FEASIBILITY STUDY FOR SITE 14 SHORT TERM SANITARY LANDFILL NAS WHITING FIELD

3/1/2001

HARDING LAWSON ASSOCIATES

FEASIBILITY STUDY

SITE 14, SHORT-TERM SANITARY LANDFILL

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

UNIT IDENTIFICATION CODE: N60508
CONTRACT NO.: N62467-89-D-0317/116

MARCH 2001

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA 29418

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FEASIBILITY STUDY
SITE 14, SHORT-TERM SANITARY LANDFILL

NAVAL AIR STATION WHITING FIELD
MILTON, FLORIDA

USEPA ID No.: FL2170023244

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Contract No.: N62467-89-D-0317/116

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March 2001

CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

The Contractor, Harding Lawson Associates, hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/116 are complete and accurate and comply with all requirements of this contract.

DATE: March 15, 2001

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(DFAR 252.227-7036)

The evaluations and professional opinions rendered in this planning document describing the feasibility study for Site 14, Naval Air Station Whiting Field, Milton, Florida, were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice. This document is not intended to be used for construction of the selected alternative.

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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, and/or disposal of hazardous materials. Through accidental spills or leaks or as a result of and conventional methods of past disposal, hazardous materials may have entered the environment in ways unacceptable by current standards. With growing knowledge of the long-term effects of hazardous materials on the environment, the Department of Defense 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 Resource Conservation and Recovery Act, and the Hazardous and Solid Waste Amendments of 1984. These acts establish the means to assess and clean up hazardous waste sites for both private-sector and Federal facilities. The CERCLA and SARA acts form the basis for what is commonly known as the Superfund program.

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

The IR program is conducted in several stages as follows:

- preliminary assessment (PA),
- site inspection (SI) (formerly the PA and SI steps were called the initial assessment study under the NACIP program),
- remedial investigation and feasibility study, and
- remedial design and remedial action.

The Southern Division, Naval Facilities Engineering Command manages and the U.S. Environmental Protection Agency and the Florida Department of Environmental Protection oversee the Navy environmental program at Naval Air Station (NAS) Whiting Field. 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 CERCLA program at NAS Whiting Field should be addressed to Ms. Linda Martin, Code 1859, at (843) 820-5574.

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
AFFF	aqueous film-forming foam
ARAR	applicable or relevant and appropriate requirement
BEI	Bechtel Environmental Inc.
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/s	centimeters per second
CT	central tendency
COPC	chemicals of potential concern
ELCR	excess lifetime cancer risk
ERA	ecological risk assessment
FDEP	Florida Department of Environmental Protection
FGGC	Florida Groundwater Guidance Concentration
FS	feasibility study
FSCG	Florida Soil Cleanup Goal
GCTL	groundwater cleanup target level
GIR	General Information Report
HHCOPC	human health chemical of potential concern
HHRA	human health risk assessment
HI	hazard index
HLA	Harding Lawson Associates
IR	Installation Restoration
IRA	interim remedial action
JP-5	jet propellant
LUCAP	Land-Use Control Assurance Plan
LUCIP	Land-Use Control Implementation Plan
MCL	maximum contaminant level
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
PCB	polychlorinated biphenyls
RA	remedial action
RAO	remedial action objective
RBC	risk based concentration
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation

GLOSSARY (Continued)

RME	reasonable maximum exposure
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SCTL	soil cleanup target level
SVOC	semivolatile organic compound
TBC	to be considered
TCL	target compound list
TRPH	total petroleum recoverable hydrocarbon
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
yd^3	cubic yard

1.0 INTRODUCTION

Harding Lawson Associates (HLA) has been contracted by the Department of the Navy, Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) to complete a feasibility study (FS) for Site 14, Short-Term Sanitary Landfill, at Naval Air Station (NAS) Whiting Field, Milton, Florida. The FS is being completed under contract number N62467-89-D-0317-116. The FS report for Site 14 is one in a series of site-specific reports being completed in conjunction with the NAS Whiting Field General Information Report (GIR) (HLA, 1998) and Remedial Investigation (RI) report (ABB Environmental Services, Inc. [ABB-ES], 1998) to present the results of the overall RI/FS for the site. This FS report includes the development, screening, and evaluation of potential remedial alternatives that address contaminated media at Site 14.

Investigations at NAS Whiting Field, a facility listed on the National Priorities List, are being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR], Part 300). The investigations at the facility are being conducted under the Navy's Installation Restoration (IR) program, which is designed to identify and abate or control contaminant migration resulting from past operations at naval installations while working within the aforementioned regulatory framework. SOUTHNAVFACENGCOM is the agency responsible for the Navy's IR program in the southeastern United States. Therefore, SOUTHNAVFACENGCOM has the responsibility to process NAS Whiting Field through preliminary assessment, site inspection, RI/FS, and remedial response selection.

The goals of the RI/FS for Site 14 at NAS Whiting Field are (1) to assess the extent, magnitude, and impact of contamination at the site; (2) to qualitatively and quantitatively assess the risk posed to human health and the environment by site-related contamination; and (3) to develop remedial alternatives that address threats to human health and/or the environment. The first two elements have been discussed in the GIR and RI reports; the remaining element will be presented and discussed in this FS Report.

The GIR provides information common to all sites at NAS Whiting Field, such as

- facility information and history,
- description of physical characteristics of the facility (climatology, hydrology, soil geology, and hydrogeology),
- summary of previous investigations,
- summary of the field investigations activities conducted during the RI,
- baseline risk assessment (BRA) methodology for both human health and ecological receptors, and
- a summary of the facilitywide background evaluation.

The RI serves as the mechanism for collecting data to identify the source of contamination and migration pathway characteristics for conducting a BRA, and for collecting physical measurements and chemical analytical data necessary for remedial alternative evaluation in the FS. The RI provides the basis for determining whether or not remedial action is necessary. The RI Report of Site 14 as NAS Whiting Field provides the following information:

- a site description and summary of previous investigations for Site 14;
- a summary of the field investigation methods used during the RI at the site;
- a site-specific data quality assessment;
- an assessment of the extent, magnitude, and impact of contamination at the site; and
- a qualitative and quantitative assessment of risks to human health and the environment.

The FS, described in more detail later in this chapter, uses the results of the RI and the information presented in the GIR to identify remedial action objectives (RAOs) and to develop, screen, and evaluate potential remedial alternatives. The FS is prepared in accordance with the following regulations and guidance documents: CERCLA, as amended by SARA (references made to CERCLA in this report should be interpreted as "CERCLA, as amended by SARA"); the NCP; 40 CFR, Part 300; and Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (RI/FS Guidance) (U.S. Environmental Protection Agency [USEPA], 1988).

The remaining sections in this chapter describe the FS process for CERCLA sites (Section 1.1), present how this process is applied to NAS Whiting Field sites (Section 1.2), and provide the conceptual understanding of Site 14 environmental conditions as of the completion of the RI report (Section 1.3).

1.1 THE CERCLA FS PROCESS.

The development of remedial alternatives for CERCLA sites consists of developing RAOs and then identifying applicable technologies and developing those technologies into remedial alternatives to meet RAOs. The NCP requires that a range of alternatives be presented in the FS to the maximum practicable extent.

The first step in the FS process is to develop RAOs that specify the contaminants, media of interest, exposure pathways, and preliminary remedial goals that permit a range of alternatives to be developed. The preliminary remedial goals are developed based on chemical-specific applicable or relevant and appropriate requirements (ARARs) (when available), site-specific risk-based factors, or other available information.

Once RAOs are identified, general response actions for each medium of interest are developed. General response actions typically fall into the following categories: no action, containment, excavation, extraction, treatment, disposal, or other actions, singularly or in combination, taken to satisfy the RAOs for the site.

The next step in the FS process is to identify and screen applicable technologies for each general response action. This step eliminates those technologies that cannot be implemented technically. Those technologies that pass the screening phase are then assembled into remedial alternatives. Remedial alternatives are then described and analyzed in detail using seven criteria described in the NCP, including

- overall protection of human health and the environment;
- reduction of toxicity, mobility, or volume of contaminants through treatment;
- compliance with ARARs;
- long-term effectiveness and permanence;
- short-term effectiveness;
- implementability; and
- economics (i.e., cost).

Alternatives are evaluated against two additional factors after State participation and the public comment period for the FS. The factors are

- State acceptance, and
- community acceptance.

The results of the detailed analyses (for the first seven criteria) are summarized and compared in a comparative analysis. The alternatives are compared with each other against several criteria, including the following:

Threshold criteria:

- Protection of human health and the environment; and

- Attainment of Federal and State human health and environmental requirements identified for the site.

Primary Balancing criteria:

- cost effectiveness;
- use of permanent solutions and alternative treatment technologies or resource recovery technologies, to the maximum extent practicable; and
- preference for treatment that reduces toxicity, mobility, or volume of contaminants as a principal element.

These criteria are used because SARA requires them to be considered during remedy selection. **Modifying criteria**, which include State and community acceptance, are also evaluated. State acceptance is evaluated when the State reviews and comments on the draft FS report and a Proposed Plan is then prepared in consideration of the State's comments. Community acceptance is evaluated based on comments received on the FS and Proposed Plan during a public comment period. This evaluation is described in a responsiveness summary in the Record of Decision (ROD).

The entire FS process provides the technical information and analyses that form the basis for a proposed remedial action plan (Proposed Plan) and the subsequent ROD that documents the identification and selection of the remedy.

1.2 PURPOSE OF THE FS REPORT.

The purpose of the FS report for Site 14 at NAS Whiting Field is to document the results of the study that includes developing RAOs to address contaminated media at the site and developing, screening, and evaluating potential remedial alternatives to meet these objectives. The FS was based on the results and conclusions of the RI completed for the site, and the information presented in the GIR. Information presented in these reports will not be repeated in this FS report.

The FS report for Site 14 was developed in accordance with the NCP and with USEPA's *Streamlining the RI/FS for CERCLA Municipal Landfill Sites* (USEPA, 1991a); both of these documents provide guidance for identifying technologies for municipal landfills. Because municipal landfill sites typically have similar characteristics, the USEPA recognizes that similar waste management approaches will be required for remediation. The NCP states that the USEPA expects containment technologies will generally be appropriate for waste (e.g., landfills) that pose a relatively low long-term threat or where treatment is impractical (Section 300.430[a][1][iii][B]). Additionally, the USEPA expects physical and/or thermal treatment to be considered for identifiable areas of highly toxic and/or mobile material that constitute the principal threat(s) posed by the site (Section 300.430[a][1][iii][A]).

The purpose of the FS report for Site 14 is not to present all the possible variations and combinations of remedial actions that could be taken at the site, but to present distinctly different alternatives representing a range of opportunities for meeting RAOs. It is expected that these different alternatives can be adjusted during the proposed plan and decision process, and to a lesser extent during detailed design, to accomplish RAOs in a manner similar to the initially proposed alternative. The FS report also does not present information on alternatives that fail to meet the RAOs, except for a no action alternative, which provides a baseline for comparison of all alternatives.

The components listed below are considered in identifying appropriate remedial action for Site 14.

- ***RAOs (Chapter 2.0)***. RAOs are developed to specify the contaminants, media of interest, exposure pathways, and remedial action goals for the site.

- ***Applicable Technologies (Chapter 3.0)***. Technologies applicable for addressing contaminated media at the site are identified and screened. Technologies that cannot be implemented are eliminated.

- ***Remedial Alternatives (Chapter 3.0)***. Technologies that pass the screening phase are assembled into remedial alternatives.

- ***Detailed Analysis (Chapter 4.0)***. Selected remedial alternatives are described and evaluated using seven of the nine criteria outlined in the NCP.

- ***Comparative Analysis (Chapter 5.0)***. Remedial alternatives identified for Site 14 are compared against each other using threshold and primary balancing criteria.

Upon completion of the FS report, a Proposed Plan will be developed. The Proposed Plan will identify the preferred remedial alternative for Site 14. This document will be written in community-friendly language and will be made available for public comment. Upon receipt of public comments, responses to these comments will be developed in a responsiveness summary, and the ROD will be prepared. The ROD will document the chosen alternative for the site, and will include the responsiveness summary as an appendix. Once the ROD is signed, the chosen remedial alternative will be implemented.

1.3 ENVIRONMENTAL CONDITIONS.

Site 14, Short-term Sanitary Landfill, is an approximately 3-acre area located adjacent to the southeastern boundary of NAS Whiting Field, east of Perimeter Road (Figure 1-1). It is one of six sites (Site 9 through Site 14) that comprise the area known as the southeast disposal area. The site was the primary sanitary landfill for 6 to 9 months during the latter part of 1978 and the early part of 1979.

The Initial Assessment Study conducted in 1985 by Envirodyne Engineers, Inc., revealed that for 6 to 9 months, starting in 1978 and ending in 1979, general refuse and wastes associated with pilot training, housing, and operation and maintenance of aircraft were disposed of at Site 14. The study also turned up anecdotal evidence of disposal of unknown quantities of waste paints, paint thinners, solvents, waste oils, and hydraulic fluids.

