reference.

69. Page A-9, Bullet Section: A freeze/thaw characteristic test may have been appropriate; however, it was not conducted at the time the treatability study was conducted. While it would be beneficially to have results from a freeze/thaw test, this information is not considered critical to selection of an alternative.

STATE OF MAINE
Department of Environmental Protection

MAIN OFFICE: RAY BUILDING, HOSPITAL STREET, AUG., STA
MAIL ADDRESS: State House Station 17, Augusta, 04333
207-289-7688

JOHN R. McKERNAN, JR.
GOVERNOR

DEAN C. MARRIOTT
COMMISSIONER

June 27, 1991

Mr. James Shafer
Department of the Navy, Northern Division
Naval Facilities Engineering Command
Building 77-L
Philadelphia Naval Shipyard
Philadelphia, PA 19112-5094

Re: Naval Air Station Brunswick, Draft Focused Feasibility Study Site 8, May, 1991, by E.C. Jordan Co.

Dear Mr. Shafer:

The Maine Department of Environmental Protection (MEDEP) has completed its review of the Draft Focused Feasibility Study Site 8, which was submitted to the MEDEP by E.C. Jordan Co. on May 13, 1991 on behalf of the U.S. Department of the Navy for the Naval Air Station Brunswick (NASB) Site.

This correspondence represents partial comments developed by the MEDEP. Additional comments may follow in the near future as an addendum to this letter.

The MEDEP conditionally approves of the alternatives presented in this report provided that the following comments are addressed:

General Comments:

Any assumptions made regarding site conditions must be supported by specific informations or references in the discussion.

Contaminants of concern for Site 8 were presented in table Q-6 in the Draft Final RI Report dated August, 1990. Selection of these COC's were based on field sampling and E.C. Jordan's evaluation of conditions at the site. Although the MEDEP has provided written comments reflecting its reservations regarding some of the discarded COC's, little direct discussion regarding these contaminants, as well as target clean-up levels has occurred. Continued elimination of specific COC's in the FS stage is not appropriate. The MEDEP does not concur with the elimination of DDT as a

contaminant of concern based on statements contained in the Risk analysis of the RI report.

The target PAH clean-up level has been overestimated. The MEDEP will not concur with this clean-up level as calculated.

Specific Comments:

Page Section Comments

2-5, section 2.2.1, Human Health Risk Assessment: Justify why only children in the 7-12 age group were evaluated for risk in the exposure scenario. It seems likely that children ages 12+ would also access the site.

The "most probable scenario" and "realistic worst case scenario" need to be defined.

If clean-up levels are based on any risk scenario other than a residential exposure, steps must be taken to assure that future risks will be limited.

2-6, section 2.2.1, Human Health Risk Assessment: The presence of compounds attributed to "natural chemistry" needs to be explain. Identify what background levels are being considered (ie. Eastern US, State, local, site specific).

The statement regarding the Jordan Avenue Wellfields should read: Present available data indicate there is no hydraulic connection.... .

2-7, section 2.2.2, Summary of Environmental Risks: Identify how the average DDT concentration was obtained. As presented, data from sampling rounds II and III do not support an average concentration of 0.003 mg/kg.

2-8, section 2.2.2, Summary of Environmental Risks: The Draft Final RI (page Q-121) states that "based on the total hazard indices, both Sites 8 and 9 are probably being severely impacted by the presence of DDT and PAH's in sediment. This conclusion is supported by the results of an analysis of the macroinvertebrate communities associated with these sites." Once the RI process has selected COC's, it seems inappropriate to continue narrowing the list of COC's to be targeted for clean-up. If DDT and other contaminants (including lead) are impacting ecological communities as indicated in the RI, then appropriate remedial alternatives need to be evaluated.

Specifically state contaminants and corresponding target clean-up levels for surface water.

2-9, section 2.3, Summary of Remedial Action Objectives: If target clean-up levels are based on a "reasonable future land use", a decision will be required as to how use of this site can be restricted so that zoning changes and/or changing development patterns in Brunswick do not convert the area to residential or other high exposure use.

