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CORRECTIVE MEASURES STUDY WORK PLAN NS MAYPORT FL
2/1/1995
ABB ENVIRONMENTAL SERVICES

NAVSTA Mayport Administrative Record
Document Index Number

32228-000

19.07.00.0001

CORRECTIVE MEASURES STUDY WORKPLAN

NAVAL STATION MAYPORT
MAYPORT, FLORIDA

Unit Identification Code: N60201

Contract No. N62467-89-D-0317/028

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February 1995

CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, ABB Environmental Services, Inc., hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/028 are complete and accurate and they comply with all requirements of this contract.

DATE: February 10, 1995

NAME AND TITLE OF CERTIFYING OFFICIAL: Task Order Manager

NAME AND TITLE OF CERTIFYING OFFICIAL: Project Technical Lead

(DFAR 252.227-7036)

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FOREWORD

To meet its mission objectives, the U.S. Navy performs a variety of operations, some requiring the use, handling, storage, or disposal of hazardous materials. Through accidental spills and leaks and conventional methods of past disposal, hazardous materials may have entered the environment in ways unacceptable by today's standards. With growing knowledge of the long-term effects of hazardous materials on the environment, the Department of Defense (DOD) initiated various programs to investigate and remediate conditions related to suspected past releases of hazardous materials at their facilities.

One of these programs is the Installation Restoration (IR) program. This program complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). The acts, passed by Congress in 1980 and 1986, respectively, established the means to assess and clean up hazardous waste sites for both private-sector and Federal facilities. These acts are the basis for what is commonly known as the Superfund program.

Originally, the Navy's part of this program was called the Navy Assessment and Control of Installation Pollutants (NACIP) program. Early reports reflect the NACIP process and terminology. The Navy eventually adapted the program structure and terminology of the standard IR program.

The IR program is conducted in several stages.

- The Preliminary Assessment (PA) identifies potential sites through record searches and interviews.

- A Site Inspection (SI) then confirms which areas contain contamination, constituting actual "sites." (Together, the PA and SI steps were called the Initial Assessment Study [IAS] under the NACIP program.)

- Next, the Remedial Investigation and the Feasibility Study (RI/FS) together determine the type and extent of contamination, establish criteria for cleanup, and identify and evaluate any necessary remedial action alternatives and their costs. As part of the RI/FS, a Risk Assessment identifies potential effects on human health or the environment to help evaluate remedial action alternatives.

- The selected alternative is planned and conducted in the remedial design and remedial action stages. Monitoring then ensures the effectiveness of the effort.

A second program to address present hazardous material management is the Resource Conservation and Recovery Act (RCRA) Corrective Action Program. This program is designed to identify and clean up releases of hazardous substances at RCRA-permitted facilities. RCRA is the law that ensures that solid and hazardous wastes are managed in an environmentally sound manner. The law applies primarily to facilities that generate or handle hazardous waste.

This program is conducted in three stages.

- The RCRA Facility Assessment (RFA) identifies solid waste management units (SWMUs), evaluates the potential for releases of contaminants, and determines the need for future investigations.

- The RCRA Facility Investigation (RFI) then determines the nature, extent, and fate of contaminant releases.

- The Corrective Measures Study (CMS) identifies and recommends measures to correct the release.

The hazardous waste investigations at Naval Station Mayport are presently being conducted under the RCRA Corrective Action Program. Earlier preliminary investigations had been conducted at Naval Station Mayport under the NACIP program and IR program following Superfund guidelines. In 1988, in coordination with the U.S. Environmental Protection Agency (USEPA) and the Florida Department of Environmental Regulation (FDER; now known as the Florida Department of Environmental Protection [FDEP]), the hazardous waste investigations were formalized under the RCRA program.

Mayport is conducting the cleanup at their facility by working through the Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM). The USEPA and the FDEP oversee the Navy environmental program. All aspects of the program are conducted in compliance with State and Federal regulations, as ensured by the participation of these regulatory agencies.

Questions regarding the RCRA program at Naval Station Mayport should be addressed to Mr. David Driggers, Code 1852, at (803) 743-0501.

EXECUTIVE SUMMARY

ABB Environmental Services, Inc. (ABB-ES), has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to conduct a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) and Corrective Measures Studies (CMS) for Solid Waste Management Units (SWMUs) at U.S. Naval Station (NAVSTA) Mayport, Mayport, Florida. The RFI and CMS are being conducted in accordance with the Hazardous and Solid Waste Amendment (HSWA) permit No. FL9 170 024 260, issued by the U.S. Environmental Protection Agency (USEPA) on March 25, 1988, and revised and reissued on June 15, 1993.

The HSWA permit identified 18 SWMUs as requiring an RFI, and 23 SWMUs and two Areas of Concern (AOCs) that require confirmatory sampling. Following the completion of the RFI and evaluation of risks to human health and the environment, a CMS will be performed for each SWMU requiring corrective action. This workplan presents the objectives of the CMS and the approach that will be followed for each CMS performed at Mayport. The approach will include identification of corrective action objectives, identification and screening of technologies, development of alternatives, evaluation of alternatives, and justification and recommendation of corrective action.

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
AMI	Atlantic Marine, Inc.
AOC	area of concern
CAMP	Corrective Action Management Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action, Navy
CMS	Corrective Measures Study
DOD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulation
FTC	Fleet Training Center
HSWA	Hazardous and Solid Waste Amendments
IAS	Initial Assessment Study
IM	interim measure
IR	Installation Restoration
JSI	Jacksonville Ship Yard, Inc.
LNAPL	Light Non-Aqueous Phase Liquid
MCL	maximum contaminant level
NA	not applicable
NACIP	Navy Assessment and Control of Installation Pollutants
NADEP	Naval Aviation Depot
NAVSTA	Naval Station
NFI	North Florida Ship Yard, Inc.
NIRP	Naval Installation Restoration Program
NPDES	National Pollution Discharge Elimination System
OWTP	oily waste treatment plant
PA	Preliminary Assessment
ppm	parts per million
PWC	Public Works Center
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFA/SV	RCRA Facility Assessment and Sampling Visit
RFA/VSI	RCRA Facility Assessment and Visual Site Inspection
RFI	RCRA Facility Investigation
RI/FS	Remedial Investigation and Feasibility Study

GLOSSARY (Continued)

SARA	Superfund Amendments and Reauthorization Act of 1986
SI	Site Inspection
SIMA	Ships Intermediate Maintenance Area
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SVOCs	semivolatile organic compounds
SWMU	Solid Waste Management Unit
USEPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds

1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), under the Comprehensive Long-term Environmental Action, Navy (CLEAN) Contract, No. N62467-89-D-0317, is conducting a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) on behalf of the U.S. Navy at the Naval Station (NAVSTA) Mayport. This investigation is being conducted in accordance with the Hazardous and Solid Waste Amendment (HSWA) of 1984 permit No. FL9-170-024-260, issued by the U.S. Environmental Protection Agency (USEPA) on March 25, 1988, and revised and renewed on June 15, 1993.

1.1 OBJECTIVE OF THE CORRECTIVE MEASURES STUDY (CMS) WORKPLAN. This document presents the CMS workplan for NAVSTA Mayport. The CMS workplan describes the process for preparing the CMS for Solid Waste Management Units (SWMUs) where sufficient information exists to warrant initiation of a CMS. The CMS workplan permits site managers and other decision makers an early opportunity to review the process by which the CMS will be conducted for SWMUs at NAVSTA Mayport. The process includes identification of corrective action objectives, identification and screening of corrective measure technologies, identification of corrective action alternatives, evaluation of alternatives, and recommendation and justification of corrective action alternatives for each SWMU or groups of SWMUs. Chapter 2.0 of this document describes each of these components of the CMS process.

Chapter 2.0 also includes examples of tables that will be used in the CMS to represent each step of the CMS process. These tables present the identification of corrective action objectives, identification and screening of technologies, and identification of corrective action alternatives for Group II SWMUs (see Section 1.2). These tables are included in the CMS workplan as an example of the format by which the CMS will be conducted at NAVSTA Mayport. In this manner, all CMSs conducted for NAVSTA Mayport will be consistent. Additionally, including these tables provides the regulators an opportunity to review and comment on the CMS process.

1.2 FACILITY DESCRIPTION. NAVSTA Mayport is located in Jacksonville, Florida, in northeastern Duval County on the south shore of the confluence of the St. Johns River and the Atlantic Ocean (Figure 1-1).

A RCRA Facility Assessment and Visual Site Inspection (RFA/VSI) for NAVSTA Mayport was conducted by the USEPA Region IV in 1989. The RFA/VSI identified 56 SWMUs and 2 areas of concern (AOCs) at NAVSTA Mayport. Fifteen of these SWMUs were determined to require no further action. Twenty-three of the remaining SWMUs and the two AOCs were determined to require further investigation by conducting RCRA Facility Assessment and Sampling Visits (RFA/SVs), referred to in the current HSWA permit as confirmatory sampling. The remaining 18 SWMUs were determined to require an RFI (Figure 1-2). These SWMUs and AOCs were included in the HSWA permit and are summarized in Table 1-1.