Landfilling operations ceased in this area in early 1979 because the soil contained a high clay content that resulted in the ponding of rainwater throughout the site. The disposal area was covered with soil and abandoned. Subsequent to covering the site, pine trees were planted, the predominant species being slash pine.

According to the U.S. Department of Agriculture's (USDA) Soil Conservation Service mapping (USDA, 1980), the site's soils are classified as Lucy loamy sand. Surface drainage from Site 14 is toward the unlined, vegetated "Y" ditch, which is located approximately 400 feet east of the site. The "Y" ditch drains east toward Big Coldwater Creek, which is located 1.8 miles east of Site 14 (Figure 1-2).

1.4 RI SUMMARY.

The RI report was completed by HLA in October 1999. The conclusions from the RI listed below are pertinent to the development of this FS.

- The soil at Site 14 consists of interbedded sand, silt, and clay ranging from very fine to medium grain size.

- Methane and total volatile organic compounds (TVOCs) were detected at four of the 24 soil gas locations investigated. At these locations, methane accounted for 80 percent or greater of the total gas measurement. However the occurrence of soil gas appears to be limited in areal extent (Table 5-6 of the RI) and there is no evidence of off-site migration. A total of 70 samples were collected at the site and only one location (Sample ID-32, depth 3.0 feet) had methane detected at >5,000 ppm. Remedial alternatives will identify restrictions to intrusive work at this site.

- Surface soil samples were reported to contain two volatile organic compounds (VOCs) (xylene and methylene chloride) and two semivolatile organic compounds (SVOCs) (chrysene and bis(2-ethylhexyl)-phthalate). The concentrations detected did not exceed the USEPA Region III RBCs or the Florida soil cleanup target levels (SCTLs).

- Nine inorganic analytes (aluminum, barium, cadmium, chromium, iron, manganese, potassium, and vanadium) were detected in surface soil samples at concentrations exceeding the background screening criteria. Aluminum, arsenic, beryllium, iron, vanadium, and manganese were detected at concentrations that exceeded either the USEPA Region III RBCs or Florida SCTLs.

- Subsurface soil samples collected from test pits contained four VOCs (acetone, ethylbenzene, toluene, and xylenes) and three SVOCs (4-methylphenol, naphthalene, and bis(2-ethylhexyl) phthalate) at detectable concentrations. All reported concentrations were below the Florida SCTLs and USEPA Region III RBCs. Nineteen inorganic analytes were detected in the subsurface soil samples. However, only arsenic and vanadium were detected at concentrations exceeding the USEPA Region III RBCs for residential and industrial soil and Florida residential and industrial SCTLs. The detected arsenic and vanadium concentrations did not exceed the background screening value for NAS Whiting Field.

- The human health risk assessment (HHRA) for Site 14 identified five inorganic analytes, aluminum, arsenic, iron, manganese, and vanadium as human health chemicals of potential concern (HHCOPCs) for surface soil at the site. No analytes were selected as HHCOPCs for subsurface soil. Arsenic was the only HHCOPC identified for groundwater at the site.

- The total excess lifetime cancer risk (ELCR) at Site 14 of 1×10^{-5}, associated with exposure to soil by a hypothetical future resident, exceeds Florida's target risk level of concern (1×10^{-6}) due to arsenic.

- Concentrations of arsenic detected in NAS Whiting Field background samples exceeded Florida residential SCTLs and may result in an unacceptable carcinogenic risk. It is likely that naturally occurring arsenic contributes to the Florida Department of Environmental Protection (FDEP) target risk-level exceedance.

- The surface soil, subsurface soil, and groundwater noncancer risks are below USEPA and FDEP target levels for all potential current and hypothetical future receptors.

- The results of the ERA suggest risks are not predicted for ecological receptor populations at Site 14.

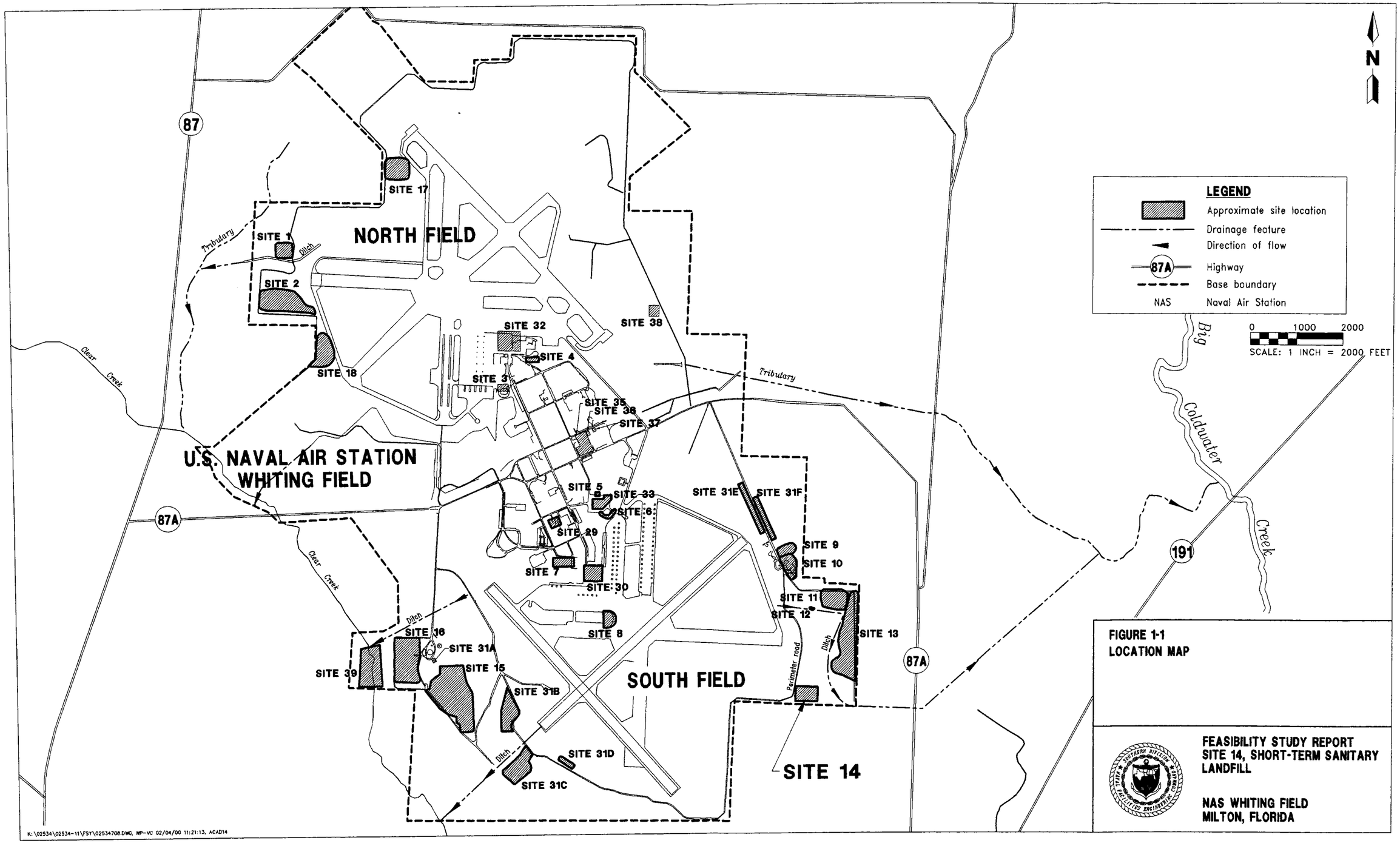

FIGURE 1-1
LOCATION MAP

FEASIBILITY STUDY REPORT
SITE 14, SHORT-TERM SANITARY LANDFILL

NAS WHITING FIELD
MILTON, FLORIDA

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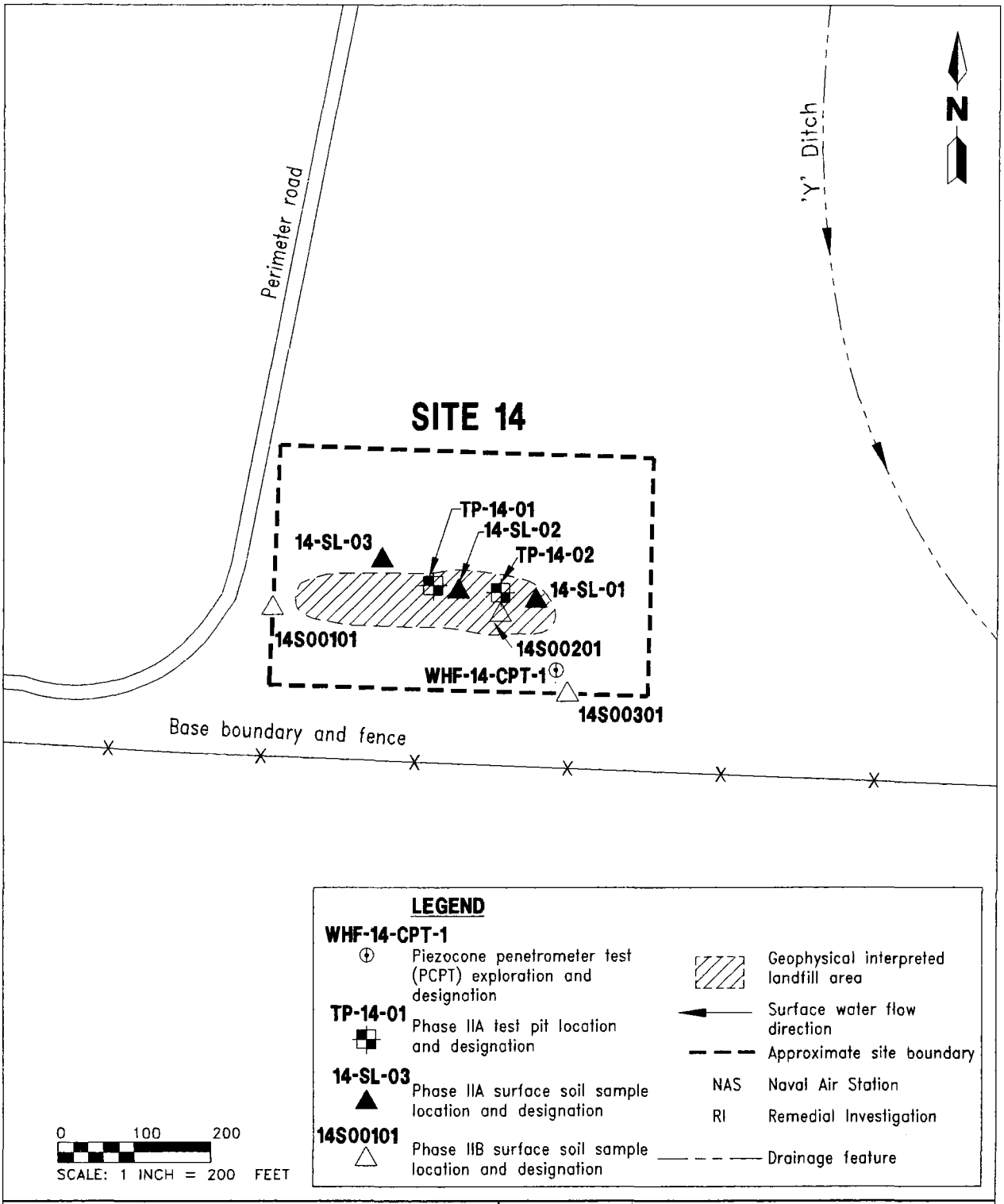

FIGURE 1-2
GENERAL FEATURES AND RI SAMPLING LOCATIONS

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FEASIBILITY STUDY REPORT
SITE 14, SHORT-TERM SANITARY LANDFILL

NAS WHITING FIELD
MILTON, FLORIDA

2.0 REMEDIAL ACTION OBJECTIVES

This section presents the goals and objectives for remedial action at Site 14 that provide the basis for selecting appropriate RAOs and, subsequently, identifying remedial technologies and developing alternatives to address contamination at the site. To establish these objectives, ARARs are first identified (Section 2.1). Next, RAOs are defined based on consideration of ARARs, the results and conclusions of the RI, the BRA, and other criteria (Section 2.2). Finally, general response actions appropriate for technology identification are discussed (Section 2.3). The information presented in this chapter will be used to identify appropriate remedial technologies for the site (presented in Chapter 3.0).

2.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS.

ARARs are Federal and State human health and environmental requirements used to define the appropriate extent of site cleanup, identify sensitive land areas or land uses, develop remedial alternatives, and direct site remediation. CERCLA and the NCP require that remedial actions comply with State ARARs that are more stringent than Federal ARARs, are legally enforceable, and are consistently enforced statewide.