2-10, section 2.3.1, Human Health Clean-up Levels: The MEDEP believes that the proposed 18 ppm PAH target clean-up level for this site is excessive if based on a future scenario that allows repeated exposure. A residential risk scenario also needs to be discussed.

Rather than providing a broad range of PAH concentrations (1.8 to 21.9 mg/kg) a background value must be calculated for NASB and Site 8 specifically. Utilizing all values obtained from sampling at Site 8, outside the area of contamination, background carcinogenic PAH values could be as low as 0.25 ppm.

2-11, table 2-1, Exposure Assumptions: Following consultation with the Maine State Toxicologist, the MEDEP believes that the exposure assumptions at Site 8 have been underestimated. It is doubtful that exposure will be limited to only the 7-12 age group. The population assumption does not consider children older than 12 years who could also come in contact with the site. The exposed population should also include children in the 13-18 age group. Therefore, the exposure frequency should be increased from 48 days/year for a 6 year duration to 48 days/year for a 12 year duration. The dermal exposure should be increased from 1.0 grams/event to 3.0 grams/event The ingestion exposure should be increased from 0.5 grams/event to 1.0 grams/event.

Recalculation of the target clean-up level using the increased exposure assumptions result in a target clean-up level of approximately 3 ppm. The MEDEP believes that 3 ppm is appropriate for this site.

2-13, section 2.3.2, Ecological Target Clean-up Levels: Specify if the elimination of contaminant contribution from Site 8 would lower the overall contaminant impact on the stream a level equal to or below the AWQC.

3-4, section 3.1-Volume Calculations and Treatability Study Results: Recalculation of Site 8 PAH target clean-up levels using the recommended exposure assumptions will result in a greater lateral distribution of carcinogenic PAH's needing remediation. The MEDEP estimates that the area to be considered could be equal to or greater than 250'x 150'. Target clean-up level contours will need to be redrawn to reflect a lowered target level.

3-6, section 3.1-Volume Calculation and Treatability Study Results: Extending the target level contours to cover a clean-up to 3 ppm could result in a volume estimate equal to or greater than 1400 cubic yards. New volume estimates must be calculated to reflect lowered target clean-up levels.

The MEDEP disagrees that DDT is no longer a "chemical of interest". If DDT levels are sufficient to impact the ecological system as reported in the Ecological Risk Assessment then appropriate remedial options need to be presented for evaluation.

3-10, section 3.3, Alternative 8B-Minimal Action: The final design for restricting site access will be submitted to both the USEPA and the MEDEP for review and approval.

3-12, section 3.3, Alternative 8B-Five Year Review: The five year technical memorandum regarding sampling results must be reviewed by the MEDEP and USEPA.

3-13, section 3.3.1, Alternative 8B-Criteria Assessment/Implementability: Installation of fencing will depend on the area to be remediated. Additional area beyond that identified in this report will be necessary. Additional costs will need to be calculated for the cost summary.

3-14, section 3.4, Alternative 8C-Soil Cover: An animal barrier should be incorporated into the cover system to discourage burrowing animals. Specify whether the geotextile fabric will be suitable for this purpose or if an additional mesh layer will be necessary.

3-18, section 3.4, Alternative 8C-Soil Cover/Covering Contaminated Area: Make specific reference to the MEDEP suggestion regarding the cover system for this site.

3-20, section 3.4.1, Alternative 8C-Criteria Assessment: Closure requirements of 38 M.R.S.A., section 1304, Chapter 404.5 (H) also state that additional, more specific requirements will depend on waste, site, and operational conditions. If deemed necessary, the Department can require additional measures for closure under this regulation. To state that Site 8 is already in compliance is not accurate.

3-21, section 3.4.1, Alternative 8C-Criteria Assessment/ Compliance with ARAR's: Explain why confirmatory air monitoring will not be performed. Identify how it will be determined that both Federal and State Ambient Air Quality Standards will not be exceeded.