Due to the number of SWMUs, the diversity of their past and present operations, and the magnitude of the permit requirements, the USEPA recommended that a phased approach be used to implement the RFI and other corrective action activities at

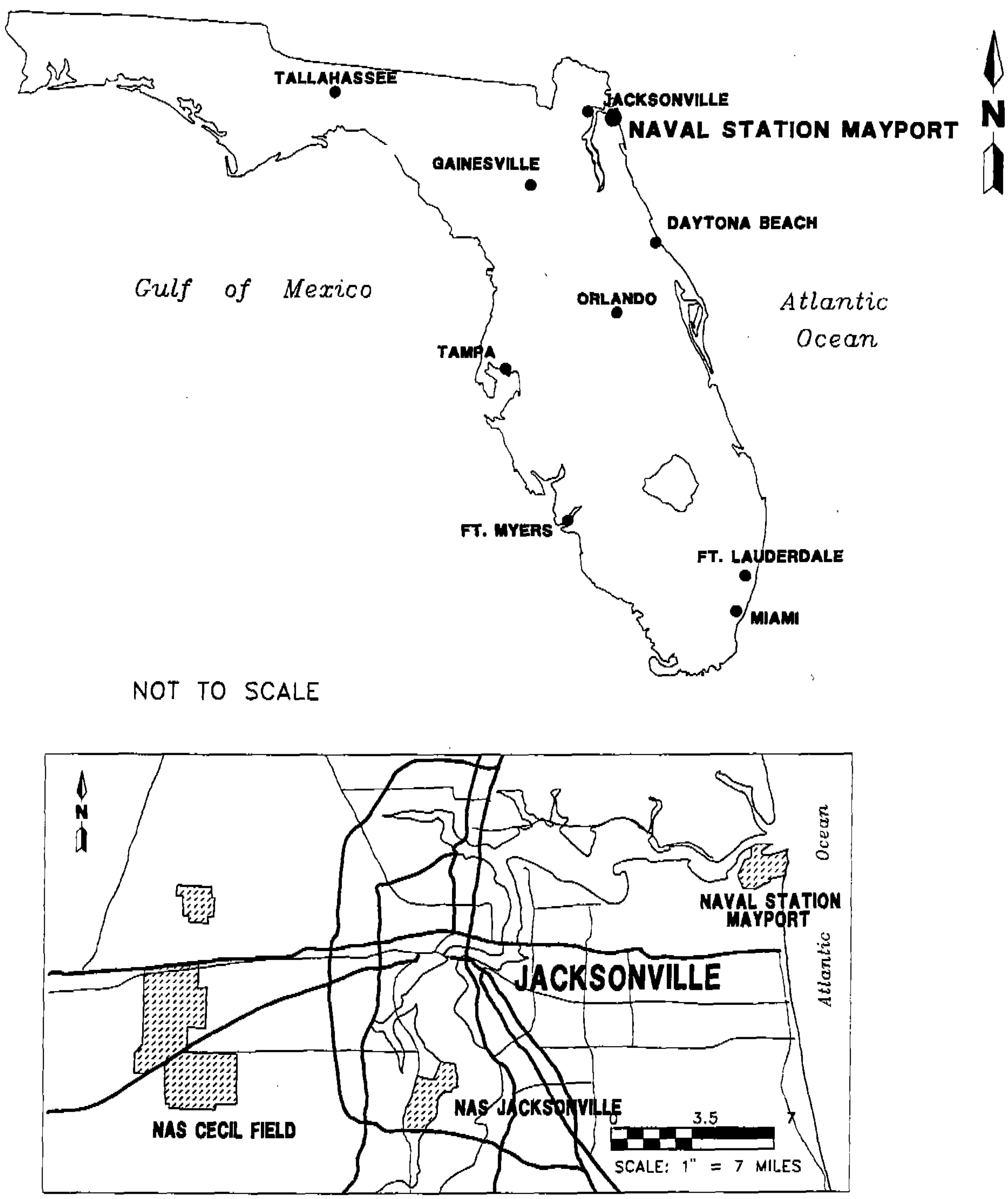

FIGURE 1-1
FACILITY LOCATION MAP

CORRECTIVE MEASURES STUDY WORKPLAN

U.S. NAVAL AIR STATION MAYPORT, FLORIDA

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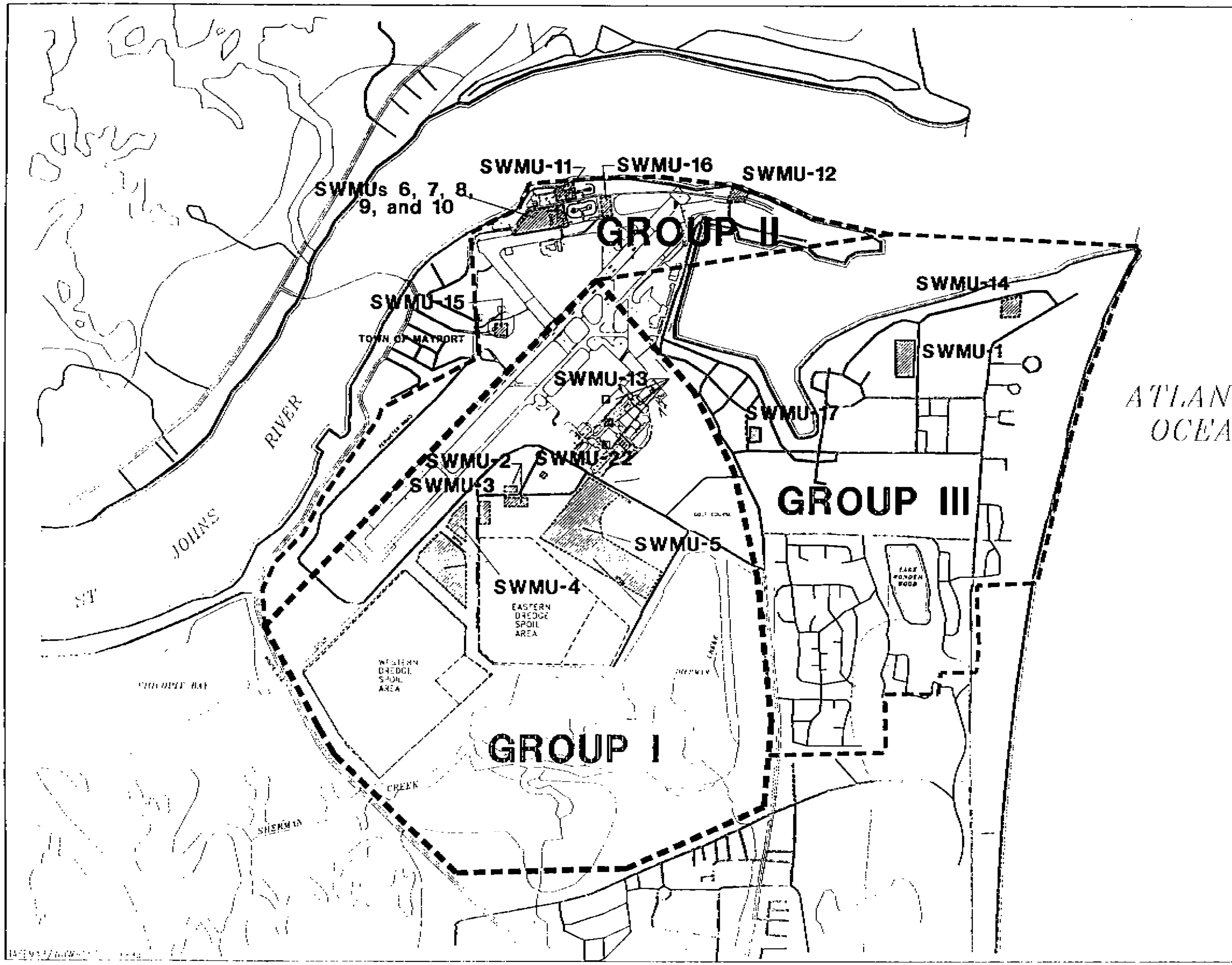

FIGURE 1-2
SITE LOCATION MAP AND LOCATION OF SOLID WASTE MANAGEMENT UNIT GROUPS

CORRECTIVE MEASURES STUDY WORKPLAN

U.S. NAVAL STATION MAYPORT, FLORIDA

Table 1-1
Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Summary

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Group	RFI or RFA/SV	SWMU	NIRP	Description
I	RFI	02	02	Landfill B
I	RFI	03	04	Landfill D
I	RFI	04	05	Landfill E
I	RFI	05	06	Landfill F
I	RFI	13	13	Old Fire Training Area
I	RFI	22	NA	Building 1600 Blasting Area
I	RFA/SV	26	03	Landfill C
I	RFA/SV	49	NA	Flight Line Retention Ponds
I	RFA/SV	50	NA	Dredge Spoil Disposal Areas
I	RFA/SV	56	NA	Building 1552 Accumulation Area
II	RFI	06	08	Waste Oil Pit
II	RFI	07	8A	OWTP Sludge Beds
II	RFI	08	8B	OWTP Percolation Pond
II	RFI	09	8C	OWTP
II	RFI	10	8D	RCRA Hazardous Waste Storage Area
II	RFI	11	09	Fuel Spill Area
II	RFI	12	11	Neutralization Basin
II	RFI	15	15	Old Pesticide Handling Area
II	RFI	16	16	Old Transformer Storage Yard
II	RFA/SV	19	NA	NADEP Blasting Area
II	RFA/SV	28	10	DRMO Yard
II	RFA/SV	48	NA	Former Chemistry Laboratory Accumulation Area
II	RFA/SV	51	NA	Waste Oil Tanks
III	RFI	01	01	Landfill A
III	RFI	14	14	Mercury/Oily Waste Spill Area
III	RFI	17	17	Carbonaceous Fuel Boiler
III	RFA/SV	18	NA	FTC Diesel Generator Sump
III	RFA/SV	20	NA	Hobby Shop Drain

See notes at end of table.