The NCP defines two ARAR components: (1) applicable requirements, and (2) relevant and appropriate requirements.

> Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, or other circumstance found at a CERCLA site. State standards that may be applicable are only those which (1) have been identified by the State in a timely manner, (2) are consistently enforced, and (3) are more stringent than Federal requirements.
>
> Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements under Federal and State environmental and facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, or remedial action, address situations sufficiently similar to those encountered at the CERCLA site so that their use is well suited to the particular site. Only those State standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.

"Applicability" is a legal determination of jurisdiction of existing statutes and regulations, whereas "relevant and appropriate" is a site-specific determination of the appropriateness of existing statutes and regulations. Therefore, relevant and appropriate requirements allow flexibility not provided by applicable requirements in the final determination of cleanup levels. Once a requirement is identified as an ARAR, the selected remedy must comply with ARARs, even if the ARAR is not required to assure protectiveness. The general relevant and appropriate requirements apply only to actions at the site. Applicable requirements apply to both on- and off-site remedial actions.

Under the description of ARARs set forth in the NCP and SARA, State and Federal ARARs are categorized as

- Chemical-specific (i.e., governing the extent of site remediation with regard to specific contaminants and pollutants);
- Location-specific (i.e., governing site features such as wetland, floodplains, and sensitive ecosystems and pertaining to existing natural and man-made site features such as historical or archaeological sites); and
- Action-specific (i.e., pertaining to the proposed site remedies and governing the implementation of the selected site remedy).

Other requirements "to be considered" (TBC) are Federal and State nonpromulgated authorities or guidance that are not legally binding and do not have the status of potential ARARs (i.e., they have not been promulgated by statute or regulation). However, if there are no specific ARARs for a chemical or site condition, or if ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure the protection of human health and the environment.

During the detailed analysis of remedial alternatives, each alternative will be analyzed to determine its compliance with ARARs. Chemical-, location-, and action-specific ARARs are discussed in the following subsections and presented in Table 2-1.

2.1.1 Chemical-Specific ARARs

Chemical-specific requirements are standards that limit the concentration of a chemical found in or discharged to the environment. They govern the extent of site remediation by providing either actual cleanup levels or the basis for calculating such levels. The State of Florida has developed chemical-specific risk based SCTLs for soil. These target levels are listed in Chapter 62-777, Florida Administrative Code (FAC) (FDEP, 1999). The USEPA Region III has also developed a risk-based concentration table which specifies residential and industrial RBCs in soils (USEPA, 1998).

2.1.2 Location-Specific ARARs

Location-specific ARARs govern site features (e.g., wetlands, floodplains, wilderness areas, and endangered species) and manmade features (e.g., places of historical or archaeological significance). These ARARs place restrictions on concentrations of hazardous substances or the conduct of activities based solely on the site's particular characteristics or location.

As stated in the RI (ABB-ES, 1998), no State or federally listed rare, threatened, or endangered species or species of concern are known to inhabit Site 14 (Nature Conservancy, 1997). Furthermore, Site 14 is not located in the 100-year floodplain or known to contain areas of historical or archeological significance. Therefore location-specific ARARs do not apply to Site 14.

2.1.3 Action-Specific ARARs

Action-specific ARARs are technology- or activity- based limitations controlling activities for remedial actions. Action-specific ARARs generally set performance or design standards, controls, or restrictions on particular types of activities. To develop technically feasible alternatives, applicable performance or design standards must be considered during the detailed analysis of remedial alternatives. During the detailed analysis of alternatives, each alternative will be analyzed to determine compliance with action-specific ARARs.

Certain action-specific ARARs include permit requirements. Under CERCLA Section 121(e), permits are not required for remedial actions conducted entirely on site at Superfund sites. This permit exemption applies to all administrative requirements, including approval of or consultation with administrative bodies, documentation, record keeping, and enforcement. However, the substantive requirements of these ARARs must be attained.

2.1.4 TBC Criteria

As previously stated, TBCs are Federal and State non-promulgated advisories or guidance that are not legally binding and do not have the status of being a potential ARAR (i.e., have not been promulgated by statute or regulation). However, if there are no specific regulatory requirements for a chemical or site condition, or if ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure the protection of human health and the environment.

Table 2-1
Synopsis of Federal and State ARARs and Guidance

Feasibility Study
Site 14, Short-Term Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the National Hazardous Substance and Contingency Plan Regulations (40 Code of Federal Regulations [CFR], Section 300.430)	Discusses the types of institutional controls to be established at CERCLA sites.	**Applicable.** These regulations may be used as guidance in establishing appropriate institutional controls at Site 14.	Action-specific
Occupational Safety and Health Act (29 CFR Part 1910)	Requires establishment of programs to ensure worker health and safety at hazardous waste sites.	**Applicable.** These requirements apply to response activities conducted in accordance with the National Contingency Plan. During the implementation of any remedial alternative for Site 14, these regulations must be attained.	Action-specific
Resource Conservation and Recovery Act (RCRA) Regulations, Identification and Listing of Hazardous Waste [40 CFR Part 261]	Defines those solid wastes that are subject to regulation as hazardous waste.	**Applicable.** Any excavated materials would be sampled and analyzed for hazardous characteristics as defined by 40 CFR Part 261.	Chemical-specific
Hazardous Materials Transportation Act Regulations, [49 CFR Parts 171-179]	Provides requirements for packaging, labeling, manifesting, and transporting of hazardous materials. Similar requirements are found in 40 CFR Part 263.	**Applicable.** If surface soil, wetland sediments, or shoreline sediments are determined to be hazardous material and off-site disposal arranged, the hazardous material would need to be handled, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations.	Action-specific
RCRA Regulations, Standards Applicable to Transporters of Hazardous Wastes [40 CFR Part 263]	Establish the responsibilities of generators and transporters of hazardous waste in the handling, transportation and management of that waste. To avoid duplicative regulation, USEPA has expressly adopted certain DOT regulations (see next entry) governing the transportation of hazardous materials.	**Relevant and Appropriate.** If surface soil is determined to be hazardous material and off-site disposal is arranged, the hazardous material would need to be handled, manifested, and transported to a licensed off-site disposal facility in compliance with these regulations.	Action-specific
RCRA Regulations, Landfills (40 CFR, Part 264, Subpart N)	Provides monitoring, inspection, closure, and post-closure care requirements for landfills that contain hazardous waste.	**Relevant and Appropriate.** These regulations are not applicable to Site 14 because they apply only to landfills that received waste after 1980; however, the requirements may be used as guidance for developing a landfill inspection program.	Action-specific

See notes at end of table.

Table 2-1 (Continued)
Synopsis of Federal and State ARARs and Guidance

Feasibility Study
Site 14, Short-Term Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Name and Regulatory Citation	Description	Consideration in the Remedial Action Process	Type
Solid Waste Disposal Act Regulations, Criteria for Municipal Solid Waste Landfills (40 CFR, Part 258)	This rule establishes minimum standards for design and operation of municipal solid waste landfills.	**Relevant and Appropriate.** Although this regulation applies to RCRA municipal landfills, not CERCLA landfills, some applications may apply.	Action-specific
Region III Risk-Based Concentrations (USEPA, 1998)	Provides RBCs from ingestion or exposure to chemicals in soil, tap water, ambient air, and fish consumption.	**Applicable.** The chemicals detected at Site 14 were screened against these standards for selection of chemicals of concern and developing remedial action alternatives.	Chemical-specific
Florida Contaminant Cleanup Criteria Rule (Chapter 62-777, FAC)	Provides soil and groundwater cleanup levels.	**Applicable.** These values should be considered when evaluating cleanup levels.	Chemical-specific
Florida Rules on Hazardous Waste Warning Signs (Chapter 62-736, FAC)	Requires warning signs at National Priorities List (NPL) sites to inform the public of the presence of potentially harmful conditions.	**Applicable.** This requirement is applicable for sites that are on the NPL.	Action-specific
Florida Solid Waste Disposal Facility Regulations (Chapter 62-701, FAC)	Provides the minimum landfill final closure standards for inactive landfills. Chapter 62-701.600 provides information on closure procedures, permits, closure report, design plan, final cover design, and post closure monitoring.	**Relevant and Appropriate.** Although these regulations are not directly applicable because Site 14 did not receive wastes after the effective date of regulation (1985); Chapter 62-701.600, FAC, provides guidance for closure procedures.	Action-specific
Florida Hazardous Waste Rules (Chapter 62-730, FAC)	Adopts specific sections of the federal hazardous waste regulations, including the section regulating hazardous waste landfills (40 CFR, Part 264, Subpart N) and makes additions to these regulations.	**Relevant and Appropriate.** These regulations are not applicable to Site 14 because they apply only to landfills that received waste after 1983; however, the requirements may be used as guidance for developing a landfill inspection program.	Chemical-specific; Action-specific

Notes: ARAR = applicable or relevant and appropriate requirement.
USEPA = U.S. Environmental Protection Agency.
DOT = Department of Transportation.
TBC = "to be considered" guidance materials.

2.2 IDENTIFICATION OF RAOs.

RAOs are defined in the CERCLA RI/FS guidance manual as media-specific goals established to protect human health and the environment, and are typically based on chemicals of concern, exposure routes, and receptors present or available at the site. RAOs are developed to ensure compliance with ARARs. RAOs for Site 14 will be identified based on consideration of ARARs, the RI, and the BRA.

Groundwater. Groundwater at NAS Whiting Field has been identified as a separate site (Site 40), and will be investigated and, if necessary, remediated separately from Site 14. Therefore RAOs addressing groundwater and leaching to groundwater will be addressed in the FS for Site 40.

Surface Soil. Chemical-specific ARARs and TBCs for surface soil were considered when identifying RAOs based on ARARs. Two chemicals, arsenic and vanadium, were detected in surface soil above their respective residential and/or industrial Florida SCTLs and USEPA Region III RBCs. However, arsenic concentrations were below the FDEP approved site specific cleanup goal of 4.62 mg/kg. Vanadium exceeded the FDEP residential SCTL of 15 mg/kg. Table 2-2 provides a summary of the detected concentrations of arsenic and vanadium and their respective cleanup target levels.

The HHRA completed for Site 14 evaluated risks to current and future users of the site due to HHCPCs aluminum, arsenic, iron, manganese, and vanadium. The risks posed to trespassers, site maintenance workers, occupational workers, and excavation workers based on exposure to surface soil at Site 14 via direct contact, ingestion, or inhalation of particulates are less than the USEPA target risk range and the FDEP risk threshold.

The human health assessment for Site 14 also considered adult and child residents exposed to surface soil at the site using central tendency, or average exposure assumptions. This assessment indicated an ELCR of 1×10^{-5}, due to arsenic which is within the acceptable USEPA risk range, but exceeds Florida's target risk level of concern of 1×10^{-6}. Noncancer risks for the adult and child resident were within the acceptable USEPA and FDEP risk thresholds.

> **RAO 1:** Reduce risks associated with exposure to surface soil containing contaminant concentrations greater than action levels.

The ERA completed for Site 14 does not predict risks for ecological receptor populations.

Because Site 14 and several other sites at NAS Whiting Field are disposal sites, the Navy requested that the FDEP consider a site-specific cleanup goal for arsenic because the fill and cover material obtained at NAS Whiting Field included subsurface soil which contained elevated arsenic levels. The Navy recommended a site-specific cleanup goal for arsenic at NAS Whiting Field covered landfill sites (Sites 1, 2, 9, 10, 11, 12, 13, 14, 15, and 16) of 4.62 milligrams per kilogram. This request is included as Appendix A of this report.

The FDEP responded to this request in a letter dated April 27, 1998 (FDEP 1998a). The FDEP concurred with the recommendation for the site-specific cleanup goal for arsenic at NAS Whiting Field disposal sites given the following conditions:

- In the future, the disposal sites will be used for activities that involve less than full-time contact with surface soil at the site. These activities could include parks, recreation areas, or agricultural sites.
- The Navy will incorporate these land-use considerations into a Land-Use Control Agreement.
- The site-specific cleanup goal for arsenic will not be used at any other site without prior FDEP approval.

Based on establishment of this site-specific cleanup goal for arsenic at Site 14, NAS Whiting Field, and as shown in Table 2-2, the establishment of a chemical-specific RAO for arsenic is not necessary if the above conditions are met. However, pending the future land use of Site 14 and a cost sensitivity analysis, varying levels of site cleanup may be required.

In order to apply the FDEP approved site-specific cleanup goal for arsenic at NAS whiting Field disposal sites, the Navy must adhere to the conditions of the FDEP concurrence letter (Appendix B) and the Memorandum of Agreement (MOA).

Subsurface Soil. Chemical-specific ARARs and TBCs for subsurface soil were considered when identifying RAOs based on ARARs. The chemicals detected in subsurface soil at Site 14 were compared to the State SCTLs and to the USEPA RBCs for industrial sites, and no exceedances were noted. Based on this analysis, no RAOs will be developed for subsurface soil at Site 14.