3-22, section 3.4.1, Criteria Assessment-Implementability: The amount of soil necessary to construct the soil cover must be recalculated to reflect a lower PAH target clean-up level.

3-24, table 3-4, Alternative 8C-Cost Summary: Include future maintenance costs in this summary.

3-26, section 3.5, Alternative 8D-Excavation/Solidfication-Site Preparation: Contamination in the vicinity of TP-805 extends deeper than 1 foot. Explain why a greater excavation depth was not considered in this general area.

3-28, section 3.5, Alternative 8D-Excavation/Solidfication-Site Preparation: The statement that the area of PAH risk is not believed to include the hill leading down to the stream can lead one to conclude that an assumption is being made with out adequate evaluation of the area.

Since the trees and brush act to stabilize the steep hill, their removal could likely result in a greater impact on the stream environment due to erosion than any potential impact due to PAH's associated with the site.

3-28, section 3.5, Alternative 8D-Excavation/Solidfication-Stockpile: The reasons why wastes are not hazardous under RCRA regulations and why land disposal restrictions do not apply are not clearly stated.

3-30, section 3.5.1, Alternative 8D-Criteria Assessment: Since the excavation/solidification alternative appears to require less future maintenance than a soil cover, maintenance should be considered as an additional criteria assessment for all alternatives. The reduced need for continual maintenance for this alternative (as compared to alternative 8C) is a positive aspect that merits strong consideration

3-32, section 3.5.1, Alternative 8D-Criteria Assessment/ Reduction in Mobility: On page A-12 of the Treatability Study Summary, Willams Environmental stated that "significant improvements in the final disposal properties of the NAS waste were demonstrated in this benchscale stabilization program". Discussions on page 3-32 did not include reference to the Willams Environmental evaluation but instead appeared to imply that alternative 8D has no additional benefits over that of a soil cover alternative. An expanded discussion to include more information and interpretation of the treatability test is needed.

3-33, section 3.5.1, Alternative 8D-Criteria Assessment/Implementability: With a lowered target clean-up level for PAH's, the amount of soil needed to be treated will increase to a volume >500 cubic yards. Finding a vendor to perform the excavation/solidification will be less difficult. The lack of vendor availability is not a reason for not considering this alternative to the fullest possible extent.

Cost should not be the primary factor in determining the selected alternative.

4-5, table 4-1, Comparative Summary of Remedial Alternatives: The need for continued maintenance should be considered as an additional comparative criteria.

A-11, Solidification/Stabilization Treatability Study-Summary: Willams Environmental stated that additional PAH compounds not listed in Jordan's RFP were estimated at significant concentrations. Explain how these findings may impact not only Jordan's interpretation of the treatability test but also the possible extent of additional contaminants not previously identified at the site

If you have any concerns or questions regarding these comments, please contact me at (207) 289-2651.

Sincerely,

T. Wolfe

Ted Wolfe
Division of Site Investigation and Remediation
Bureau of Hazardous Materials and Solid Waste Control

cc: Michael Barden, MEDEP
Sam Butcher, Harpswell Representative
Meghan Cassidy, EPA
Eileen Curry, NASB
✓Mel Dickenson, E.C. Jordan/ABB Environmental
Donald Gerrish, Town of Brunswick
Fred Lavalle, MEDEP
Loukie Lofchie, BACSE
Denise Messier, ME DEP
Susan Weddle, Community Representative

A:NASBFFS8

SITE 8
FOCUSED FEASIBILITY STUDY
NAS BRUNSWICK

RESPONSE TO MEDEP COMMENTS

1. The assumptions made regarding site conditions have been supported or appropriate references made.

2. The contaminants of concern presented in Table Q-6 were quantitatively evaluated in the baseline risk assessment (see Tables Q-114 through Q-147; and Q-5 through Q-22). Based on the quantitative evaluation exposure to carcinogenic PAHs compounds in surface soil were associated with incremental carcinogenic risks. Remedial action objectives were therefore developed for these compounds/medium. Exposure to other contaminants/media were not associated with an increased health risk and were therefore not the focus of the FFS for Site 8.