Table 1-1 (Continued)
Solid Waste Management Unit (SWMU) and Area of Concern (AOC) Summary

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Group	RFI or RFA/SV	SWMU	NIRP	Description
III	RFA/SV	21	NA	Hobby Shop Scrap Storage Area
III	RFA/SV	23	NA	Jacksonville Ship Yard, Inc. (JSI), Area
III	RFA/SV	24	NA	North Florida Ship Yard, Inc. (NFI), Area
III	RFA/SV	25	NA	Atlantic Marine, Inc. (AMI), Area
III	RFA/SV	29	12	Oily Waste Pipe Line Break
III	RFA/SV	44	NA	Wastewater Treatment Facility Clarifiers 1 and 2
III	RFA/SV	45	NA	Wastewater Treatment Facility Sludge Drying Beds
III	RFA/SV	46	NA	Ships Intermediate Maintenance Area (SIMA) Engine Drain Sump
III	RFA/SV	52	NA	Public Works Department (PWD) Service Station Storage Area
IV	RFA/SV	47	NA	Oily Waste Collection System
IV	RFA/SV	53	NA	Sewer Pipeline
IV	RFA/SV	54	NA	Oil-Water Separators
IV	RFA/SV	55	NA	Storm Sewer and Drainage System
IV	RFA/SV	AOC-A	NA	Fuel Distribution Systems
IV	RFA/SV	AOC-B	NA	Underground Product Storage Tanks

Notes: RFI = Resource Conservation and Recovery Act (RCRA) Facility Investigation.
RFA/SV = RCRA Facility Assessment and Sampling Visit.
NIRP = Naval Installation Restoration program.
NA = not applicable.
OWTP = Oily Waste Treatment Plant.
RCRA = Resource Conservation and Recovery Act.
NADEP = Naval Aviation Depot.
DRMO = Defense Reutilization and Marketing Office.
FTC = Fleet Training Center.

NAVSTA Mayport. A Corrective Action Management Plan (CAMP) was prepared in response to the USEPA recommendation and describes the strategy to implement the RCRA corrective action program at NAVSTA Mayport. The CAMP is periodically revised based on new site information and permit requirements (ABB-ES, 1994).

The corrective action program at NAVSTA Mayport described in the CAMP has been structured to permit a phased approach to assure collection of adequate site characterization data to support the selection of effective corrective measures. The structure of the corrective action program at NAVSTA Mayport is based on the establishment of four SWMU groups. The corrective action activities at each group of SWMUs are being implemented in phases.

The Group I SWMUs are located in the southwest part of NAVSTA Mayport and include former landfills, active dredge material disposal areas, and other individual SWMUs. These SWMUs were incorporated into Group I because of their: (1) proximity to each other, (2) common drainage to the Sherman Creek watershed, (3) similarity of past waste disposal activities, and (4) the potential for similar or related corrective measures. RFI and confirmatory sampling (RFA/SV) assessment activities have been implemented for Group I SWMUs. The preliminary results of the RFI at Group I RFI SWMUs are included in Volumes I and II of the Phase I RFI report (final) dated November 1992 (ABB-ES, 1992c). The results of confirmatory sampling at Group I RFA/SV SWMUs are included in the RFA/SV report (final draft) dated November 1992 (ABB-ES, 1992d).

The Group II SWMUs are located along the northern part of NAVSTA Mayport contiguous with the St. Johns River and include former hazardous and solid waste storage areas, petroleum waste treatment and disposal, and an oily waste treatment facility. The SWMUs were incorporated into Group II because of their: (1) proximity to each other, (2) nearness to the St. Johns River, and (3) potential for similar or related corrective measures. RFI and RFA/SV activities have been implemented for Group II SWMUs. Confirmatory sampling (RFA/SV) activities are described in the Group II RFA/SV workplan (final draft) dated November 1993 (ABB-ES, 1993).

The Group III SWMUs are located in the eastern part of NAVSTA Mayport adjacent to the turning basin and include industrial areas, a wastewater treatment plant, and a firefighter training area. RFI and confirmatory sampling (RFA/SV) assessment activities for Group III SWMUs are planned for 1995.

The Group IV SWMUs and AOCs are composed of utility networks and system components that span multiple geographic areas at NAVSTA Mayport. The HSWA permit does not require an RFI for SWMUs in Group I, but confirmatory sampling (RFA/SV) will be conducted to assess whether an RFI would be required. RFA/SV assessment activities have not been implemented for Group IV SWMUs.

2.0 CORRECTIVE MEASURES STUDY IMPLEMENTATION

This chapter describes the process for preparing the CMS. Components of the CMS are: identification of corrective action objectives, identification and screening of corrective action technologies, identification of corrective action alternatives, evaluation of corrective action alternatives, and justification and recommendation of corrective action alternative(s). This chapter also discusses the reports and provides a schedule for the submittal of draft and final reports.

2.1 CORRECTIVE ACTION OBJECTIVES. Corrective action objectives are site-specific objectives for corrective action. These objectives are based on human health and environmental criteria, information gathered during the RFI, USEPA guidance, and the requirements of applicable State and Federal statutes. Corrective action objectives will be determined at the completion of the RFI and are subject to approval by the USEPA Regional Administrator.

Corrective action objectives will be developed for each SWMU or group of SWMUs where existing data justifies initiation of a CMS. These objectives can be refined as the RFI is completed for each SWMU.

Corrective action objectives are typically based on:

- promulgated standards such as maximum contaminant levels (MCLs) and surface water quality standards from Federal and Florida standards and soil thermal treatment criteria from Florida guidances,
- background concentrations determined from facility-wide sampling and analysis, and
- human health and ecological risk-based concentrations estimated in accordance with USEPA risk assessment guidance.

State of Florida guidance, such as soil cleanup goals, sediment guidelines, and groundwater guidance concentrations will also be considered in setting corrective action objectives. Table 2-1 provides an example of corrective action objectives. This table presents corrective action objectives for soil and groundwater for Group II SWMUs. These objectives will be reviewed and revised if necessary when the CMS for the Group II SWMU is initiated. Corrective action objectives developed for Group I and III SWMUs, if appropriate, will be completed in a similar manner.

2.2 IDENTIFICATION AND SCREENING OF CORRECTIVE ACTION TECHNOLOGIES. After the results of the RFI are reviewed and corrective action objectives are identified, technologies applicable to corrective action for each group of SWMUS will be identified.

Corrective action technologies will be identified based on review of current literature, vendor information, and experience in developing alternatives for similar sites with similar release characteristics.

Table 2-1
Corrective Action Objectives for Group II Solid Waste Management Units (SWMUs)

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Media	Corrective Action Objective
General	Group II SWMUs (SWMUs 6, 7, 8, 9, and 11) exhibit similar hydrogeologic and geologic conditions as well as release characteristics. These SWMUs are linked geographically and an economic advantage would be gained by treating the media from these sites collectively rather than individually. Therefore, SWMUs 6, 7, 8, 9, and 11 have been combined into one unit for evaluation of treatment alternatives.
Soil	Group II soil contains concentrations of VOCs and SVOCs exceeding Florida's clean soil criteria. Pesticides and inorganics were also detected in soil samples. Concentrations of pesticides found in soil samples are attributed to historical pesticide application. Patterns of contamination could not be determined from existing inorganic soil data. The corrective action objective for Group II soil will include: · reducing concentrations of detected VOCs and SVOCs to Florida's clean soil criteria.
Standing water	Standing water in the treatment basins at SWMUs 6, 7, 8, 9, and 11 was determined to contain VOCs, SVOCs, and inorganics. The organic compounds detected suggest a potential for a continuing release of hydrocarbon-related compounds. Therefore, the corrective action objective for standing water includes: · reducing the potential for further groundwater contamination by hydrocarbon-related compounds.
Sludge	VOCs and SVOCs found in sludge at SWMUs 6, 7, 8, 9, and 11 exceed Florida's clean soil criteria. Pesticides and inorganics were also detected in the sludge of the sludge drying beds. The sludge is considered to be a continuing source of groundwater contamination at SWMUs 6, 7, 8, 9, and 11. The corrective action objectives for sludge include: · reducing contaminant concentrations of detected VOCs and SVOCs to below Florida clean soil criteria, · reducing contaminant concentrations of detected pesticides to below concentrations considered protective of human health and the environment, · reducing contaminant concentrations of inorganic analytes to below concentrations considered protective of human health and the environment, and · reducing the potential for further groundwater contamination by hydrocarbon-related compounds.
Groundwater	Secondary water quality standards were exceeded in samples from monitoring wells at SWMUs 6, 7, 8, 9, and 11. Some VOCs and SVOCs detected in the groundwater samples exceed MCLs for those compounds. Inorganic analytes such as iron, lead, manganese, and cyanide exceed MCLs for those analytes in some of the groundwater samples at SWMUs 6, 7, 8, 9, and 11. Iron, manganese, and lead were detected in groundwater samples at other Group II SWMUs. Therefore, the corrective action objectives for groundwater include: · reducing contaminant concentrations of detected VOCs that exceed MCLs to below MCLs for those contaminants, · reducing contaminant concentrations of detected SVOCs that exceed MCLs to below MCLs for those contaminants, · reducing concentrations of inorganics that exceed MCLs to below the MCLs for those constituents; and · cleaning up groundwater to meet secondary water quality standards.