Waste Disposal. Action-specific ARARs related to landfill closure were considered for identifying RAOs. In order to complete this review, it was noted that the disposal site at Site 14 did not receive wastes after 1979. Based on this review, Federal and State landfill closure regulations were deemed not applicable to Site 14 for the following reasons:

- Federal regulations for closure of Resource Conservation and Recovery Act (RCRA) hazardous waste landfills (40 CFR, Part 264, Subpart N) are not applicable because the disposal sites did not receive waste after the effective date of RCRA, November 19, 1980;

- Federal regulations for the closure of solid waste landfills (40 CFR, Part 258) are not applicable because the disposal site did not receive waste after the effective date of the regulation, October 9, 1993; and

- Florida Solid Waste Disposal Facilities Regulations (Florida Administrative Code, Chapter 62-701) are not applicable because the disposal site did not receive waste after the effective date of the regulation, July 1, 1983.

The closure requirements described in these regulations do not apply to disposal areas that received their final covers before 1983; however, closure certification of the site has not been provided by the FDEP. Therefore, the following RAO has been developed for Site 14:

> **RAO 2:** Complete closure of the disposal area in accordance with State and Federal ARARs for landfill closure.

Other Considerations. Although the above-referenced regulations are not directly applicable to remedial action at Site 14, portions of the regulations may be relevant for developing remedial alternatives for the sites. For example, the *Draft Technical Manual for Solid Waste Disposal Criteria* (USEPA, 1992) provides information regarding statistical evaluation of groundwater monitoring data. In addition, guidance published for CERCLA sites provides information regarding closure of CERCLA landfills.

As stated in *Design and Construction of RCRA/CERCLA Final Covers* (USEPA, 1991b), closure of CERCLA landfills that are not subject to specific closure regulations can be achieved by "hybrid-landfill closure." A "hybrid-landfill closure" may be used when residual contamination poses a direct contact threat, but does not pose a groundwater threat. As indicated from the results of the RI (ABB-ES, 1998b), chemicals in soil and groundwater at Site 14 do not pose a serious groundwater threat. Therefore, Site14 qualifies for a

Table 2-2
Summary of Chemicals Exceeding Chemical-Specific ARARs and TBCs in Surface Soil

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Analyte	Frequency of Detection[1]	Range of Detected Analyte Concentration	Background Screening Value[2]	Soil Cleanup Target Level Residential/ Industrial[3]/Leachability	USEPA Region III RBCs Residential/ Industrial[4]	Site-Specific Soil Cleanup Goal[5]
Inorganic Analytes (ug/L)						
Arsenic	6/6	1.7* to 4.3	3	0.8/3.7/29	0.43/3.8	4.62
Vanadium	6/6	14.1 to 42.1	21.2	15**/7,400/980	550/14,000	NA

[1] Frequency of detection is the fraction of total samples analyzed in which the analyte was detected.
[2] Background screening values are two times the arithmetic mean of detected background concentrations.
[3] Source: Contaminant Cleanup Target Levels, Chapter 62-777, FAC (June 1999).
[4] USEPA Region III RBCs for soil ingestion based on an excess lifetime cancer risk of 1×10^{-6} or an adjusted hazard quotient of 0.1. (October 1998).
[5] Site-specific cleanup goal for arsenic based on information provided in Appendices A and B.

Notes: ARAR = applicable or relevant and appropriate requirement.
TBC = "to be considered" guidance material.
mg/kg = milligrams per kilogram.
NA = not applicable.
* = average of sample and duplicate.
** = value based on acute toxicity considerations.

hybrid-landfill closure and USEPA guidance (USEPA, 1991b) suggests the following items be considered for hybrid-landfill closures:

- covers, which may be permeable, to prevent a direct contact threat;
- limited long-term cover maintenance;
- minimal groundwater monitoring; and
- institutional controls (e.g., land-use controls), as necessary.

Based on consideration of these items and the recommendations of the RI (including the RA), some or several of these components will be considered in developing remedial alternatives for Site 14.

Summary of RAOs. Two RAOs have been established for Site 14. Table 2-3 lists the RAOs.

Table 2-3
Summary of Remedial Action Objectives

Feasibility Study
Site 14, Short-Term Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Remedial Action Objectives	Description
1	Reduce risks associated with exposure to surface soil containing contaminant concentrations greater than action levels.
2	Complete closure of disposal area in accordance with State and Federal ARARs for landfill closure.

2.3 VOLUME OF CONTAMINATED MEDIA.

Surface soil is the only media at Site 14 for which RAOs have been established. Therefore, this section presents the basis for the calculation of the volume of surface soil containing COCs above RAOs. Appendix C contains detailed calculations and supporting information used to develop the soil volume.

The chemicals of concern for which RAOs were identified are arsenic and vanadium in surface soil. All six samples collected at the site contained arsenic vanadium above their respective residential SCTLs. Calculations presenting the extent of contamination are included in Appendix C.

The sampling locations where chemical concentrations exceeded the residential SCTLs are shown in Appendix C. The depth range of contamination was assumed to be 0 to 2 feet. Confirmatory soil sampling is proposed under one of the alternatives to ensure that cleanup goals are met. The volume of contaminated soil is approximately 2,600 cy.

2.4 IDENTIFICATION OF GENERAL RESPONSE ACTIONS.

General response actions describe potential medium-specific measures that may be employed to address RAOs. Potential response actions for CERCLA sites include the following general response categories:

- no action
- limited action
- containment
- treatment (either *in situ* or *ex situ*)
- disposal

To develop appropriate response actions for former disposal sites, the NCP and USEPA provide guidance for developing general response actions for such sites. The USEPA has produced a document entitled

Streamlining the RI/FS for CERCLA Municipal Landfill Sites (USEPA, 1991a). Because municipal landfill sites typically have similar characteristics as land disposal sites, the USEPA recognizes that similar waste management approaches will be required for remediation. The NCP states that the USEPA expects containment technologies will generally be appropriate for landfills that pose a relatively low long-term threat or where treatment is impractical (Section 300.430[a][1][iii][B]). Therefore, the number of general response actions identified for Site 14 are limited based on these guidance documents.

The USEPA states in *Streamlining the RI/FS for CERCLA Municipal Landfill Sites* (USEPA, 1991a) that physical and/or thermal treatment technologies should be considered for identifiable areas of highly toxic and/or mobile material that constitute the principal threat(s) posed by the site (Section 300.430[a][1][iii][A]). However, the RI for Site 14 did not identify highly toxic areas or materials that pose a principal threat; therefore, the general response actions identified for Site 14 do not include physical or thermal treatment technologies. As a result, the presumptive remedy for Site 14 are focused on limited action and disposal technologies rather than physical or chemical treatment technologies.

In summary, the general response actions identified for Site 14 include:

- no action;
- limited action (i.e., land-use controls); and
- disposal (i.e., soil removal).

3.0 REMEDIAL ACTION ALTERNATIVES

The approach and rationale leading to the development of remedial alternatives for Site 14 are presented in this chapter. The development of remedial alternatives for CERCLA sites consists of identifying applicable technologies, screening those technologies, and using the selected technologies to develop remedial alternatives that accomplish the RAOs identified in Chapter 2.0.

The NCP requires that a range of remedial alternatives be considered. SARA emphasizes the use of treatment technologies. Treatment alternatives range from those that eliminate the need for long-term management to those that reduce toxicity, mobility, or volume of contaminants. The range of alternatives considered in this FS include technologies from the following categories:

- no action
- limited action (land-use controls)
- disposal (soil excavation and disposal)

The NCP and USEPA provide guidance for developing remedial alternatives (USEPA 1991). Because municipal landfill sites typically have similar characteristics, the USEPA recognizes that similar waste management approaches will be required for remediation. Section 300.430[a][1][iii][B] of the NCP states that the USEPA expects containment technologies will generally be appropriate for waste (e.g., landfills) that poses a relatively low long-term threat or where treatment is impractical. In this FS, the number of technologies and alternatives evaluated for Site 14 were limited in scope based on these guidance documents.

The remaining sections of this chapter identify the types of technologies that contribute to achieving the RAOs, evaluate and select representative technologies for each technology type, and develop remedial alternatives using the selected technologies. A detailed evaluation of remedial alternatives is presented in Chapter 4.0.

3.1 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES.

The purpose of this section is to identify and screen appropriate technologies for assembly into remedial alternatives that address the RAO identified for Site 14. Each technology is then screened based on site- and waste-limiting characteristics.

Site characteristics considered during this process included the following:

- site geology, hydrogeology, and terrain;
- availability of space and resources necessary to implement the technology; and
- presence of special site features (e.g., wetlands, floodplains, or endangered species).

The following waste characteristics were also considered:

- contaminated media,
- types and concentrations of waste constituents, and
- physical and chemical properties of the waste (e.g. volatility, solubility, and mobility).

Table 3-1 presents the remedial technologies applicable for addressing the RAOs for Site 14. This table also presents the screening of those technologies. The technology screening process reduces the number of potentially applicable technologies by evaluating the applicability of each technology to site- and waste-limiting factors. Technologies deemed ineffective or not implementable were eliminated from further consideration. The remaining technologies are assembled into remedial alternatives in Section 3.2.

Table 3-1
Identification and Screening of Remedial Technologies

Feasibility Study
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General Response Action and Technology	Description of Technology	Applicability to:		Screening Status
		Site Characteristics	Waste Characteristics	
No Action				
No action	No remedial actions are taken at Site 14. Five-year site reviews would be required.	Applicable.	Applicable.	Retained. This alternative is retained for a baseline for comparison with other alternatives as required by CERCLA.
Five-year site reviews	Under CERCLA, if wastes are left on a site after closure, the site should be reviewed every 5 years.	Applicable.	Applicable.	Retained. This alternative is retained based on the CERCLA requirement that if wastes remain on site after closure, a review of the site must be completed every 5 years.
Limited Action				
Land-use controls	Use of land-use control documents to maintain the site for non-residential purposes.	Applicable.	Applicable.	Retained. This alternative is retained because it would achieve RAO 1.
Containment				
Soil covering and related activities	A cover material (i.e. clay, soil, asphalt, gravel, or synthetic membrane) is placed over the site. Provides a barrier preventing receptor contact with Site 14 soil.	Applicable.	Applicable.	Eliminated. The minimal extent of soil contamination at Site 14 makes use of this technology cost prohibitive.

See notes at end of table.

Table 3-1 (Continued)
Identification and Screening of Remedial Technologies

Feasibility Study
Site 14, Short-Term Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

General Response Action and Technology	Description of Technology	Applicability to:		Screening Status
		Site Characteristics	Waste Characteristics	
Containment (Continued)				
Soil stabilization	Soils are mixed with an additive, such as a reactive chemical or concrete, to bind specific analytes chemically or physically with soil particles. This technology eliminates migration of contaminants from soil. The process can be performed *in situ* or *ex situ*.	Applicable.	Applicable.	Eliminated. This alternative would achieve the RAO, however significant arsenic migration from Site 14 is not expected.
Disposal				
Off-Site Soil Disposal:				
RCRA Subtitle D Solid Waste Landfill	Removed soil is sampled and analyzed for waste classification. Soil is transported to a nonhazardous, solid waste landfill based on analytical results from excavated soil.	Applicable. Soil is most likely not characteristically ignitable, corrosive, reactive, or toxic.	Applicable. Analytical results from the RI indicate that the soil would most likely not be classified as hazardous for toxicity.	Retained.
RCRA Subtitle C Hazardous Waste Landfill	Excavated soil is sampled and analyzed for waste classification. Soil is transported to a hazardous, solid waste landfill based on analytical results from excavated soil.	Not Applicable. Soil is most likely not characteristically ignitable, corrosive, reactive, or toxic.	Not Applicable. Analytical results from the RI indicate that the soil would most likely not be classified as hazardous for toxicity.	Eliminated. It was assumed that soil at Site 14 would be classified as nonhazardous.

Notes: CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act.
RAO = remedial action objective.
RCRA = Resource Conservation and Recovery Act.
RI = remedial investigation

3.2 REMEDIAL ALTERNATIVES.

Remedial technologies that passed the technology screening are assembled into alternatives that will meet the RAOs. Table 3-2 presents the alternative development for Site 14. The alternatives for Site 14 were developed to address closure of the disposal area in accordance with ARARs.

Table 3-2
Development of Remedial Alternatives

Feasibility Study
Site 14, Short-Term Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Alternative	Description of Key Components
Alternative 1: No Action	Five-year site review.
Alternative 2: Land-Use Controls	land-use controls including land-use control implementation plans. Five-year site review.
Alternative 3: Soil Excavation and Disposal	Posting of warning signs. Clearing and grubbing of disposal area. Disposal of landfill soil. Site restoration. Five-year site review.