   DDT has been eliminated as a contaminant of concern based on its widespread presence at NAS Brunswick. DDT was widely used as a pesticide and the relatively low levels detected (e.g., less than 1 mg/kg) is associated with historical past use and not as a result of disposal practices at Site 8. As indicated in the IAS, DDT was used between 1955 and 1970 and approximately 25 pounds per year were applied basewide. A table summarizing the DDT concentrations at NAS Brunswick has been included in the text.

3. The Target Clean-up Levels of 1.8 and 18 mg/kg are associated with a lifetime incremental cancer risk of 10^{-6} and 10^{-5}, respectively. These clean-up levels were derived based on the exposure scenario presented in the Preliminary Risk Assessment (E.C. Jordan Co., February 1989) and the Draft Final RI; Baseline Risk Assessment (E.C. Jordan Co., August 1990). Target Clean-up Levels attaining these residual risk levels are consistent with the NCP.

4. 2-5, Section 2.2.1, Human Health Risk Assessment: The age group 7-12 was selected based on the assumed land use of Site 8. The exposure scenarios developed for Site 8 have been presented in both the Preliminary Risk Assessment and Draft Final RI report, which have been reviewed and accepted by EPA and MEDEP. The "most probable" and "realistic worst case" have been defined in the text. The residual risks are considered in developing and selecting a final remedial alternative. CERCLA mandates 5-year reviews for all sites where wastes have not been removed or treated. These 5-year reviews would pertain to Site 8, and would be used to ensure long-term protection of human health and the environment.

5. 2-6, Section 2.2.1, Human Health Risk Assessment: A discussion of the natural chemistry and background levels is presented in the Draft Final RI and Draft Final Supplemental RI. These reports have been referenced in the text. The statement

concerning JAW has been revised to read "Present available".

6. 2-7, Section 2.2.2, Summary of Environmental Risks: The average DDT concentration should read 0.008 and not 0.003 mg/kg. This topographical error has been corrected. The average of 0.008 mg/kg was calculated based on the detected concentrations of DDT divided by the total number of samples collected. This has been clarified in the text.

7. 2-8, Section 2.2.2, Summary of Environmental Risks: As discussed, the presence of DDT is attributed to the widespread use of this pesticide during the 1950s, 1960s, and 1970s. The levels of DDT detected at Site 8 are consistent with "background" levels basewide. A table summarizing the DDT concentrations at NAS Brunswick has been included. Remedial action objectives for DDT at Site 8 have not been developed. The inclusion of surface water target clean-up levels have been included in Table 2-6 of the text. The AWQC are the proposed clean-up levels.

8. 2-9, Section 2.3, Summary of Remedial Action Objectives: The institutional controls and/or deed restrictions that may be required for Site 8 are discussed in Section 3.0. These would be finalized during the development of the ROD.

9. 2-10, Section 2.3.1, Human Health Clean-up Levels: As stated, the Target Clean-up Level of 18 mg/kg is associated with lifetime incremental carcinogenic risk of 10^{-5}. The exposure scenario is based on assumed current and future land use. A residential scenario was developed and is presented in the Draft Final RI Report. However, this scenario was not used to develop Target Clean-Up Levels because it is not considered to be a "reasonable" future land use for this site. This is explained in Section 2.0 of this FFS.

10. 2-11, Table 2-1, Exposure Assumptions: The exposure scenario used to calculate the Target Clean-Up Level is consistent with the scenario used in the Preliminary Risk Assessment Report (E.C. Jordan Co., 1989) and the Baseline Risk Assessment (E.C. Jordan Co., 1990). It was based on assumed current and future land use at this Site. These reports were submitted, reviewed, and approved by EPA and MEDEP. No changes to the text have been made.