Notes: VOCs = volatile organic compounds.
SVOCs = semivolatile organic compounds.
MCLs = maximum contaminant levels.

Once corrective action technologies are identified, they will be screened to eliminate those that may prove infeasible to implement, that rely on technologies unlikely to perform satisfactorily or reliably, or that do not achieve the corrective action objective(s) within a reasonable time. This screening process will focus on eliminating those technologies that have severe limitations for a given set of waste- and site-specific conditions. This screening step may also eliminate technologies based on inherent technology limitations.

Site, waste, and technology characteristics that are used to screen inapplicable technologies are described below.

- Site Characteristics. Site data will be reviewed to identify conditions that may limit or promote the use of certain technologies. Technologies whose use is clearly precluded by site characteristics will be eliminated from further consideration.

- Waste Characteristics. Identification of waste characteristics that limit the effectiveness or feasibility of technologies is an important part of the screening process. Technologies clearly limited by these waste characteristics will be eliminated from consideration. Waste characteristics particularly affect the feasibility of *in-situ* methods, direct treatment methods, and land disposal (onsite or offsite).

- Technology Limitations. During the screening process, the level of technology development, performance record, and inherent construction, operation, and maintenance problems will be identified for each technology considered. Technologies that are unreliable, perform poorly, or are not fully demonstrated may be eliminated in the screening process.

Tables 2-2 and 2-3 provide examples of how the technology identification process will be implemented at NAVSTA Mayport. These tables present the technology identification process for soil and groundwater for Group II SWMUs. Similar technologies will be identified in the CMS for Groups I and III SWMUs (i.e., upon completion of the RFI at these SWMUs if appropriate).

Tables 2-4 and 2-5 provide examples of how the technology screening process will be implemented at NAVSTA Mayport. These tables present the technology screening phase for soil and groundwater for Group II SWMUs. A similar table will be prepared in the CMS for Groups I and III SWMUs (i.e., upon completion of the RFI at these SWMUs, if appropriate).

2.3 IDENTIFICATION OF CORRECTIVE ACTION ALTERNATIVES. Corrective action alternatives will be identified based on corrective action objectives and an analysis of the corrective action technologies that passed the screening step. Engineering practice and experience will be used to determine which of the corrective action technologies appear most suitable for each SWMU.

Each alternative may consist of an individual technology or a combination of technologies. The alternatives developed will represent a workable number of options that each appear to adequately address all site-related problems and corrective action objectives.

Table 2-2
Identification of Corrective Measures Technologies, Group II Soil

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

General Response Action	Soil Technology	Description
No action	None	No action. Site monitoring
Minimal action	Institutional controls, educational programs, and fencing.	Zoning and deed restrictions on potentially contaminated areas. Educate public concerning site hazards. Erect physical barrier to site access.
Containment	Soil cover	A layer of native soil is placed over the site that is sufficiently thick to prevent direct contact and ingestion hazards associated with contaminated surface soil.
	Capping	Low-permeability cover (e.g., clay and soil, asphalt, or clay and synthetic membrane covered with soil) is constructed over the site to provide a barrier to water infiltration and prevent direct contact and ingestion hazards associated with contaminated soil.
	Cap and slurry wall	Emplacement of a low permeability barrier to restrict contaminant migration in the vadose zone.
Excavation and disposal	Onsite landfill	Soil is excavated, transported, and disposed in a secure landfill.
	Offsite landfill	Soil is excavated, transported, and disposed in a permitted Resource Conservation and Recovery Act (RCRA) facility.
Ex-situ treatment	Onsite incineration	Soil is excavated and treated by a mobile or onsite incinerator that thermally destroys organics (volatile and semivolatile) in a direct fired unit.
	Offsite incineration	Soil is excavated and transported to a licensed incinerator that thermally destroys organics in a direct fired unit.
	Supercritical extraction	Extract organics using gases (e.g., carbon dioxide or propane) at a certain temperature and pressure (critical point) such that their solvent properties are greatly altered. These properties make extraction of organics more rapid and efficient than processes using distillation or conventional solvent extraction methods.
	Stabilization and solidification.	Soil is excavated and mixed with a setting agent (e.g., cement, fly ash, and lime) to form a product (either a cement-like or soil-like product) in which contaminants are entrapped by the solidified mass.
	Thermal soil aeration	Soil is excavated and treated by a mobile unit that volatilizes and desorbs organics from the soil through contact with a heated surface within a reaction vessel. Contaminants are transferred to the gaseous state.
	Soil washing	Soil is excavated and mixed with an aqueous based washing solution in a series of high-energy mobile washing units. Organics and metals can be separated from soil with this system. Washing solution is recycled.
	Composting	Soil is excavated and mixed with amendment (cow manure, straw, and vegetable wastes) to prepare for composting. The mixture is placed in windrows and composted for several weeks. Final compost is backfilled into the excavated area.

Table 2-2 (Continued)
Identification of Corrective Measures Technologies, Group II Soil

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

General Response Action	Soil Technology	Description
In-situ treatment	Soil vapor extraction	A vacuum is applied to wells to extract vapor from voids in the subsurface soil. The vapor is collected and either treated or released to the atmosphere.
	Stabilization and solidification.	A setting agent is mixed in place with contaminated soil to form a monolithic product in which contaminants are entrapped by the solidified mass.
	Soil flushing	Aqueous-based washing solution is applied at the ground surface. Contaminants are removed through extraction wells after reaching the water table.
	Bioventing	Air, nutrients, and moisture (as needed) are injected into a contaminated soil zone to enhance the indigenous microbe environment and increase the biodegradation rate of organics.

Table 2-3
Identification of Corrective Measures Technologies, Group II Groundwater

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

General Response Action	Groundwater Technology	Description
No action	Groundwater monitoring	Perform water quality analyses to monitor contaminant migration and assess future environmental impacts.
Minimal action	Institutional controls and educational programs.	Restrictions on use of contaminated groundwater. Educate public concerning site hazards.
Containment	Slurry wall	Emplacement of a low-permeability barrier to restrict groundwater migration. Should include a cover system to reduce infiltration.
Collection	Groundwater extraction wells.	Installation of several strategically located pumping wells to collect contaminated groundwater for treatment.
Ex-situ treatment	Ultraviolet (UV) light and oxidation.	Oxidize organics in extracted groundwater through simultaneous application of UV light and ozone or hydrogen peroxide.
	UV reduction	Chemically reduce organics in extracted groundwater through simultaneous application of UV light and a proprietary liquid catalyst.
	Air stripping	Reduce concentrations of volatile organic compounds (VOCs) through intimate contact of extracted groundwater with air. Air is forced through a column of contaminated water (packed column or diffused air tank) to promote mass transfer of organics from aqueous to gaseous phase.
	Carbon adsorption	Reduce concentrations of aqueous or gaseous phase organics through adsorption onto granular activated carbon. May be used as a polishing step for treatments such as air stripping to further reduce organic concentrations in groundwater or to capture VOCs in air stripper emissions. Process produces a concentrated waste stream requiring further treatment.
	Resin adsorption	Contaminants are transferred from the dissolved state to the surface of the resin. Resin can be regenerated by removing the contaminants with steam or solvent. Process produces a concentrated waste stream requiring further treatment.
	Wet air oxidation	Destroy organic compounds in an aqueous solution by inducing oxidation and hydrolytic reactions at high temperature and pressure. Oxygen, at elevated temperatures, enhances oxidation of organic compounds to carbon dioxide and water.
	Biological treatment	Destroy organic compounds through biodegradation, acclimation-degradation, or chemical conversion of the organic wastes by introducing the extracted groundwater to either an aerobic or anaerobic biological treatment process. Microorganisms and nutrients (if needed) are added to induce one or more of the responses.
	Reverse osmosis	Remove organic compounds from extracted groundwater using membrane processes. Process will remove organics with a molecular weight greater than 200. Recent studies indicate success in treating organic chemicals with molecular weights greater than 120. At high pressures, membrane allows water to pass while organics are rejected. Process produces a concentrated waste stream requiring further treatment.

Table 2-3 (Continued)
Identification of Corrective Measures Technologies, Group II Groundwater

Corrective Measures Study Workplan
NAVSTA Mayport

General Response Action	Groundwater Technology	Description
Ex-situ treatment (continued)	Ion exchange	Metal ions are removed from solution by exchanging ions electrostatically attached to a solid resin material for dissolved ions in solution. Regeneration of the exhausted resin would produce a concentrated waste stream requiring further treatment.
	Precipitation	Chemical precipitation involves the formation of a solid phase, usually particulate matter, suspended in a liquid phase containing the pollutant to be removed. Process generates a sludge requiring collection, treatment, and disposal.
	Adsorptive filtration	Metals are collected by attachment to a thin layer of ferrihydrite (iron oxide) that has been immobilized on the surface of sand grains.
	Microfiltration	Metals are filtered out of water by high-grade filters; usually used as a polishing step.
In-situ treatment	Biological	Introduce nutrients and oxygen or methane into the groundwater using a matrix of extraction wells and recirculation techniques.
	Air sparging	Air is injected into the saturated zone. As air bubbles travel upward, contaminants are volatilized from soil or groundwater and carried to the vadose zone where they are recovered via vacuum extraction.
Disposal	Wastewater treatment facility.	Disposal of extracted groundwater to the base treatment facility. Groundwater would require transport by means of a force main and/or gravity sewer or by truck to the facility.
	Groundwater reinjection	Reinject treated groundwater using a series of wells and pumps. Can be used to enhance plume removal and accelerate remediation.
	Discharge to surface water.	Discharge treated groundwater to St. Johns River. Requires permitted outfall. Transport groundwater by means of force or gravity main.