Based on applicable technologies identified in the preceding section, three remedial alternatives were developed for Site 14. These alternatives are options under the no action, limited action, and disposal general response categories. The no action alternative was developed to provide a baseline for comparison with other alternatives (USEPA, 1988). The alternatives developed for Site 14 are discussed in the following subsections.

3.2.1 Alternative 1: No Action

The NCP requires the development of the no action alternative to provide a baseline for comparison against other remedial alternatives. This alternative (i.e. Alternative 1) does not involve the implementation of any remedial technologies to treat wastes at Site 14. Under CERCLA Section 121(c), any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years. The 5-year site review typically involves an administrative review of site records. For cost estimating purposes, Alternative 1 would include 5-year reviews for a period of 30 years.

3.2.2 Alternative 2: Land-Use Controls

Alternative 2 consists of activities necessary to maintain land-use controls at the Site 14 landfill. These activities are

- land-use controls and
- 5-year site reviews.

Land-use controls restricting the use of the land in the vicinity of a disposal area and place regulatory controls on excavation of soil, would be drafted, implemented, and enforced in compliance with local regulations as a part of this alternative. The land-use controls would be enforced on the parcel of land encompassing the disposal site, including a typical buffer zone, as is currently used at other sites in the State.

Under CERCLA Section 121(c), any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years.

3.2.3 Alternative 3: Soil Excavation and Disposal

One disposal alternative developed for Site 14 consists of excavation and off-site disposal of the landfill soil.

Prior to soil removal and disposal, the site would be cleared and grubbed to facilitate excavation. One composite sample would be collected from the landfill to characterize the soil for off-site disposal. After the soil was taken to off-site disposal areas, the excavation area would be backfilled with clean fill and topsoil. The fill material and topsoil would be transported from a nearby off-site borrow source using dump trucks and tractor-trailers. The backfill would be spread across each excavated area using a bulldozer.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

This chapter presents detailed analyses of alternatives for Site 14 at NAS Whiting Field. A detailed analysis is performed to provide decision makers with sufficient information to select the appropriate remedial alternative for a site. The detailed analysis has been conducted in accordance with CERCLA Section 121, the NCP, and USEPA RI/FS guidance (USEPA, 1988). The detailed evaluation of each remedial alternative includes the following:

- a detailed description of the alternative, emphasizing the applications of the technology or actions proposed for each alternative; and
- a detailed analysis of the alternative against seven of the nine criteria.

The remedial alternatives are examined with respect to the requirements stipulated by CERCLA and factors described in the USEPA's *Guidance for Conducting RI/FS Under CERCLA* (USEPA, 1988). The nine criteria from the RI/FS guidance document are

- overall protection of human health and the environment;
- compliance with ARARs
- long-term effectiveness and permanence;
- reduction of toxicity, mobility, and volume of contaminants through treatment;
- short-term effectiveness;
- implementability;
- cost;
- State acceptance; and
- community acceptance.

This FS presents evaluation of the first seven criteria in the alternative evaluation process. Table 4-1 outlines the specific elements considered for these seven criteria. Typically, State acceptance (i.e., the eighth factor) is addressed when comments on the draft FS report have been received from the State. Therefore, State comments will be addressed in the final FS, and a summary of State acceptance of this FS will be included in the final FS report.

Community acceptance (i.e., the ninth factor) is addressed upon receipt of public comments on the Proposed Plan (USEPA, 1988). The responsiveness summary, included as an appendix to the ROD for the site, is intended to provide the overview of achievement of this ninth criterion.

4.1 DETAILED ANALYSIS FOR ALTERNATIVE 1: NO ACTION.

Alternative 1 is a no action alternative. Under this alternative, no actions would be taken to address contamination at the site. A description of this alternative is presented in Subsection 4.1.1, and a technical assessment of this alternative is presented in Subsection 4.1.2.

4.1.1 Detailed Description of Alternative 1

In accordance with the NCP, the no-action alternative is used as a baseline for comparison against other alternatives. Because hazardous substances, pollutants, or contaminants would be left in place at Site 14 as part of this alternative, this alternative would include 5-year site reviews. There would be no restrictions on land-use types; therefore, the site could be used for residential use or other high-exposure uses.

Five-Year Site Reviews. Under CERCLA Section 121(c), any remedial action that results in hazardous substances, pollutants, or contaminants remaining on site must be reviewed at least every 5 years. It is

assumed, for this FS, that these reviews would occur over a 30-year period. These reviews would consist of evaluating changes to site conditions at the site (e.g. construction, demolition, change in potential receptors, migration pathways, qualitative risks, etc.) to assess whether or not human health and the environment continue to be protected by the alternative. The appropriateness of this alternative would then be compared to other remedial alternatives to confirm that it is still the most appropriate selection.

Table 4-1
Criteria for Evaluation of Remedial Action Alternatives

Feasibility Study
Site 14, Short-Term Sanitary Landfill
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Factors	Criteria to Consider
Overall protection of human health and the environment	How risks are eliminated, reduced, or controlled. Short-term or cross-media effects.
Compliance with ARARs	Compliance with chemical-specific ARARs. Compliance with location-specific ARARs. Compliance with action-specific ARARs.
Long-term effectiveness and permanence	Magnitude of residual risk. Adequacy of controls. Reliability of controls.
Reduction of mobility, toxicity, and volume of contaminants through treatment	Treatment process and remedy. Amount of hazardous materials destroyed or treated. Reduction of mobility, toxicity, or volume through treatment. Irreversibility of treatment. Type and quantity of treatment residual.
Short-term effectiveness	Protection of community during remedial action. Protection of workers during remedial action. Environmental effects. Time until RAOs are achieved.
Implementability	Ability to construct technology. Reliability of technology. Ease of undertaking additional remedial action, if necessary. Coordination with other agencies.
Cost	Capital cost. Operation and maintenance cost. Total present worth of alternative.

Notes: ARAR = applicable or relevant and appropriate requirement.
RAO = Remedial Action Objective.

4.1.2 Technical Criteria Assessment of Alternative 1

This subsection provides the technical criteria assessment of Alternative 1 against the seven criteria.

Overall Protection of Human Health and the Environment. This alternative would provide no additional protection to human receptors who may be exposed to soils at Site 14. If this alternative were selected, 5-year site reviews would be instituted.

No adverse short-term or cross media effects are anticipated with this no-action alternative.

Compliance with ARARs. This alternative would not comply with chemical-specific ARARs or TBCs (e.g., MCLs, Florida GCTLs, or Florida SCTLs) in the short term. Eventually, this alternative may comply with ARARs if natural processes including physical, chemical, and biological changes in the soil and groundwater reduce contaminant concentrations.

Long-Term Effectiveness and Permanence. Land-use controls are not part of the alternative; therefore, human and ecological risks due to exposure to site soils would not be addressed via this alternative. Therefore, these risks would remain over a period of time until natural processes reduce the contaminant concentrations and reduce the mobility of the contaminants, or other land-use controls are implemented.

Administrative actions proposed in this alternative (e.g., 5-year site reviews) would provide a means of evaluating the effectiveness of the alternative, but would not provide a permanent remedy for the site. Administrative actions are considered to be reliable controls.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. This alternative would not provide a reduction in contaminant toxicity, mobility, or volume because no active mitigation of contaminant concentrations is proposed. No treatment residuals would be produced if this alternative were implemented.

Short-Term Effectiveness. This alternative would not reduce human or ecological health risks in the short term because no land-use restrictions would be implemented.

This alternative does not pose a threat to workers through exposure to contaminated soils because remedial construction activities are not proposed under this alternative.

Implementability. This alternative does not require remedial construction for implementation. Other activities, such as 5-year site reviews, are easily implemented.

Cost. The present worth cost of Alternative 1 is presented in Table 4-2. The 5-year site reviews were estimated over a 30-year monitoring period. A 30-year period was chosen only because the RI/FS guidance recommends using this time frame. The total present worth cost of Alternative 1 is $19,000. Cost estimates are presented in Appendix D.

Table 4-2
Cost Summary Table, Alternative 1: No Action

Feasibility Study
Site 14, Short-Term Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Operation and Maintenance Cost (O&M) (per event)		
5-year site review		$5,000
	Total O&M cost (per event)	$5,000
	Total O&M cost (present worth of semi-annual O&M for 30 years)	$17,000
	Contingency (10 percent)	$2,000
	Total cost Alternative 1: no action	$19,000

Note: Costs are rounded to the nearest $1,000. See Appendix D for cost details.
Total cost is based on present worth costs.

4.2 DETAILED ANALYSIS FOR ALTERNATIVE 2: LAND-USE CONTROLS.

Alternative 2 consists of administrative actions to limit the exposure to soils at Site 14. A description of this alternative is presented in Subsection 4.2.1, and a technical assessment of this alternative is presented in Subsection 4.2.2.

4.2.1 Detailed Description of Alternative 2

Under this alternative, land-use controls would be implemented that would provide protection to human receptors. These land-use controls would involve the use of institutional controls that would restrict the use of the land in the vicinity of Site 14. The agreement would mandate an ongoing inspection program to ensure compliance while the land-use controls are in effect. Additionally, land-use controls would place regulatory controls on the excavation of soils or similar activities that have the potential to disturb the site soils or increase the likelihood of exposure to the site soils. The land-use controls would be placed on a parcel of land slightly larger than the boundaries of the current disposal area. This would ensure that an appropriate buffer zone is created and maintained between the disposal area and other areas of NAS Whiting Field.

The following components would be included as part of this alternative:

- Land-use controls, and
- 5-year site reviews.

Land-Use Controls. Under new USEPA Region IV guidance, the use of the land-use controls as a remedy for contaminated sites requires the development of an land-use control assurance plan, as provided in the MOA dated November 1999, and a land-use control implementation plan (LUCIP). These documents detail the actions required when land-use controls are selected as a remedy for a site.

The LUCIP is then developed for each site where land-use controls are necessary on the facility. The LUCIP would include details regarding additional required activities, such as quarterly and annual inspection, and reporting for the specific area. These activities are required as part of the land-use control agreement to ensure compliance while the land-use controls for the sites are in effect. Further, because land-use controls will remain in effect until the contamination at the sites has been adequately addressed, the activities identified in the LUCIP will also remain in effect until such time that the contamination present at the sites has been adequately addressed.

5-Year Site Reviews. Refer to Subsection 4.1.1 for a detailed description of these reviews.

4.2.2 Technical Criteria Assessment of Alternative 2

This subsection presents the technical criteria assessment of Alternative 2.

Overall Protection of Human Health and the Environment. Human receptors, namely potential future residents, would be protected if this alternative were implemented. Regulatory controls (i.e. land-use controls) would prohibit potential future residents from exposure to the site because residential use of the site would be restricted under the proposed land-use controls.

By implementing this alternative, no adverse short-term or cross-media effects are anticipated.

Compliance with ARARs. This alternative would comply with chemical-specific ARARs or TBCs (e.g., MCLs, Florida GCTLs, or Florida SCTLs). Concentrations of contaminants are less than their respective industrial SCTLs or site-specific cleanup goals, as discussed in Chapter 2.0.

Long-Term Effectiveness and Permanence. The risks presented to the future resident and ecological receptors based on exposure to surface soil at the site would be addressed via the land-use controls. The long-term effectiveness and permanence of these controls will be managed by the facility under the MOA dated November 1999.

Administrative actions proposed in this alternative (e.g., land-use controls and 5-year site reviews) would provide a means of evaluating the effectiveness of the alternative. These administrative actions are considered to be reliable controls.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment. Although no treatment is included in this alternative, this alternative may provide some reduction in contaminant toxicity through natural processes. However, this alternative would not provide a reduction in contaminant mobility or volume because no active mitigation of contaminant mobility or reduction in volume is proposed. No treatment residuals would be produced if this alternative were implemented.

Short-Term Effectiveness. This alternative would reduce human health risks in the short term by reducing the potential exposure to Site 14 soils by human receptors.

This alternative does not pose a threat to workers through exposure to contaminated soils because only limited remedial construction activities (e.g., posting signs) are proposed under this alternative.

Implementability. This alternative does not require remedial construction for implementation. Other activities, such as land-use controls and 5-year site reviews, are easily implemented.

Cost. The present worth cost of Alternative 2 is presented in Table 4-3. Both the land-use controls and 5-year site reviews were costed out over a 30-year monitoring period. A 30-year period was chosen only because that is what the RI/FS guidance recommends. The total present worth cost of Alternative 2 is $135,000. Cost estimates are presented in Appendix D.

Table 4-3
Cost Summary Table, Alternative 2: Land-Use Controls

Feasibility Study
Site 14, Short-Term Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Direct Cost	
Land-use controls	$12,000
Total direct cost	$12,000
Operation and Maintenance Cost (O&M) (per event)	
5-year site review	$ 5,000
Inspection/Reporting	$7,000
Total O&M cost (per event)	$ 12,000
Total O&M cost (present worth of semi-annual O&M for 30 years)	$111,000
Total Direct and O&M	$123,000
Contingency (10 percent)	$12,000
Total cost Alternative 2: Land-Use Controls	$135,000

Note: Costs are rounded to the nearest $1,000. See Appendix D for cost details.
Total costs are based on present worth costs.