11. 2-13, Section 2.3.2, Ecological Target Clean-Up Levels: Inorganic contaminants were not detected in the surface water immediately adjacent to the disposal area of Site 8. Elevated levels of these contaminants were detected in the western tributary, cross gradient of Site 8. Based on this observation, Site 8 does not appear to be the source of surface water contamination.

12. 3-4, Section 3.1: See response to comment No. 10.

13. 3-6, Section 3.1, Volume Calculations and Treatability Study Results: The Target Clean-Up Levels for PAHs have not been modified. A summary of the DDT concentrations at NAS Brunswick has been included in Section 2.0 of the text and

supports the assumption that concentrations of DDT detected at Site 8 are consistent with background levels. The ecological HI associated with exposure to the average DDT concentration (0.008 mg.kg) is 0.9. This has been included in the text.

14. 3-10, Section 3.3, Alternative 8B-Minimal Action: MEDEP has been added to the sentence.

15. 3-12, Section 3.3, Alternative 8B-Five-Year Review: MEDEP has been added to the sentence.

16. 3-13, Section 3.3.1, Alternative 8B-Criteria Assessment/Implementability: Area of remediation does not change based on response to comment No. 10.

17. 3-14, Section 3.4, Alternative 8C-Soil Cover/Covering Contaminated Area: Problems associated with burrowing animals are a design issue and will be addressed during the design phase.

18. 3-18, Section 3.4, Alternative 8C-Soil Cover/Covering Contaminated Area: No formal suggestion of a cover system was made. The statement has been removed from the text.

19. 3-20, Section 3.4.1, Alternative 8C - Criteria Assessment: The requirements of and compliance with Maine Solid Waste Regulations have been presented in more detail.

20. 3-21, Section 3.4.1, Alternative 8C - Criteria Assessment/Compliance with ARARs: The text has been modified to indicate that real-time monitoring of dust levels would be conducted during remedial construction.

21. 3-22, Section 3.4.1, Criteria Assessment-Implementability: The alternative does not change based on response to comment No. 10.

23. 3-26, Section 3.5, Alternative 8D-Excavation/Solidification-Site Preparation: The excavation depth has been changed to 2 feet. Carcinogenic PAHs were detected at the surface at greater than 18 ppm but at four feet were below 18 ppm. Therefore, for cost estimating purposes, excavation was assumed to extend two feet.

24. 3-28, Section 3.5, Alternative 8D-Excavation/Solidification-Site Preparation: Although no soil samples were taken on the steep bank which leads down to the stream, it is unlikely that PAH contaminations exceed the target clean-up level in this area based on the location of disposed materials and the soil samples taken in test pits above the steep bank. An assumption is being made concerning this area but not without adequate information.

25. 3-28, Section 3.5, Alternative 8D-Excavation/Solidification-Stockpile: The reasons that the wastes at Site 8 are not considered hazardous are the lack of historical records indicating that listed wastes were disposed of at the site and the material did

not fail the TCLP test. This has been clarified in the text.

26. 3-30, Section 3.5.1, Alternative 8D-Criteria Assessment: The criteria assessment are based on USEPA guidance for the RI/FS process. Maintenance can be considered under the long-term effectiveness and permanence criteria and the differences in maintenance for the different alternatives has been added in the comparative analysis.

27. 3-32, Section 3.5.1, Alternative 8D-Criteria Assessment/Reduction in Mobility: The improvements in the final disposal properties that are referred to in the Williams report are the structural strength and the permeability. The treatability test did not demonstrate that any improvement in leachability was achieved. This has been clarified in the description of the treatability study.

28. 3-33, Section 3.5.1, Alternative 8D-Criteria Assessment/Implementability: The target clean-up level was not lowered (see response to comment No. 10), but the volume was changed based on a 2-foot excavation depth to 630 cubic yards. The statement concerning the minimum volume of 500 cubic yards has been removed, but it may still be difficult to find a vendor for the small volume. This does not limit consideration of the alternative to the fullest extent.