Table 2-4
Screening of Corrective Measure Technologies,
Group II Soil

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Remedial Technology	Advantages	Disadvantages	Screening Status	Comments
No action	• No cost would be incurred other than for monitoring.	• Does not reduce exposure potential for human or environmental receptors. • Would not reduce mobility, toxicity, or volume of contaminants.	Eliminated	Not protective of human health or the environment.
Soil cover	• Reduces exposure potential for human receptors. • Easily implemented. • Not subject to RCRA land disposal restrictions.	• Would not reduce toxicity or volume of contaminants. • Would not reduce mobility of contaminants resulting from infiltration of precipitation. • Uncertain design life. • Long-term monitoring and maintenance would be required. • Long-term liability associated with waste.	Eliminated	Would not reduce the mobility of contaminants or leaching of contaminants to groundwater. Not protective of human health.
Capping	• Reduces exposure potential for human receptors. • Not subject to RCRA land disposal restrictions. • Commonly used method for remediation.	• Would not reduce toxicity or volume of contaminants. • Uncertain design life. • Long-term monitoring and maintenance would be required. • Long-term liability associated with waste.	Retained	Reduces leaching of contaminants to groundwater.
Slurry wall	• Reduces migration of contaminated groundwater. • Reduces lateral migration of infiltration precipitation in the vadose zone. • Technology has been demonstrated for controlling groundwater at dam projects. • Slurry walls can be constructed up to a 200-foot depth.	• Would not reduce toxicity or volume of contaminants. • Long-term integrity of a slurry wall in the presence of common groundwater contaminants is not proven. • Compatibility tests with slurry wall material and contaminants are necessary.	Eliminated	Not compatible with site hydrogeology.
Onsite landfill	• No secondary wastes produced. • Contaminants may be relocated to a more stable, contained, lower exposure potential environment. • No transportation of waste over public roads.	• Would not reduce toxicity or volume of contaminants. • RCRA land disposal restrictions may limit wastes eligible for disposal. • Long-term monitoring and maintenance would be required. • Long-term liability associated with landfilled waste.	Retained	Could be used for direct disposal of soil or as an option for disposal of treatment residuals.

See notes at end of table.

Table 2-4 (Continued)
Screening of Corrective Measure Technologies, Group II Soil

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Remedial Technology	Advantages	Disadvantages	Screening Status	Comments
Offsite landfill	• Widely used and easily implemented technology. • No wastes or treatment residuals remaining onsite. • Contaminants may be relocated to a more stable, contained, lower exposure potential environment. • Relatively little mobilization effort and cost. • Experienced excavation contractors available.	• Would not reduce toxicity or volume of contaminants. • RCRA land disposal restrictions may limit wastes eligible for disposal. • Limited landfill capacity nationwide. • Transportation and landfilling costs may be expensive. • Long-term liability associated with landfilled waste.	Retained	Could be used for direct disposal of soil or as an option for disposal of treatment residuals.
Onsite incineration	• Destruction and removal efficiencies are greater than 99.99 percent, thus reducing volume of contaminants. • Technology is reliable and has been demonstrated for treating organics at full scale. • Widely used for treatment of organics wastes. • Mobile units are available.	• Treatment of volatile metals (e.g., lead) collected by air pollution control equipment potentially required. • Treatment of inorganics remaining in soil potentially required. • Incineration of RCRA waste would require trial burns to receive permits to operate.	Eliminated	Although capable of treating organics, thermal aeration is less energy intensive.
Offsite incineration	• Destruction and removal efficiencies are greater than 99.99 percent, thus reducing volume of contaminants. • Technology is reliable and has been demonstrated for treating organics at full scale. • Widely used for treatment of organics wastes. • Experienced vendors are available.	• Treatment of inorganics remaining in soil potentially required. • Limited capacity at RCRA-permitted incinerators. • High costs associated with transportation and incineration of wastes.	Eliminated	Although capable of treating organics, thermal aeration is less energy intensive.
Supercritical extraction	• Capable of treating soil contaminated with organic contaminants. • Contaminants are transferred to a manageable gaseous waste stream.	• Would not reduce mobility, toxicity, or volume of contaminants. • Concentrated contaminant waste stream requires further treatment. • Limited operating experience with site-specific contaminated soil. • Treatability studies required to determine potential for treating site soil.	Eliminated	Not a proven technology for site contaminants. Would not offer any advantage over other proven technologies.

See notes at end of table.

Table 2-4 (Continued)
Screening of Corrective Measure Technologies, Group II Soil

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Remedial Technology	Advantages	Disadvantages	Screening Status	Comments
Stabilization and solidification	• Reduces mobility of metals. • Technology is reliable and has been demonstrated at full scale for treating inorganics. • Technology is relatively simple and easily implemented. • Experienced vendors are available.	• Would not reduce toxicity or volume of contaminants. • Volume of contaminated media increased by 20 to 30 percent. • Long-term performance for treating organic wastes not demonstrated. • Pre-treatment of organics potentially required.	Retained	Capable of treating inorganics contamination.
Thermal soil aeration	• Technology has been demonstrated full scale for treating organics. • May not require an incinerator permit to operate. • Mobile units are available.	• Would not reduce toxicity, mobility, and volume of contaminants. • Permits unattainable if PCBs present in soil. • Secondary waste stream requires further treatment.	Retained	Capable of treating organics.
Soil washing	• Demonstrated at full scale for removal of metals from soil. • Wide application to varied waste groups. • Mobile units are available.	• Difficulty in treating complex waste mixtures. • Potentially hazardous chemicals may be brought onsite to be used in process. • Potential difficulty in removing washing solution from treated soil. • Limited effectiveness for treating soil with high humic content and high fine-grained clay fraction.	Eliminated	Not effective for treating complex wastes (i.e., VOCs, SVOCs, pesticides, and inorganics).
Composting	• Widely used technology for organic wastes and does not require specialized operating personnel. • Minimal operating cost. • No secondary waste stream generated. • Operating equipment readily available. • Treated soil can be used for backfilling. • Very cost-effective method of treatment.	• Treatability studies may be necessary for site-specific wastes.	Retained	Capable of treating site contaminants.

See notes at end of table.

Table 2-4 (Continued)
Screening of Corrective Measure Technologies,
Group II Soil

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Remedial Technology	Advantages	Disadvantages	Screening Status	Comments
Soil vapor extraction	• Reduces mobility, toxicity, and volume of contaminants if vapors are collected and treated. • Effective for extraction of VOCs from unsaturated zone. • Demonstrated capability for extracting up to 2,000 pounds of VOCs per day. • Not subject to RCRA land disposal restrictions. • Extraction equipment is off-the-shelf and experienced vendors are readily available.	• Dispersion of vapors could result in localized concentrations of contaminants near well heads. • Contaminants with low vapor pressure cannot be effectively removed. • Extensive soil, air, and groundwater monitoring required, including soil borings. • Treatment of metals remaining in soil potentially required. • Not effective for treating soil with a high moisture content.	Retained	Capable of treating organic compounds. May be used with air sparging or bioventing.
In-situ stabilization and solidification	• Technology has been demonstrated at pilot scale for metals. • Reduces mobility of metals. • Not subject to RCRA land disposal restrictions.	• High concentrations of organics may interfere with the setting agent. • Reagent and waste ratios are difficult to control. • Volume of contaminated media increased. • Not demonstrated at full scale. • Verification of treatment can be difficult.	Eliminated	Not effective for subsurface soil.
Soil flushing	• Can be used in conjunction with groundwater treatment. • Effective for removal of organics from permeable soil. • Not subject to RCRA land disposal restrictions. • Full-scale units are available.	• Difficulty in treating complex waste mixtures. • Potential for uncontrolled migration of contaminants to groundwater. • Limited effectiveness for treating soil with high humic content and high fine-grained clay fraction.	Eliminated	Not effective for complex wastes.
Bioventing	• Demonstrated at pilot-scale for treating hydrocarbons in soil. • Reduces toxicity and volume of organics. • No secondary waste streams. • Not subject to RCRA land disposal restrictions.	• Significant time and expense for laboratory degradation studies and field demonstrations. • Injected air may mobilize VOCs in the vadose zone. • Strict operating controls are required to maintain optimal biodegradation environment.	Retained	Capable of treating organics. May be used with soil vapor extraction.

Notes: Shading indicates technology was eliminated.
RCRA = Resource Conservation and Recovery Act.
PCBs = polychlorinated biphenyls.
VOCs = volatile organic compounds.
SVOCs = semivolatile organic compounds.