4.3 DETAILED ANALYSIS FOR ALTERNATIVE 3: SOIL EXCAVATION AND DISPOSAL.

Alternative 3 consists of excavation and disposal of the contaminated soil at Site 14. A description of this alternative is presented in Subsection 4.3.1, and a technical criteria assessment of this alternative is presented in Subsection 4.3.2.

4.3.1 Detailed Description of Alternative 3

Alternative 3 is designed to address RAOs at Site 14. It includes the following components:

- site preparation
- waste characterization
- soil removal and disposal
- site restoration

Site Preparation. Trees, shrubs, and other vegetation will be cleared with a backhoe or other type of excavation equipment as necessary prior to excavation. Small brush vegetation will be chopped and spread over the disposal area surface. Large trees will be disposed of as yard-waste at an appropriate mulching or tree recycling facility.

Waste Characterization. One composite waste characterization sample will be taken and analyzed prior to removal activities. Based on the RI, it is expected that the results of the sample will allow for disposal at a Resource Conservation and Recovery Act Subtitle D (Solid Waste) Landfill.

Soil Removal. The soil (6,200 yd^3) will be removed with a backhoe and loaded immediately into rolloffs or dumptrucks. Excavated soil will then be transported to a local landfill.

Site Restoration. A 2-foot layer of soil will be placed over the excavated areas to support vegetative growth. The soil will be obtained from an off-site borrow source to provide the adequate soil composition required to stimulate and support natural vegetation. The soil will be analyzed for target compound list volatile organic compounds, SVOCs, pesticides and polychlorinated biphenyls, target analyte list inorganic analytes, and TRPH and checked for pH to verify that it is "clean" fill and exhibits a pH between 6 and 7.5.

Selected seed and fertilizer will be placed on the vegetative support layer to establish vegetation. Hay will be used to protect the seed and fertilizer during initial development.

4.3.2 Technical Criteria Assessment of Alternative 3

This subsection presents the technical criteria assessment of Alternative 3.

Overall Protection of Human Health and the Environment. Overall protection of human health would be achieved by the implementation of Alternative 3.

This alternative would adversely impact the environment by removing trees and vegetation across the site. However, site restoration activities, such as seeding and fertilizer, would promote vegetative growth, and human and ecological receptor exposure to contaminants would be eliminated.

Compliance with ARARs. This alternative would comply with chemical-specific ARARs or TBCs (e.g., MCLs, Florida GCTLs, or Florida SCTLs). Source excavation, transportation and disposal, and backfilling activities comply with ARARs identified for this site. Concentrations of contaminants are less than their respective industrial Florida SCTLs or site-specific cleanup goals, as discussed in Chapter 2.0.

Worker safety standards will be maintained during removal activities to comply with ARARs. A site-specific health and safety plan will be developed and implemented during all site activities.

Long-Term Effectiveness and Permanence. This alternative is expected to provide long-term effectiveness and permanence by excavation and disposal of contaminant source materials.

Reduction of Toxicity, Mobility, and Volume of Contaminants through Treatment.

Alternative 3 does not include treatment of contaminants and does not physically or chemically alter contaminants in soil at the site. However, this alternative does reduce the volume (approximately 2600 yd^3) of contaminants on site because the contaminated soil would be taken off site for disposal.

Short-term Effectiveness. This alternative would provide an immediate reduction in risk to human health. Worker exposure to contaminants during excavation and soil handling activities would be minimal and can be addressed in a site health and safety plan. Non-site workers and trespassers would be protected once the excavated soils were backfilled with clean fill.

Implementability. Equipment and materials are readily available to remove the soil for Alternative 3. Site work will be completed within a 30-day period and will require standard removal expertise. The quantity of soil necessary to sustain the vegetative cover is available locally.

Cost. The cost estimate for Alternative 3 is presented in Table 4-4, and detailed cost calculations are provided in Appendix D. This estimate is based on the preliminary design criteria presented in this section. The total present worth cost of Alternative 3 is approximately $793,000.

Table 4-4
Cost Summary Table, Alternative 3: Soil Excavation and Disposal with Land-Use Controls

Feasibility Study
Site 14, Short-Term Sanitary Landfill
Naval Air Station Whiting Field
Milton, Florida

Direct Cost		
Mobilization		10,000
Site preparation		16,000
Site clearing and grubbing		7,000
Soil sampling		12,000
Vegetative support layer		107,000
Loading and off site soil disposal		415,000
Site restoration		5,000
Total direct cost		572,000
Indirect Cost		
Health and safety (3%)		17,500
Administration and permitting (3%)		17,500
Engineering and design (10%)		57,000
Construction support services (10%)		57,000
Total indirect cost		149,000
	Total capital cost (direct + indirect)	721,000
	Contingency (10 percent)	72,000
	Total cost Alternative 3: Off-Site Disposal	793,000

Notes: Total cost is based on present worth costs.
Costs are rounded to be nearest $1,000. See Appendix D for details.

5.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

Remedial alternatives for Site 14 were developed in Chapter 3.0 and were individually evaluated in Chapter 4.0 using seven criteria. For comparative purposes, these criteria are grouped into the following categories:

- threshold criteria
- primary balancing criteria
- modifying criteria

The remainder of this chapter presents a comparison of remedial alternatives with respect to these criteria. This comparison is intended to provide technical information required to support the selection of a preferred alternative for Site 14.

5.1 OVERALL APPROACH TO COMPARATIVE ANALYSIS.

As presented in Chapter 4.0, remedial alternatives were developed to accomplish the RAOs identified for the site. The three sets of criteria identified above are used to streamline the comparison between alternatives while ensuring compliance with the RAOs. Components of these criteria are described below.

5.1.1 Threshold Criteria

Because the selected remedy must be protective of human health and the environment, as well as comply with ARARs, the following two threshold criteria are essential:

- overall protection of human health and the environment, and
- compliance with ARARs.

An individual assessment of each alternative with respect to these criteria was presented in Chapter 4.0. An overall comparative analysis of alternatives using threshold criteria is presented in Section 5.2.

5.1.2 Primary Balancing Criteria

Primary balancing criteria consist of the following five components:

- long-term effectiveness and permanence;
- reduction of toxicity, mobility, and volume of contaminants through treatment;
- short-term effectiveness;
- implementability; and
- cost.

These criteria are used to provide an assessment of the permanence of each remedial alternative, while ensuring their implementability and cost-effectiveness. An individual assessment of each alternative with respect to these criteria is presented in Chapter 4.0. An overall comparative analysis of alternatives using primary balancing criteria is presented in Section 5.2.

5.1.3 Modifying Criteria

The final two criteria are as follows:

- State acceptance, and
- community acceptance.

Typically, State acceptance (i.e., the eighth factor) is addressed when comments on the draft FS report have been received from the State. Therefore, State comments will be addressed in the Final FS, and a response to State comments will be included in the final FS report.

Community acceptance (i.e., the ninth factor) is addressed upon receipt of public comments on the Proposed Plan (USEPA, 1988). The responsiveness summary, included as an appendix to the ROD for the site, is intended to provide the overview of achievement of this ninth criterion.

Based on this information, an evaluation of modifying criteria is not included in this FS.

5.2 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVE.

This section provides a comparative analysis for remedial alternatives for Site 14 with respect to the criteria described in Section 5.1.

5.2.1 Comparison of Threshold Criteria

The remedial alternatives for Site 14 were first compared to the two threshold criteria: overall protection of human health and the environment and compliance with ARARs.

Alternative 1 does not provide a means of restricting future land use of the area. Therefore, this alternative does not protect potential future residents from environmental conditions at the site. Alternative 1 would not achieve the RAOs established for Site 14.

The implementation of Alternative 2 would provide a measure of continued protection of human health and the environment because the alternative includes land-use controls. In this manner, Alternative 2 would achieve the RAOs established for the site and would also achieve ARARs.

Alternative 3 would remove contaminated soils from Site 14, which would achieve ARARs and the RAOs established for the site.

5.2.2 Comparison of Primary Balancing Criteria

A comparison is made between alternatives with respect to five criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume of contaminants through treatment; short-term effectiveness; implementability; and cost.

For long-term effectiveness, Alternatives 1 and 2 will not reduce concentrations of arsenic and vanadium through natural mechanisms. Alternative 3 would provide long-term effectiveness by removing surface soil where COC concentrations exceed action levels established in the RAOs.

Alternative 3 would reduce the volume of contaminated soil at Site 14. Alternative 3 is the only alternative where off-site disposal of contaminated soil would reduce the toxicity and volume on site. However, the removal of the top 2 feet of contaminated surface soil and placement of 2 feet of clean soil cover on site would still not address the contamination in subsurface soils. If excavation of the 2 feet of the clean soil cover occurred, it would expose receptors to contaminated soil. Therefore, if excavation and soil covering were accomplished, land-use controls would still be required at Site 14. Alternatives 1 and 2 would not reduce the toxicity or mobility of contaminants at the site because these alternatives do not involve treatment of contaminants in media at the site.

The implementability of Alternatives 1, 2, and 3 would be relatively easy. For Alternative 2, a LUCIP would need to be developed. Alternative 3 would require potential destruction of ecological habitat.

The relative present-worth cost estimates are shown below for each alternative. In accordance with USEPA guidance the costs for Alternative 1, and 2 are based on a 30-year timeframe. Alternative 3 can be implemented within a 6-month timeframe.

- Alternative 1: $19,000
- Alternative 2: $135,000
- Alternative 3: $793,000

As expected, Alternative 1, the no-action alternative, has the lowest estimated overall cost. Alternative 2 involves land-use controls and quarterly/annual inspections and reporting over 30 years and is the next lowest cost. Alternatives 3 is the most expensive but has the shortest timeframe, and also could result in destruction of existing ecological habitat.

5.2.3 Modifying Criteria

As stated in Subsection 5.1.3, an evaluation of modifying criteria will not be included in this FS.

REFERENCES

ABB Environmental Services, Inc. (ABB-ES). 1993. *Geophysical Survey Technical Report, Naval Air Station Whiting Field, Milton, Florida*. Prepared for Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), North Charleston, South Carolina.

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Harding Lawson Associates. 1998. *Remedial Investigation and Feasibility Study, General Information Report, Naval Air Station Whiting Field, Milton, Florida*. Prepared for SOUTHNAVFACENGCOM, North Charleston, South Carolina (June).

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U.S. Department of Agriculture. 1980. *Soil Survey of Santa Rosa County, Florida*. Soil conservation Service. Washington, D.C.

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USEPA, Region III, 1998. Memorandum from Roy L. Smith, Office of RCRA, Technical & Program Support Branch. Subject: "Risk-Based Concentrations Table." Philadelphia, Pennsylvania.

USEPA, Region IV. 1998. Memorandum from Jon D. Johnston, Chief of Federal Facilities Branch to the Region IV Federal Facilities Branch. Subject: "Assuring Land-Use Controls at Federal Facilities." Washington, D.C.

APPENDIX A

NAVY'S REQUEST FOR SITE-SPECIFIC SOIL CLEANUP GOAL FOR ARSENIC AT DISPOSAL SITES AT NAS WHITING FIELD

Evaluation of Background Arsenic Concentrations for Covered Landfill Sites

At Naval Air Station (NAS) Whiting Field, nine soil types, as identified by the U. S. Department of Agriculture, Soil Conservation Service (USSCS), are present. The Remedial Investigation (RI) sites at NAS Whiting Field are associated with seven of the nine soil types. The background surface soil data set for each RI site was initially determined to be comprised of background surface soil samples from the same USSCS soil types as occur on the individual sites. However, available information and review of historical aerial photographs indicated that in the construction of landfills at the facility, a borrow pit was dug to an approximate depth of 10 to 15 feet bls and the excavated soil was piled to the side. Following landfill operations, the borrow materials comprised of undifferentiated surface and subsurface soils were used for the landfill cover. Any additional soils required to complete the landfill cover are believed to have been obtained from other borrow pits located at the facility.

If a mix of surface and subsurface soils were used in the cover for landfills, it would be appropriate to use the combined data set of surface and subsurface soil samples as the background screening value. However, in order to be protective of human health and the environment, it is proposed that the background surface and subsurface data set be combined to a single value as the "Industrial Use Soil Cleanup Goal." This modified "Industrial Use Soil Cleanup Goal" is specifically limited to the covered landfill sites including Sites 1, 2, 9, 10, 11, 13, 14, 15, and 16, and to the inorganic analyte arsenic.