29. 4-5, Table 4-1, Comparative Summary of Remedial Alternatives: Consideration of continued maintenance was added under the long-term effectiveness criteria.

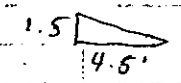
30. A-11, Solidification/Stabilization Treatability Study - Summary: The Williams Environmental Report is referring to the noncarcinogenic PAH compounds. These compounds were identified and adequately addressed in the Draft Final RI and Phase I RF Reports (E.C. Jordan Co., 1990). The carcinogenic PAH compounds are the contaminants of concern; however, all PAH compounds would be adequately treated/solidified using this technology.

SUPPORTING INFORMATION FOR VOLUME ESTIMATES

PROJECT	COMP. BY Sup	JOB NO.
	CHK. BY BRW	DATE 8/6/91

Volumes for soil cover

Common borrow: 1.5' over 8500 sf = 472 cy



to toe out - area = 3.375

assume area is a circle: $8500 = \pi r^2$ $r = 62$ ft

perimeter = $2\pi r$ = 327 ft x 3.375 ft² = 41 cy

total = 512 cy say 525

vegetative soil - extends 5.0' beyond 18 ppm area

r = 62 ft + 5 ft = 67 ft

area = 10,200 ft²

0.5' · 10,200 ft² = 185 cy say 200

For 18 ppm:

Common borrow: 1.5' over 46,000 sf = 2555 cy

assume area is a circle: $46{,}000 = \pi r^2$ $r = 121$

perimeter = $2\pi r$ = 760 ft x 3.375 = 95 cy

total = 2650 cy

vegetative soil: r = 121 ft + 5 ft = 126 ft

area = 50,000 sf

0.5' · 50,000 ft² = 925 cy

PROJECT	COMP. BY	JOB NO.
NAS Brunswick - Site 8	SCP	
	CHK. BY	DATE 7/17/91

	Total PAHs	Carcinogenic PAHs
TP801 - 0'	ND	
TP801 - 2'	ND	
TP802 - 0'	ND	
TP802 - 1'	ND	
TP803 - 0'		
Phenanthrene	5400	
Anthracene	720	
Fluoranthene	7700	
Pyrene	8400	
Benzo(a)Anthracene	2400	2400
Chrysene	3100	3100
Benzo(b) Fluoranthene	2000	2000
Benzo(k) Fluoranthene	1700	1700
Benzo(a) Pyrene	2000	2000
Indeno(1,2,3-cd)pyrene	1200	1200
Benzo(g,h,i,)perylene	1600	
	36,220	12,400
TP803 - 2'	ND	
TP803 - 3'	ND	
TP804 - 0'		
Fluoranthene	580	
Pyrene	560	
Chrysene	460	460
Benzo(b) Fluoranthene	540 *	540 *
Benzo (k) Fluoranthene	540 *	540 *
	2,680	1,540
TP804 - 2'	ND	
TP805 - 0'		
Acenaphthylene	1100 ?	
Fluorene	590 ?	
Phenanthrene	2000	
Anthracene	470	
Fluoranthene	8800	
Pyrene	10,000	
Benzo(a)anthracene	4300	4300
Chrysene	4100	4100
Benzo(b) Fluoranthene	7600	7600
Benzo(k) Fluoranthene	7600	7600
Benzo(a) Pyrene	3900	3900
Indeno(1,2,3-cd)pyrene	1400	1400
Dibenzo(a,h)anthracene	770	770
Benzo(g,h,i) perylene	1700	
	54,130	29,670