Table 2-5
Screening of Corrective Measure Technologies, Group II Groundwater

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Remedial Technology	Advantages	Disadvantages	Screening Status	Comments
Groundwater monitoring	• Monitors short- and long-term effectiveness of remedial technologies when used during and after remediation.	• Would not reduce mobility, toxicity, or volume of contaminants when used alone.	Retained	Required component of any groundwater remediation.
Slurry wall	• May reduce the mobility of contaminants present in groundwater. • Current construction methods are capable of going to a depth of 200 feet below ground surface.	• Containment would not reduce the toxicity or volume of contaminants in groundwater. • Would not reduce mobility of contaminants without capping the site. • Contaminants may well degrade slurry wall material.	Eliminated	Would not be effective with the hydrogeologic conditions present at the site.
Groundwater extraction wells	• Groundwater extraction systems have been successfully implemented in similar hydrogeologic conditions. • Existing wells and sumps from interim measures may be used.	• Wells must be strategically located so that cones of depression intersect and capture all contaminated groundwater.	Retained	Groundwater extraction wells required for pump and treat alternatives.
Ultraviolet (UV) light and oxidation	• Treatment provides permanent onsite destruction of organics into carbon dioxide and water, or nontoxic intermediates. • No air emissions or sludge are produced during the treatment process. • Destruction of organics proven during full-scale operation. • Effective for treatment of aromatics and chlorinated aliphatics.	• Treatability study should be performed prior to full-scale design to determine operating parameters and pretreatment requirements necessary to optimize operating efficiency. • Pretreatment is required for the removal of inorganics.	Retained	Capable of treating organic constituents with pretreatment.
UV reduction	• Treatment provides permanent onsite destruction of organics into carbon dioxide and water or nontoxic intermediates. • No air emissions or sludge are produced during the treatment process.	• Reliability of this technology has not been demonstrated. • Treatability study should be performed prior to full-scale design to determine operating parameters and pretreatment requirements necessary to optimize operating efficiency. • Pretreatment is required for the removal of inorganics.	Eliminated	Reliability of this technology has not been demonstrated.

See notes at end of table.

Table 2-5 (Continued)
Screening of Corrective Measure Technologies, Group II Groundwater

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Remedial Technology	Advantages	Disadvantages	Screening Status	Comments
Air stripping	• Treatment would reduce the volume of contaminants in groundwater. • Air stripping is a proven and reliable technology for the treatment of organics, particularly VOCs.	• Off-gases produced during remediation may require collection, treatment, and disposal. • Treatment is not effective for compounds with low volatility. • Pretreatment for the removal of inorganics is required to prevent fouling of the air stripping system. • Post treatment by carbon adsorption may be required to meet discharge limits.	Retained	Capable of treating VOCs present in groundwater at the site.
Carbon adsorption	• Treatment effectively removes organic material from groundwater by sorption. • Technology is reliable and has been demonstrated for treating organics at full scale. • Carbon adsorption could be implemented as a polishing step for aqueous or vapor phase contaminant removal.	• Suspended solids may require removal prior to treatment to avoid clogging carbon bed. • Spent carbon from the adsorption process would require disposal or regeneration.	Retained	Capable of treating organics in the groundwater, either alone or as a polishing step.
Resin adsorption	• Treatment would reduce the volume of contaminants in groundwater. • Removes organics and metals from the wastewater stream. • Capable of treating high flows.	• Process concentrates contaminants within the resin column, requiring regeneration or disposal. • Reliability of this technology has not been demonstrated. • Treatability testing would be required.	Eliminated	Reliability of this technology has not been demonstrated.
Wet air oxidation	• Generally achieves 80 percent oxidation of organic constituents. • Treatment would reduce the volume of contaminants in groundwater.	• This technology is not economical for dilute organic concentrations (<1 percent). • Mobile units not available. • High temperature and pressure system would require constant monitoring.	Eliminated	Technology not applicable to contaminant concentrations. Low efficiency.

See notes at end of table.

Table 2-5 (Continued)
Screening of Corrective Measure Technologies,
Group II Groundwater

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Remedial Technology	Advantages	Disadvantages	Screening Status	Comments
Biological treatment	• Treatment would reduce volume, toxicity, and mobility of chemicals present in groundwater. • Polynuclear aromatics and organic aromatics are amenable to biological treatment. • Activated sludge process on base for obtaining cultures.	• Bench scale treatability studies would be required.	Retained	Potentially applicable to contaminants of concern.
Air sparging	• Not subject to RCRA land disposal restrictions. • Injected air may volatilize contaminants from the saturated zone to the vadose zone. • Effective for VOCs when used in conjunction with soil vapor extraction.	• Treatability studies may be required to determine proper dispersion rates. • Extensive soil, air, and groundwater monitoring required.	Retained	Would provide effective treatment if combined with soil vapor extraction.
Reverse osmosis	• Applicable at near-neutral pHs. • Demonstrated to work well on inorganics and nitrate removal. • Developed for separation of oil-water emulsions.	• Treatability studies would be required. • Works best on oily wastewater (IM on groundwater should reduce amount of oily groundwater). • Produces a concentrated waste stream requiring further treatment. • Requires substantial pretreatment and high maintenance.	Retained	Although not applicable for the dilute groundwater at SWMUs 6 through 11, may be applicable for inorganics and nitrate removal.
Ion exchange	• Effectively treats metals. • Demonstrated performance. • Several experienced vendors available. • Effective as a polishing step in metals treatment.	• Does not reduce the toxicity or volume of contaminants, only concentrates them. • Concentrated contaminant waste stream requires further treatment. • Requires treatability studies.	Retained	Potentially effective for treating metals.
Precipitation	• Metal concentrations can be reduced to 0.01 to 0.5 ppm. • Mobile units readily available. • Treatment is well demonstrated and simple.	• Produces a heavy metal sludge requiring further disposal. • Relatively long detention times required. • Requires a strictly controlled environment.	Retained	Capable of treating metals or as a pretreatment.

See note at end of table.

Table 2-5 (Continued)
Screening of Corrective Measure Technologies, Group II Groundwater

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Remedial Technology	Advantages	Disadvantages	Screening Status	Comments
Adsorptive filtration	• Able to reduce metal concentrations as a polishing step after a conventional treatment process.	• Requires backwashing or regeneration. • Relatively new technology.	Eliminated	Technology not demonstrated.
Microfiltration	• Effectively treats metals and oily waste water.	• Requires treatability studies. • Expended filters require disposal. • High suspended solids can easily clog filter.	Retained	Capable of treating metals or as a pretreatment.
In-situ biological	• Treatment would reduce volume, toxicity, and mobility of chemicals present in groundwater. • Contaminants are degraded to non-toxic compounds. • No air emissions or secondary waste streams are produced.	• Significant time and expense for laboratory degradation studies and field demonstrations. • Parameters (e.g., temperature, pH, nutrients, and oxygen) for optimal microorganism growth can be difficult to maintain.	Retained	In-situ technology applicable to treatment of organics.
Wastewater treatment facility disposal	• May involve only pumping groundwater to treatment facility. • Could be used for disposal of treated effluent.	• Treatability studies would be required to determine effect on treatment processes. • Approval required by operating agency.	Retained	Could be a viable disposal option for treated effluent.
Groundwater reinjection disposal	• Treated groundwater is reinjected for further treatment. • Accelerates groundwater cleanup.	• Infiltration of treated groundwater could affect the migration of contaminants. • Reinjection of water into the plume's path may have an adverse effect on the collection system. • Requires permitting.	Retained	Could be a viable disposal option for treated effluent.
Discharge to surface water	• Existing piping and NPDES permit for outfall to St. Johns River.	• Effluent must meet discharge permit requirements.	Retained	Could be a viable disposal option for treated effluent.

Notes: Shading indicates technology was eliminated.
VOCs = volatile organic compounds.
RCRA = Resource Conservation and Recovery Act.
IM = Interim Measure.
SWMU = solid waste management units.
ppm = parts per million.
NPDES = National Pollution Discharge Elimination System.

Tables 2-6 through 2-9 provide examples of how the alternative identification process will be implemented at NAVSTA Mayport. These tables present the corrective action alternative identification phase for soil and groundwater for Group II SWMUs. A similar table will be prepared in the CMS for Group I and III SWMUs (i.e., upon completion of the RFI at these SWMUs if appropriate).

2.4 EVALUATION OF CORRECTIVE ACTION ALTERNATIVES. Each corrective action alternative identified will be described in detail and evaluated against technical, environmental, human health, and institutional concerns. A cost estimate will also be developed for each alternative.

The description of each alternative will include:

- a site topographic map;
- preliminary site layout of each corrective action alternative;
- description of the corrective measure(s) and rationale for selection;
- performance expectations of each alternative;
- preliminary design criteria and rationale;
- general operation and maintenance requirements;
- long-term monitoring requirements;
- special technical problems that may be encountered;
- additional engineering data required;
- permits and regulatory requirements;
- descriptions of access, easements, and rights-of-way;
- health and safety requirements;
- community relations activities;
- capital cost estimate;
- operation and maintenance cost estimate; and
- project schedule (design, construction, and operation).

Each corrective action alternative will be evaluated based on four criteria. These criteria are described in Table 2-10.

A cost estimate will be developed for each corrective action alternative. The cost estimate will include both capital and operation and maintenance costs (Table 2-11).

2.5 JUSTIFICATION AND RECOMMENDATION OF CORRECTIVE ACTION ALTERNATIVE. The CMS completed for SWMUs at NAVSTA Mayport will recommend and justify a corrective action alternative for each SWMU. A corrective action alternative(s) is chosen for each SWMU or group of SWMUs based on an evaluation of all alternatives by three criteria: technical issues, human health concerns, and environmental concerns (Table 2-12). Corrective action alternatives for each SWMU or group of SWMUs will be evaluated against these criteria in a tabular form so that trade-offs between health risks, environmental effects, and other pertinent factors can be highlighted.

Upon submittal of the CMS to the regulatory agencies, the USEPA Regional Administrator will approve the corrective action alternative(s) for each SWMU or group of SWMUs.