Tables 3-8 through 3-18 in the General Information Report present the detected concentrations and summarize the analytical data for the individual background soil samples collected at NAS Whiting Field. A summary of the arsenic background data set and the modified "Industrial Use Soil Cleanup Goal" for arsenic is presented in Table A-1. As indicated on the table, the modified "Industrial Use Soil Cleanup Goal" for arsenic to be used at covered landfill sites is 4.62 milligrams per kilogram.

Table A-1
Summary of Arsenic Detected in
Surface and Subsurface Background Soil Samples

Feasibility Study
Sites 9 and 10, Waste Fuel Disposal Pit, and Southeast Open Disposal Area (A)
Naval Air Station Whiting Field
Milton, Florida

Analyte	Frequency of Detection Surface Soil Samples[1]	Mean of Detected Concentrations Surface Soil Samples[2]	Frequency of Detection Subsurface Soil Samples[1]	Mean of Detected Concentrations Subsurface Soil Samples[2]	Frequency of Detection Surface and Subsurface Soil Samples[1]	Mean of Detected Concentrations Surface and Subsurface Soil Samples[2]	Surface and Subsurface Soil Background Screening Concentration (modified Industrial Use Cleanup Goal)
Inorganic Analytes (mg/kg)							
Arsenic	15/15	1.54	14/14	3.14	29/29	2.31	4.62

[1] Frequency of detection is the number of samples in which the analyte was detected divided by the total number of samples analyzed.
[2] The mean of detected concentrations is the arithmetic mean of all samples in which the analyte was detected. It does not include those samples in which the analyte was not detected.

Notes: mg/kg = milligram per kilogram.

Table A-2
Comparison of Detected Arsenic Concentrations in Surface and Subsurface Soil Samples to Florida Soil Cleanup Goals

Feasibility Study
Sites 9 and 10, Waste Fuel Disposal Pit, and Southeast Open Disposal Area (A)
Naval Air Station Whiting Field
Milton, Florida

Analyte	Minimum Detected Concentration	Maximum Detected Concentration	Mean of Detected Concentrations	Soil Cleanup Goals for Florida (Residential)[1]	Soil Cleanup Goals for Florida (Industrial)[1]	Modified Industrial Use Cleanup Goal[2]
Inorganic Analyte (mg/kg)						
Arsenic	0.52	6.3	2.31	0.8	3.7	4.62

[1] Source: FDEP Memorandum from John Ruddell, Director Division of Waste Management, to District Directors and Waste Program Administrators. Subject: Applicability of Soil Cleanup Goals for Florida, January 19, 1996.
[2] The modified Industrial Use Cleanup Goal for arsenic is twice the mean of detected concentrations in the surface and subsurface soil samples.

Notes: mg/kg = milligram per kilogram.

APPENDIX B

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION'S RESPONSE AND ACCEPTANCE OF THE SITE-SPECIFIC SOIL CLEANUP GOAL FOR ARSENIC FOR DISPOSAL SITES AT NAS WHITING FIELD

Department of Environmental Protection

Lawton Chiles
Governor

Twin Towers Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

April 27, 1998

Ms. Linda Martin
Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive, PO Box 190010
North Charleston, SC 29419-9010

file: arsenic1.doc

RE: Request for Site-Specific Arsenic Soil Cleanup Levels: Covered Landfill Sites, NAS Whiting Field

Dear Ms. Martin:

I have reviewed the request for approval of a site-specific Soil Cleanup Goal for arsenic at the "covered landfill sites" at NAS Whiting Field from Mr. Gerald Walker, ABB Environmental Services, dated April 22, 1998 (received April 22, 1998). Based on the prior presentation to Department Staff and the summary information furnished in the letter and the attached Appendix I, the request is granted to utilize a site-specific Soil Cleanup Goal for arsenic of 4.62 mg/kg at Sites 1, 2, 9, 10, 11, 12, 13, 14, 15 and 16., with the following conditions:

1. The sites may be utilized for activities that involve less than full-time contact with the site. This may include, but is not limited to, a.) parks b.) recreation areas that receive heavy use (such as soccer or baseball fields) or, c.) agricultural sites where farming practices result in moderate site contact (approximately 100 days/year, or less).

2. The Navy must assure adherence to the land use by incorporating the site and conditions in a legally binding Land Use Contol agreement.

3. The above Soil Cleanup Goal shall not be utilized at any other site without specific Department approval.

If you have questions or require further clarification, please contact me at (904) 921-4230.

Sincerely,

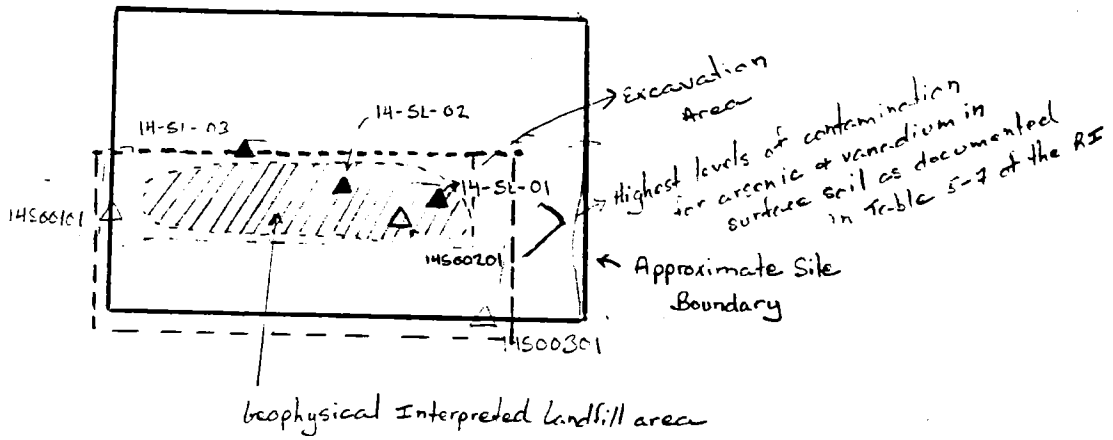
James H. Cason, P.G.
Remedial Project Manager

APPENDIX C

VOLUME ESTIMATES FOR CONTAMINATED MEDIA

Project : Whiting Field Site 14 FS Volume Calculations
Comp. By : JW
Chck. By :
Date : 1/10/99
Job # : 44230/0253411

- Determine the amt. of soil to be excavated at Site 14 :
- Original schematic is located on Figure 3-2 of the RI :



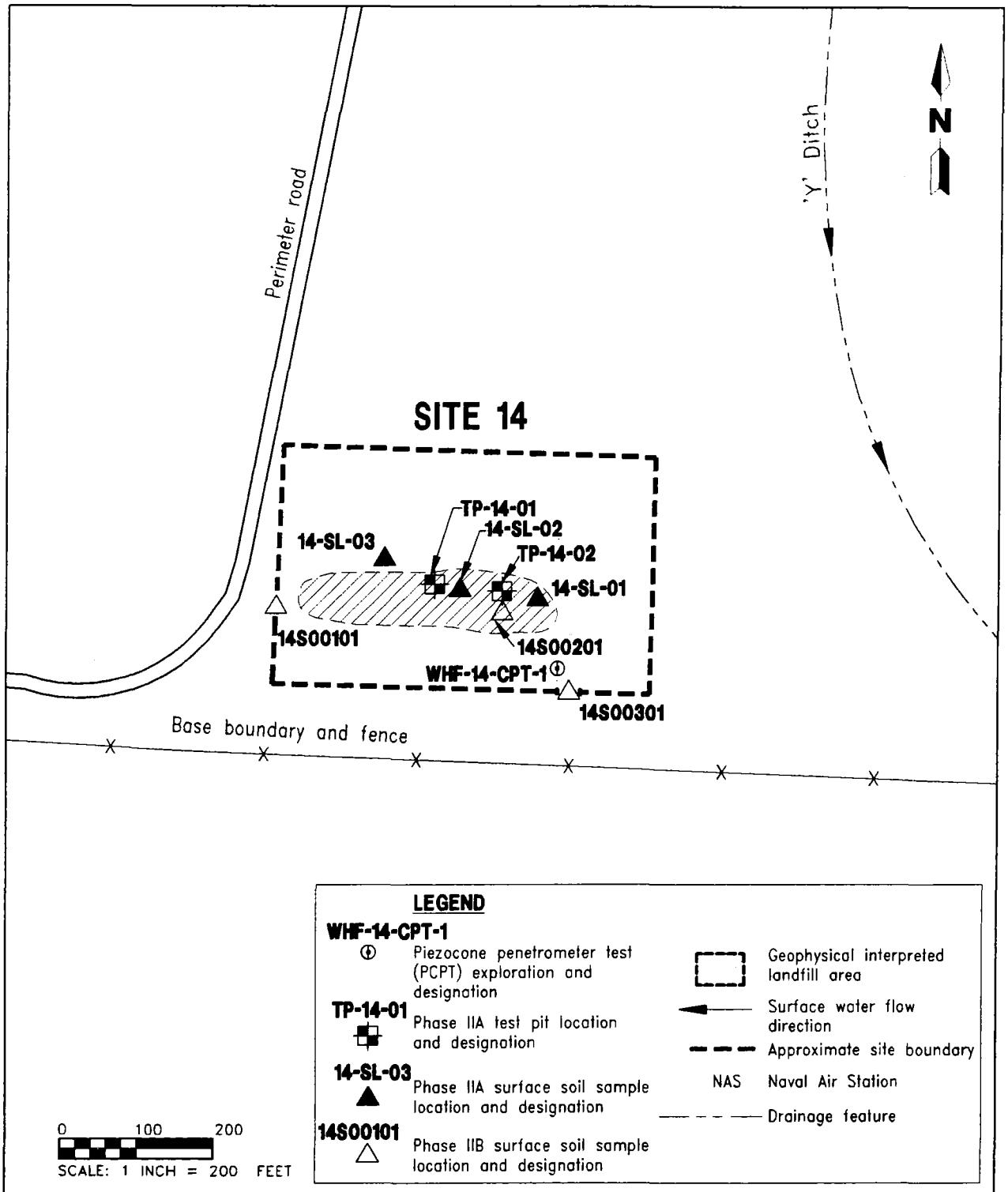
Volume = length × width × depth of excavation

length - approx 420'
width - approx 250'
depth - 2'

∴ Volume = (350') × (100') × (2')

= 168,000 ft³
= 6,200 yd³

0 100 200
Scale : 1 inch = 200 feet



SITE MAP

K:\02534\02534-11\FSY\02534719.DWG, PDP-VC 03/21/00 10:29:50, ACAD14

FEASIBILITY STUDY REPORT
SITE 14, SHORT-TERM SANITARY LANDFILL

NAS WHITING FIELD
MILTON, FLORIDA

APPENDIX D

COST CALCULATIONS FOR REMEDIAL ALTERNATIVES

ALTERNATIVE #1: No Action, Site 14

	Quantity	Unit	Unit Cost	Total Cost
FIVE YEAR SITE REVIEW COSTS				
Five-year Site Reviews (every 5 years for 30 years)				
Meetings (includes travel time)				
Senior Scientist	16	hrs	$90.00	$1,440
Mid-level Engineer	16	hrs	$60.00	$960
ODCs (includes per diem and rental car)	1	lump sum	$110.00	$110
Five-year Report				
Report				
Senior Scientist	15	hrs	$90.00	$1,350
Mid-level Engineer	20	hrs	$60.00	$1,200
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
Total 5-year costs				*$5,310*
Present Worth of 5-year costs at i=6%				*$17,352*
TOTAL FIVE YEAR SITE REVIEW COSTS				**$17,352**
CONTINGENCY @ 10 PERCENT				**$1,735**
TOTAL COST OF ALTERNATIVE #1				**$19,087**

ALTERNATIVE #2: Land Use Controls, Site 14

	Quantity	Unit	Unit Cost	Total Cost
DIRECT COSTS				
Land Use Controls (LUCs)				
Survey Plat	1	lump sum	$2,500.00	$2,500
Land Use Restriction Fees (Filling, Legal, etc.	1	lump sum	$5,000.00	$5,000
Land Use Implementation Plan:				
Senior Scientist	20	hrs	$90.00	$1,800
Mid-level Engineer	40	hrs	$60.00	$2,400
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
TOTAL DIRECT COSTS				**$11,950**
Operation and Maintenance (O&M) Costs				
Quarterly Inspection				
Senior Scientist	0	hrs	$90.00	$0
Mid-level Engineer	32	hrs	$60.00	$1,920
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$320.00	$320
Quarterly Reporting				
Senior Scientist	8	hrs	$90.00	$720
Mid-level Engineer	32	hrs	$60.00	$1,920
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$1,000.00	$1,000
Annual Reporting				
Senior Scientist	2	hrs	$90.00	$180
Mid-level Engineer	8	hrs	$60.00	$480
ODCs (per diem, rental vehicle, etc.)	1	lump sum	$250.00	$250
Subtotal				$6,790
Present Worth of Land Use Control costs at i=6%				***$93,464***
Five-year Site Reviews (every 5 years for 30 years)				
Meetings (includes travel time)				
Senior Scientist	16	hrs	$90.00	$1,440
Mid-level Engineer	16	hrs	$60.00	$960
ODCs (includes per diem and rental car)	1	lump sum	$110.00	$110
Five-year Report				
Report				
Senior Scientist	15	hrs	$90.00	$1,350
Mid-level Engineer	20	hrs	$60.00	$1,200
ODCs (includes photocopying, etc.)	1	lump sum	$250.00	$250
Subtotal				$5,310
Present Worth of 5-year costs at i=6%				***$17,352***