PROJECT	COMP. BY	JOB NO.
NAS Brunswick	SCP	
	CHK. BY	DATE 7/17/91

	Total PAHs	Carcinogenic PAHs
TP805 - 4'		
Pyrene	410	
Benzo (a) Anthracene	380	380
Chrysene	490	490
Benzo (b) Fluoranthene	820	820
Benzo (k) Fluoranthene	820	820
Benzo (a) Pyrene	600	600
	3520	3,110
TP805 - 8'		
Acenaphthylene	480	
Phenanthrene	670	
Fluoranthene	1700	
Pyrene	2500	
Benzo(a) Anthracene	1100	1100
Chrysene	1400	1400
Benzo (b) Fluoranthene	1600	1600
Benzo (k) Fluoranthene	1600	1600
Benzo(a) Pyrene	840	840
Benzo(g,h,i)perylene	390	
	12,280	6,540
TP806 - 0'		
Phenanthrene	960	
Fluoranthene	4300	
Pyrene	5000	
Benzo(a) Anthracene	1900	1900
Chrysene	2300	2300
Benzo (b) Fluoranthene	1200	1200
Benzo (k) Fluoranthene	1800	1800
Benzo(a) Pyrene	1800	1800
	19,260	9,000
TP806 - 3'	ND	
TP806 - 6'	ND	
TP807 - 1'	ND	
TP808 - 1'	ND	
TP809 - 2'	ND	
TP810 - 1'	ND	
SB809 - 18'	ND	
SB809 - 30'	ND	
MW810 - 12'	ND	
MW810 - 20'	ND	
MW811 - 12'	ND	
[illegible] - 12		

PROJECT	COMP. BY	JOB NO.
NAS Brunswick	SCP	
	CHK. BY	DATE 7/17/81

	Total PAHs	Carcinogenic PAHs
B805-12'	ND	
B805-17'	ND	
B807-6'	ND	
B807-32'	ND	
B808-12'	ND	
B808-17'	ND	
B808-19'	ND	
B808-23'	ND	

SUPPLEMENTAL RISK CALCULATIONS

SUMMARY OF RISKS - SITE 8

FEASIBILITY STUDY
NAS BRUNSWICK

Scenario	Carcinogenic Risks Child	Carcinogenic Risks Adult	Total Carcinogenic Risks
Future Landuse			
Average Concentration	9.4E-05	4.5E-05	1.4E-04
Mean Concentration	4.0E-05	1.9E-05	5.9E-05
Maximum Concentration	2.0E-04	1.0E-04	3.0E-04

SSSC_RS	19-Mar-92

TABLE 1a
DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SOIL - USEPA ASSUMPTIONS
RESIDENTIAL - 6 YEARS
SITE #8
NAS, BRUNSWICK, MAINE

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	see below	mg/kg	
INGESTION RATE	IR	200	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%		BPJ
SOIL ADHERENCE FACTOR	SAF	0.5	mg/cm^2	USEPA, 1989
SURFACE AREA EXPOSED	SA	1,000	cm^2/day	USEPA, 1989
CONVERSION FACTOR	CF	0.000001	kg/mg	
BODY WEIGHT	BW	15	kg	USEPA, 1991
EXPOSURE FREQUENCY	EF	350	days/year	BPJ
EXPOSURE DURATION	ED	6	years	Ages 1 - 6
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	6	years	
RELATIVE ABSORPTION FACTOR	RAF			
INGESTION		1		USEPA, 1989
DERMAL		0.5		USEPA, 1989

USEPA, 1989. "Supplemental Risk Assessment Guidance for the Superfund Program"; USEPA Region I; EPA901/5-89-001

USEPA, 1991. Standard Default Exposure Factors; OSWER Dir. 9285.6-03

BPJ - Best Professional Judgement

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)^-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times RAF \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times RAF \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

TABLE 1a, continued
DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SOIL - USEPA ASSUMPTIONS
RESIDENTIAL - 6 YEARS
SITE #8
NAS, BRUNSWICK, MAINE

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK
cPAHs (average concentration)	13.1	1	1.4E-05	0.05	1.8E-06	5.8	8.3E-05	1.0E-05	9.4E-05
cPAHs (mean concentration)	5.6	1	6.1E-06	0.05	7.7E-07	5.8	3.6E-05	4.4E-06	4.0E-05
cPAHs (maximum concentration)	30	1	3.3E-05	0.05	4.1E-06	5.8	1.9E-04	2.4E-05	2.1E-04

Note: Carcinogenic PAHs were detected in 4 of 10 surface soil samples at concentrations ranging from 1.5 to 29.7 mg/kg.
The average concentration is the sum of the detected values divided by four.
The mean concentratoin is based on all 10 samples and assumed ND = 0.7 mg/kg.