Table 2-6
Identification of Corrective Measures Alternatives,
Group II Soil

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Alternatives	Action						
	Capping	Landfill	Stabilization and Solidification	Thermal Soil Aeration	Composting	Soil Vapor Extraction	Bioventing
OWTP-SCI	X						
OWTP-SC2		X					
OWTP-SC3			X				
OWTP-SC4				X			
OWTP-SC5					X		
OWTP-SC6						X	X

Note: OWTP = oily waste treatment plant.

Table 2-7
Identification of Corrective Measures Alternatives, Solid Waste Management Units (SWMUs) 6, 7, 8, 9, and 11 Groundwater

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Alternatives	Action								
	Institutional Controls	Extraction Wells	Pretreatment	Ultraviolet Light and Oxidation	Air Stripping	Carbon Adsorption	Ex-Situ Biological	In-Situ Biological	Disposal
OWTP-GW1	X								
OWTP-GW2		X	X	X		X			X
OWTP-GW3		X	X		X	X			X
OWTP-GW4		X	X				X		X
OWTP-GW5								X	

Note: SWMU = Solid Waste Management Unit.
OWTP = Oily Waste Treatment Plant.

Table 2-8
Development of Remedial Alternatives,
Solid Waste Management Units (SWMUs) 6, 7, 8, 9, and 11 Soil

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Alternative		Description of Key Components
OWTP-SC1:	Minimal action	• Surround areas with fencing and post warning signs. • Institutional controls: implement zoning and deed restrictions to limit use of land within and around the site. • Institute educational programs. • Groundwater monitoring: perform water quality analyses to monitor contaminant migration and assess future environmental impacts. • Perform site reviews.
OWTP-SC2:	Capping	• Install clay cap to reduce leaching of contaminants to groundwater. • Manage surface water to minimize erosion of cover system. • Develop post-closure plan to monitor, maintain, and inspect site. • Monitor groundwater. • Perform site reviews.
OWTP-SC3:	Onsite landfill	• Excavate contaminated soil. • Conduct confirmatory sampling to ensure wastes have been removed. • Backfill excavation with clean fill. • Transport soil to an onsite landfill location. • Monitor groundwater at landfill location. • Perform site reviews.
OWTP-SC4:	Offsite landfill	• Excavate contaminated soil. • Perform confirmatory sampling to ensure wastes have been removed. • Backfill excavation with clean fill. • Sample and analyze soil to ensure it meets landfill acceptance criteria. • Transport soil to offsite landfill.
OWTP-SC5:	Onsite incineration with offsite disposal of residuals.	• Obtain required permits. • Retrofit existing incinerator onsite to accept contaminated soil. • Excavate contaminated soil. • Perform confirmatory sampling to ensure wastes have been removed. • Transport to incinerator and store in suitable containers. • Incinerate soil. • Transport fly ash offsite for disposal. • Sample and analyze treatment residuals prior to backfilling. • Backfill excavations with treatment residuals.
OWTP-SC6:	Offsite incineration	• Excavate contaminated soil. • Perform confirmatory sampling to ensure wastes have been removed. • Backfill excavation with clean fill. • Sample and analyze for incinerator-required parameters. • Transport soil to offsite incinerator.

See notes at end of table.

Table 2-8 (Continued)
Development of Remedial Alternatives,
Solid Waste Management Units (SWMUs) 6, 7, 8, 9, and 11 Soil

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Alternative		Description of Key Components
OWTP-SC7:	Stabilization and solidification with offsite disposal	• Mobilize stabilization and solidification equipment to site. • Excavate contaminated soil. • Perform confirmatory sampling to ensure wastes have been removed. • Backfill excavation with clean fill. • Transport and stockpile wastes at treatment area. • Stabilize and solidify soil. • Analyze stabilized and solidified soil to ensure conformance with landfill leaching characteristics. • Transport stabilized and solidified soil to offsite landfill for disposal.
OWTP-SC8:	Thermal soil aeration	• Excavate contaminated soil. • Perform confirmatory sampling to ensure wastes have been removed. • Backfill excavation with clean fill. • Sample and analyze for parameters required by the thermal soil treatment facility. • Transport soil to offsite facility.
OWTP-SC9:	Composting	• Mobilize equipment to site. • Conduct treatability tests to determine amendment applicability. • Excavate contaminated soil. • Perform confirmatory sampling to ensure wastes have been removed. • Transport and stockpile wastes at treatment site. • Blend and screen excavated soil. • Arrange soil into windrows and add amendment. • Backfill excavations with treated soil.
OWTP-SC10:	Soil vapor extraction with bioventing.	• Conduct tests to determine soil permeability to vapor and air flow. • Conduct degradation studies. • Mobilize vacuum extraction and bioventing equipment to the site. • Install extraction and injection wells. • Inject air and nutrients into site soil. • Control vapor and air flow with extraction wells. • Perform confirmatory sampling from soil borings to ensure remedial action objective has been attained.
OWTP-SC11:	Soil vapor extraction with air sparging.	• Conduct tests to determine soil permeability to vapor and air flow. • Mobilize vacuum extraction and air sparging equipment to the site. • Install vapor extraction and air injection wells. • Inject air into site soil. • Control vapor and air flow with extraction wells. • Perform confirmatory sampling from soil borings to ensure remedial action objective has been attained.

Note: OWTP = oily waste treatment plant.

Table 2-9
Development of Remedial Alternatives,
Solid Waste Management Units (SWMUs) 6, 7, 8, 9, and 11 Groundwater

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Alternative		Description of Key Components
OWTP-GW1:	Minimal action	• Institutional controls: implement zoning and deed restrictions to prohibit use of groundwater within and around the site. • Institute educational programs. • Groundwater monitoring: perform water quality analyses to monitor contaminant migration and assess future environmental impacts. • Perform site reviews.
OWTP-GW2:	Ultraviolet (UV) oxidation with carbon adsorption.	• Install groundwater extraction system. • Construct groundwater treatment facility. • Extract groundwater and pump to treatment facility. • Pretreat groundwater for metals removal. • Treat groundwater using UV oxidation with carbon adsorption polishing. • Dispose of treated effluent via the chosen discharge alternative.
OWTP-GW3:	Air stripping with carbon adsorption	• Install groundwater extraction system. • Construct groundwater treatment facility. • Extract groundwater and pump to treatment facility. • Pretreat groundwater for metals removal. • Treatment using air stripping with carbon adsorption polishing. • Dispose of treated effluent via the chosen discharge alternative.
OWTP-GW4:	Ex-situ biological	• Install groundwater extraction system. • Construct groundwater treatment facility. • Extract groundwater and pump to treatment facility. • Pretreat for metals removal. • Add nutrients for biological treatment. • Dispose of treated effluent via the chosen discharge alternative.
OWTP-GW5:	In-situ biological	• Conduct degradation studies. • Construct groundwater extraction and recirculation systems. • Extract groundwater, inject nutrients and oxygen or methane into the groundwater, and recirculate the treated groundwater into the aquifer. • Groundwater monitoring: perform water quality analyses to monitor the progress of the cleanup. • Perform site reviews.

Notes: OWTP = oily waste treatment plant.

Table 2-10
Evaluation Criteria for Corrective Action Alternatives

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Criteria	Component	Description
Technical	Performance	Each corrective action alternative will be evaluated for performance based on the effectiveness and useful life of the alternative. Effectiveness. The ability of each alternative to perform intended functions (e.g., containment, diversion, removal, destruction, or treatment) will be evaluated. This will be determined either through design specifications or by performance evaluation. Any specific waste or site characteristics that could potentially impede effectiveness will be considered. The evaluation will also consider the effectiveness of combinations of technologies. Useful life. Useful life is defined as the length of time the level of desired effectiveness can be maintained. Most alternatives, with the exception of destruction, deteriorate with time. Often, deterioration can be slowed through proper system O&M, but the alternative eventually may require replacement. Each alternative will be evaluated in terms of the projected service lives of its component technologies. Future resource availability of the alternative, as well as appropriateness of the technologies, must be considered in estimating the useful life of the project.
	Reliability	Each corrective action alternative will be evaluated for reliability based on its O&M requirements and its demonstrated reliability. Operation and Maintenance (O&M). O&M requirements will be identified for each alternative and will include identifying the frequency and complexity of necessary O&M activities. Alternatives requiring frequent or complex O&M activities will be regarded as less reliable than alternatives requiring little or straightforward O&M. The availability of labor and materials to meet these requirements will also be considered. Demonstrated Reliability. Each alternative will be measured to evaluate the risk and effect of failure of the component technologies. Other items that will be considered for reliability include whether alternatives have been used effectively under analogous conditions, whether the combination of technologies have been used together effectively, whether failure of any one technology has an immediate impact on receptors, and whether the technologies have the flexibility to deal with uncontrollable changes at the site.
	Implementability	Each corrective action alternative will be evaluated for implementability based on the relative ease of installation (constructability) and the time required to achieve the corrective action objectives. Constructability is determined by conditions both internal and external to the facility conditions and include such items as location of underground utilities, depth to water table, heterogeneity of subsurface materials, and location of the facility (i.e., remote location versus a congested urban area). Each alternative will be evaluated to determine measures that could be taken to facilitate construction under these conditions. Time. Each alternative will be evaluated for time for two components: the time it takes to implement an alternative and the time it takes for the benefits (reduction of contaminants to acceptable, pre-established levels) to be apparent.

Table 2-10 (Continued)
Evaluation Criteria for Corrective Action Alternatives

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Criteria	Component	Description
Technical (continued)	Safety	Each corrective action alternative will be evaluated for safety by determining the relative threats to the safety of nearby communities and environments as well as those to workers during implementation. Factors that will be considered include fire, explosion, and exposure to hazardous substances.
Environmental	–	The evaluation of each alternative will include an environmental assessment. This assessment will focus on the facility conditions and pathways of contamination addressed by each alternative and include, at a minimum, an evaluation of: the short- and long-term beneficial and adverse effects of the response alternative, any adverse effects of the response alternative, and any adverse effects on environmentally sensitive areas and an analysis of measures to mitigate adverse effects.
Human Health	--	Each alternative will be evaluated to determine the extent to which it mitigates short- and long-term potential exposure to any residual contamination and how it protects human health both during and after implementation. This evaluation will include a description of the concentrations and characteristics of the contaminants onsite, potential exposure routes, and potentially affected populations; a determination of the level of exposure to contaminants and the reduction over time; and, for management of migration alternatives (i.e., groundwater alternatives), the relative reduction of impact will be determined by comparing residual levels of contaminants to existing criteria, standards, or guidelines acceptable to the U.S. Environmental Protection Agency.
Institutional	–	The relative institutional needs for each alternative will be evaluated. Specifically, this evaluation includes the effects of Federal, State, and local environmental and public health standards, regulations, guidances, advisories, ordinances, or community relations on the design, operation, and timing of each alternative. If the selected remedy is capping and closure in place, a notation will be made in the land deed.

Table 2-11
Components of Cost Estimate for Each Corrective Action Alternative

Corrective Measures Study Workplan
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Criteria	Component		Description
Capital costs	Direct	Construction costs	Costs of materials, labor (including fringe benefits and worker's compensation), and equipment required to install the corrective measure.
		Equipment costs	Costs of treatment, containment, disposal and/or service equipment necessary to implement the action; these materials remain until the corrective action is complete.
		Land and site-development costs.	Expenses associated with development of existing property.
		Buildings and services costs	Costs of process and nonprocess buildings, utility connections, purchased services, and disposal costs.
	Indirect	Engineering expenses	Costs of administration, design, construction supervision, drafting, and testing of corrective measure alternatives.
		Legal fees and license or permit costs.	Administrative and technical costs necessary to obtain licenses and permits for installation and operation.
		Start-up and shake-down costs	Costs incurred during corrective measure start-up.
		Contingency allowances	Funds to cover costs resulting from unforeseen circumstances, such as adverse weather conditions, strikes, and inadequate facility characterization.
Operation and maintenance (O&M)	–	Operating labor costs	Wages, salaries, training, overhead, and fringe benefits associated with the labor need for post-construction operations.
		Maintenance, materials, and labor costs.	Costs for labor, parts, and other resources required for routine maintenance of facilities and equipment.
		Auxiliary materials and energy	Costs of such items as chemicals and electricity for treatment plant operations, water and sewer service, and fuel.
		Purchased services	Sampling costs, laboratory fees, and professional fees for which the need can be predicted.
		Disposal and treatment costs	Costs of transporting, treating, and disposing of waste materials, such as treatment plant residues, generated during operations.
		Administrative costs	Costs associated with administration of corrective measure O&M not included under other categories.
		Insurance, taxes, and licensing costs.	Costs of such items as liability and sudden accident insurance, real estate taxes on purchased land or right-of-way, licensing fees for certain technologies, and permit renewal and reporting costs.
		Maintenance reserve and contingency funds.	Annual payments into escrow funds to cover (1) costs of anticipated replacement or rebuilding of equipment and (2) any large unanticipated O&M costs.
		Other costs	Items that do not fit any of the above categories.

Table 2-12
Criteria for Justification and Recommendation of Corrective Action Alternatives

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Criteria	Description
Technical	The following four factors will be reviewed for the technical criteria. · Performance. The corrective measure(s) that is most effective at performing its intended functions and maintaining the performance over extended periods of time will be given preference. · Reliability. The corrective measure(s) that does not require frequent or complex operation and maintenance (O&M) activities and that has proved effective under waste and facility conditions similar to those anticipated will be given preference. · Implementability. The corrective measure(s) that can be constructed and operated to reduce levels of contamination to attain or exceed applicable standards in the shortest period of time will be preferred. · Safety. The corrective measure(s) that poses the least threat to the safety of nearby residents and environments as well as workers during implementation will be preferred.
Human health	The corrective measure(s) must comply with existing U.S. Environmental Protection Agency criteria, standards, or guidelines for the protection of human health. Corrective measures that provide the minimum level of exposure to contaminants and the maximum reduction in exposure with time are preferred.
Environmental	The corrective measure(s) posing the least adverse impact (or greatest improvement) over the shortest period of time to the environment will be favored.

2.6 <u>REPORTS AND SCHEDULE OF SUBMITTALS</u>. Separate CMS reports will be prepared for Group I, II, and III SWMUs. The CAMP (ABB-ES, 1994) for NAVSTA Mayport includes a schedule for preparing the CMSs.

A draft CMS report will be prepared and submitted to the regulatory agencies for review and comment. Table 2-13 provides a list of components that the draft CMS report will include, at a minimum.

A final CMS report will be prepared upon receipt of comments from the USEPA Regional Administrator. Comments will be addressed and the document will be revised to incorporate the comments. The CMS report will become final upon approval by the USEPA Regional Administrator.

Upon USEPA's receipt of the final CMS, the availability of the CMS for review and comment will be announced to the public. At the end of the comment period, the USEPA Regional Administrator will review the comments and then inform NAVSTA Mayport of the final decision as to the approved corrective action(s) to be implemented.

Table 2-13
Components of Draft Corrective Measures Study Report

Corrective Measures Study Workplan
Naval Station Mayport
Mayport, Florida

Component	Description
Description of the facility	· Site topographic map · Preliminary layouts of corrective action alternatives
Summary of corrective measure(s) and rationale for selection	· Description of the corrective measure(s) and rationale for selection · Performance expectations of each alternative · Preliminary design criteria and rationale · General operation and maintenance requirements · Long-term monitoring requirements
Summary of RFI and impact on selected corrective action(s)	· Field studies (groundwater, surface water, soil, and air) · Laboratory studies (bench scale or pick scale)
Design and implementation precautions	· Special technical problems · Additional engineering data required · Permits and regulatory requirements · Access, easements, and rights-of-way · Health and safety requirements · Community relations activities
Cost estimates and schedules	· Capital cost estimate · Operation and maintenance cost estimate · Project schedule (design, construction, and operation)

Note: RFI = Resource Conservation and Recovery Act (RCRA) Facility Investigation.

USEPA, 1991b, Letter from USEPA (John H. Scarbrough, RCRA and Federal Facilities Branch Division, Waste Management Division, Region IV) to Department of the Navy (Captain J. B. Mitchell, Jr., Commanding Officer, Naval Station Mayport), June 14.

USEPA, 1991c, Letter from USEPA (John H. Scarbrough, RCRA and Federal Facilities Branch Division, Waste Management Division, Region IV) to Department of the Navy (Captain J. B. Mitchell, Jr., Commanding Officer, Naval Station Mayport), October 24.

USEPA, 1993, HSWA Permit Number FL9-170-024-260: USEPA Region IV, June 15.

REFERENCES

ABB-ES, 1991, Interim Final RFI Workplan Volumes I, II, and III, U.S. Naval Station Mayport, Florida: prepared for Southern Division Naval Facilities Engineering Command, Charleston, South Carolina, October.

ABB-ES, 1992a, RCRA Facility Assessment and Sampling Visit Workplan, Group I SWMUs, U.S. Naval Station Mayport, Florida: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina, February.

ABB-ES, 1992b, Draft RCRA Facility Investigation Report, Phase I, Volumes I and II, U.S. Naval Station Mayport, Florida: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina, October.

ABB-ES, 1992c, Final RCRA Facility Investigation Report, Phase I, Volumes I and II, U.S. Naval Station Mayport, Florida: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina, November.

ABB-ES, 1992d, Final Draft RCRA Facility Assessment and Sampling Visit Report, Phase I, U.S. Naval Station Mayport, Florida: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina, November.

ABB-ES, 1992e, RFI Workplan, Addenda 1, 2, and 3, Investigation Derived Waste Management Plan, Phase 2 Background Sampling and Analysis Plan, Light Non-Aqueous Phase Liquid (LNAPL) Sampling and Analysis Plan: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina, December.

ABB-ES, 1993, Final Draft RCRA Facility Assessment Sampling Visit Workplan, Group II SWMUs, U.S. Naval Station Mayport, Florida: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina, November.

ABB-ES, 1994, Corrective Action Management Plan, Naval Station Mayport, Mayport, Florida: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina, May.

A.T. Kearny, 1989, RCRA Facility Assessment of the Naval Station Mayport, Jacksonville, Florida (Draft): prepared for U.S. Environmental Protection Agency (USEPA), September, 165 p.

C.E. Environmental, 1989, Final Draft RCRA Facility Investigation Workplan, U.S. Naval Station Mayport, Florida: prepared for Southern Division, Naval Facilities Engineering Command, Charleston, South Carolina, December.

USEPA, 1988, Hazardous and Solid Waste Amendments (HSWA) Permit Number FL9-170-024-260: USEPA Region IV, March 25.

USEPA, 1991a, Letter with enclosures from USEPA (John Dickinson, Waste Compliance Section, RCRA and Federal Facilities Branch, Region IV) to Department of the Navy (Captain Peter Long, Commanding Officer, Naval Station Mayport), May 6.