TABLE 1b
DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SOIL - USEPA ASSUMPTIONS
RESIDENTIAL - 24 YEARS
SITE #8
NAS, BRUNSWICK, MAINE

EXPOSURE PARAMETERS

PARAMETER	SYMBOL	VALUE	UNITS	SOURCE
CONCENTRATION SOIL	CS	see below	mg/kg	
INGESTION RATE	IR	100	mg/day	USEPA, 1991
FRACTION INGESTED	FI	100%		BPJ
SOIL ADHERENCE FACTOR	SAF	0.5	mg/cm²	USEPA, 1989
SURFACE AREA EXPOSED	SA	1,000	cm²/day	USEPA, 1989
CONVERSION FACTOR	CF	0.000001	kg/mg	
BODY WEIGHT	BW	70	kg	USEPA, 1991
EXPOSURE FREQUENCY	EF	350	days/year	BPJ
EXPOSURE DURATION	ED	24	years	USEPA, 1991
AVERAGING TIME				
CANCER	AT	70	years	USEPA, 1991
NONCANCER	AT	24	years	USEPA, 1991
RELATIVE ABSORPTION FACTO	RAF			
INGESTION		1		USEPA, 1989
DERMAL		0.5		USEPA, 1989

USEPA, 1989. "Supplemental Risk Assessment Guidance for the Superfund Program"; USEPA Region I; EPA901/5-89-001
USEPA, 1991. Standard Default Exposure Factors; OSWER Dir. 9285.6-03
BPJ - Best Professional Judgement

EQUATIONS

CANCER RISK = INTAKE (mg/kg-day) x CANCER SLOPE FACTOR (mg/kg-day)^-1

HAZARD QUOTIENT = INTAKE (mg/kg-day) / REFERENCE DOSE (mg/kg-day)

INTAKE = (INTAKE-INGESTION) + (INTAKE-DERMAL)

$$\text{INTAKE-INGESTION} = \frac{CS \times IR \times RAF \times FI \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

$$\text{INTAKE-DERMAL} = \frac{CS \times SA \times SAF \times RAF \times CF \times EF \times ED}{BW \times AT \times 365\ \text{days/yr}}$$

TABLE 1b, continued
DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SOIL - USEPA ASSUMPTIONS
RESIDENTIAL - 24 YEARS
SITE #8
NAS, BRUNSWICK, MAINE

CARCINOGENIC EFFECTS

COMPOUND	SOIL CONCENTRATION (mg/kg)	INGESTION RAF	INTAKE INGESTION (mg/kg-day)	DERMAL RAF	INTAKE DERMAL (mg/kg-day)	CANCER SLOPE FACTOR (mg/kg-day)^-1	CANCER RISK INGESTION	CANCER RISK DERMAL	TOTAL CANCER RISK
cPAHs (average concentration)	13.1	1	6.2E-06	0.05	1.5E-06	5.8	3.6E-05	8.9E-06	4.5E-05
cPAHs (mean concentration)	5.6	1	2.6E-06	0.05	6.6E-07	5.8	1.5E-05	3.8E-06	1.9E-05
cPAHs (maximum concentration)	30	1	1.4E-05	0.05	3.5E-06	5.8	8.2E-05	2.0E-05	1.0E-04

Note: Carcinogenic PAHs were detected in 4 of 10 surface soil samples at concentrations ranging from 1.5 to 29.7 mg/kg.
The average concentration is the sum of the detected values divided by four.
The mean concentratoin is based on all 10 samples and assumed ND = 0.7 mg/kg.