TOTAL O&M COSTS	**$110,816**
COST OF ALTERNATIVE #2	**$122,766**
CONTINGENCY @10 PERCENT	**$12,277**
TOTAL COST OF ALTERNATIVE #2	**$135,043**

ALTERNATIVE #3: Soil Excavation and Disposal, Site 14

	Quantity	Unit		Unit Cost		Total Cost
CAPITAL COSTS						
TOTAL DIRECT COSTS						
Mobilization						
Miscellaneous						
Storage Trailer	1	month	$	650.00	$	650.00
Trailer Delivery, Setup, Removal	1	each	$	500.00	$	500.00
Toilet/Water Cooler Service	1	month	$	250.00	$	250.00
Misc. Equipment	1	LS	$	2,500.00	$	2,500.00
Labor (Site Preparation)						
Foreman (1 man @ 5 days @ 10hrs/day)	50	hrs	$	60.00	$	3,000.00
Equipment (Mobilization)						
Dump Truck	3	each	$	250.00	$	750.00
Backhoe	1	each	$	250.00	$	250.00
Pressure Washer	1	each	$	250.00	$	250.00
Equipment (Mobilization)	1	LS	$	1,200.00	$	1,200.00
General Site Mobilization	1	LS	$	250.00	$	250.00
Mobilization					**$**	**9,600.00**
Soil Sampling						
Soil Sampling and Analysis (Waste Characterization)						
Sampling Plan						
Mid-level Engineer/Scientist	24	hrs	$	75.00	$	1,800.00
ODCs	1	LS	$	250.00	$	250.00
Sample Collection						
Associate Scientist	16	hrs	$	60.00	$	960.00
Technician	16	hrs	$	40.00	$	640.00
ODCs, Sample Equipment, Supplies	1	LS	$	500.00	$	500.00
Waste Characterization and Clean Fill Analysis						
TCLP, Metals, VOCs, SVOCs, Pest/Herb, TRPH	10	each	$	800.00	$	8,000.00
Soil Samping and Analysis					**$**	**12,150.00**
Site Preparation						
Labor (Site Preparation)						
Laborers (2 men @ 3 days @ 8 hrs/day)	48	hrs	$	36.00	$	1,728.00
Foreman (labor included in mobilization)						

	Quantity	Unit		Unit Cost		Total Cost
CAPITAL COSTS						
TOTAL DIRECT COSTS						
Equipment and Disposal Costs						
Backhoe and Operator	3	days	$	1,200.00	$	3,600.00
Miscellaneous Tools	1	LS	$	300.00	$	300.00
Transport and Disposal - Wood Debris	150	tons	$	69.00	$	10,350.00
Signs	6	each	$	50.00	$	300.00
Site Preparation					**$**	**16,278.00**
Clearing and Grubbing						
Foreman (1 wk @ 50 hrs/wk)	40	hrs	$	60.00	$	2,400.00
Grubbing, Removal, & Stockpile (Labor Incl)	1	LS	$	4,500.00	$	4,500.00
Transport and Disposal (Grub and Stumps)	1	LS	$	500.00	$	500.00
Clearing and Grubbing					**$**	**7,400.00**
Loading and Off-site Landfill Disposal (6,200 cy = 7,500 tons)						
Backhoe and operator	10	days	$	1,200.00	$	12,000.00
Laborers (2 @ 10 days @ 10 hrs/day)	200	hrs	$	40.00	$	8,000.00
Site Superintendent	80	hrs	$	60.00	$	4,800.00
RCRA Subtitle D (Solid Waste) Landfill						
Transportation and Disposal	7500	tons	$	52.00	$	390,000.00
Loading and Off-site Landfill Disposal (7,500 tons)					**$**	**414,800.00**
Vegetative Support Layer						
Backfill - 1.5' layer	5580	yd^3	$	16.00	$	89,280.00
Topsoil - 6" layer	1550	yd^3	$	10.00	$	15,500.00
Site Superintendent (4 day @ 8 hrs/day)	32	hrs	$	60.00	$	1,920.00
Vegetative Support Layer					**$**	**106,700.00**
Site Restoration						
Fertlize, Seed, Mulch	2	acres	$	2,000.00	$	4,000.00
Demob of Equipment	1	LS	$	1,000.00	$	1,000.00
Site Restoration					**$**	**5,000.00**

	Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS				
TOTAL DIRECT COSTS				
TOTAL DIRECT COSTS				**$ 571,928.00**
INDIRECT COSTS				
Health and Safety (@ 3% of Direct Costs)				$ 17,157.84
Administative Fees (@ 3% of Direct Costs)				$ 17,157.84
Engineering and Design (@ 10% of Direct Costs)				$ 57,192.80
Construction Support Services (@ 10% of Direct Costs)				$ 57,192.80
TOTAL INDIRECT COSTS				**$ 148,701.28**
TOAL CAPITAL COSTS - Total Direct Costs + Total Indirect Costs				***$ 720,629.28***
TOTAL CAPITAL COSTS & O&M COSTS				***$ 720,629.28***
Contingency (@ 10%)				**$ 72,062.93**
TOTAL COST OF ALTERNATIVE #3				***$ 792,692.21***

APPENDIX E

RESPONSE TO AGENCY COMMENTS

Response to EPA Review Comments
Site 14, Short-Term Sanitary Landfill
Draft Feasibility Study

1. **Cover Page**. The EPA ID number should be included on the cover page both inside and outside.

   Response: The EPA ID number will be added to the cover page and the report title page.

2. **Glossary, Page –viii-**. The abbreviation "BRA" for "baseline risk assessment" should be included. "CPC" should be changed to "COPC". In the definition for "LUCIP", change the word "Installation" to "Implementation". The definition for "RA" should be "remedial action" instead of risk assessment. On page –vii-, remove "guidance material" from the definition for "TBC". These abbreviations should be changed throughout the document, accordingly, wherever they occur.

   Response: As suggested by the reviewer, the abbreviation "BRA" for "baseline risk assessment" will be included. Also "CPC" will be changed to "COPC". In the definition for "LUCIP", the word "Installation" will be replaced by "Implementation". The report will be revised to reflect "RA" means "remedial action" and not risk assessment. On page –vii-, the phrase "guidance material" will de deleted from the definition for "TBC". These abbreviations will be changed throughout the document.

3. **Section 1.0, Page 1-1**. Change the word "Priority" to "Priorities" in the first sentence of the second paragraph.

   Response: The word "Priority" will be changed to "Priorities" in the first sentence of the second paragraph.

4. **Section 1.4, Page 1-4**. The RI summary should address in further detail the existence of methane at the site and the need for remedial action, if any.

   Response: The bullet item 2 will be expanded to include additional information on existence of methane. Remedial action pertaining to methane will be added to the text.

5. **Table 2-1, Page 2-4**. Remove the reference to the Safe Drinking Water Act. Groundwater monitoring will be addressed within the context of the Site 40 RI/FS. On page 2-5, remove the references to the Florida Groundwater Classes and the Florida Drinking Water Standards.

   Response: The reference to the Safe Drinking Water Act will be deleted. Also, references to Florida Groundwater Classes and the Florida Drinking Water Standards will be deleted.

6. **Section 2.2, Page 2-7**. In the second paragraph, delete the words "legally binding".

   Response: The last sentence will be deleted and the words "and the MOA" will be added to the previous sentence.

7. **Section 4.2.2, Page 4-4, Overall Protection of Human Health and Environment**. In the first sentence, add the words "potential future" in between "namely" and "residents". In the second sentence at the top of page 4-5, change "...maintains its LUCAP and LUCIP." to "...properly maintains and administers its LUCAP and LUCIP."

   Response: The first sentence will be revised to add the words "potential future" in between "namely" and "residents". The second sentence at the top of page 4-5 will be deleted.

8. **Section 4.3.1, Page 4-6, Soil Removal**. Site characterization to determine the extent of the removal should

be addressed in the FS.

Response: The following text will be added to section 2.3 between the current paragraph and paragraph 2.

"The chemicals of concern for which RAOs were identified are arsenic and vanadium in surface soil. All six samples collected at the site contained these contaminants above their respective residential SCTLs. Calculations presenting the extent of contamination are included in Appendix C."

Calculation presented in Appendix C will be cited.

9. **Section 5.1.3, Page 5-1, Modifying Criteria**. The text states that a summary of State acceptance will be included in the final FS; however, only a response to the State's comments is typically prepared.

Response: The text will be revised to state a response to the State's comments will be included in the final FS.

10. **Section 5.2.2, Page 5-2**. The third sentence should be deleted as it is speculative.

Response: The third sentence of the 4th paragraph will be deleted.

11. **References, Page Ref-1**. Delete the words "Washington, D.C." in the last reference. Jon Johnston is the Branch Chief of the Federal Facilities Branch within EPA, Region IV.

Response: The words "Washington, D.C." will be deleted.

Response to FDEP Comments on the Draft Feasibility Study
Site 14, Short-Term Sanitary Landfill
NAS Whiting Field, Milton, Florida

1. Page 1-5, second "bulleted" item: vanadium also exceeded the Florida SCTLs. Vanadium should also be added to the next "bulleted" item.

   Response: Vanadium will be added to the bulleted items.

2. Figure 1-1: in the legend, "RI/FS" is not necessary and should be deleted.

   Response: "RI/FS" will be deleted from Figure 1-1 legend.

3. Page 2-6, under RAO 1: in the paragraph which begins, "Because Site 14...," please include that fill and cover material obtained at NASWF included subsurface soil which contained elevated arsenic levels. This is the basis for the elevated site-specific commercial/industrial direct exposure SCTL that has been granted. To simply state that Site 14 is a "disposal site" is not an adequate explanation.

   Response: The referenced paragraph will be revised as follows:

   Because Site 14 and several other sites at NAS Whiting Field are disposal sites, the Navy requested that the FDEP consider a site-specific SCTL for arsenic because the fill and cover material obtained at NAS Whiting Field included subsurface soil containing elevated arsenic levels. The Navy recommended a SCTL for arsenic at NAS Whiting Field covered landfill sites (Sites 1, 2, 9, 10, 11, 12, 13, 14, 15, and 16) of 4.62 milligrams per kilogram. This request is included as Appendix A of this report.

4. Page 2-7, second paragraph: delete the last sentence and add to the preceding sentence, "and the MOA."

   Response: The last sentence will be deleted and the phrase "and the MOA" will be added to the second paragraph.

5. Page 2-10, second bulleted item: delete "post-closure activities" and substitute, "land use controls." Please do not use "LUCs" and further, please consider not using them in most of this document.

   Response: As recommended by the reviewer, "land use controls" will replace the phrase "post closure activities". Also throughout the document, LUCs will be replaced with "land use controls".

6. Page 3-1, second paragraph, second bulleted item: please replace "LUCs" with "land use controls."

   Response: As recommended by the reviewer, "land use controls" will replace LUCs.

7. Page 4-4 and 4-5, Section 4.2.2 and 4.2.2: please delete all references to "LUCAP", since this actually the Memorandum of Agreement already in effect. All discussion of the LUCAP should be deleted since the adopted document is a Memorandum of Agreement and is not referred to as a LUCAP.

   Response: All references to LUCAP will be deleted. Also, discussions related LUCAP will be deleted from the report.

8. Page 4-5, first paragraph: delete the remaining words after "considered to be reliable controls".

   Response: The first paragraph on Page 4-5 will be revised as recommended by the reviewer.

9. Page 5-2, Section 5.2.2, paragraph three: an explanation of the fact that removal of the top two feet of contaminated surface soil and placing two feet of clean soil cover on site would still not address the remaining contamination in the subsurface soils. In that situation, if excavation of the two feet of the clean

soil cover occurred, it would expose receptors to contaminated soil. Therefore, even though excavation and soil covering were accomplished, land use controls would still be required at Site 14 which address this possibility.

Response: Paragraph will be revised as follows:

Alternative 3 would reduce the volume of contaminated soil at Site 14. Alternative 3 is the only alternative where off-site disposal of contaminated soil would reduce the toxicity and volume on site. However, the removal of the top two feet of contaminated surface soil and placement of two feet of clean soil cover on site would still not address the contamination in subsurface soils. If excavation of the two feet of the clean soil cover occurred, it would expose receptors to contaminated soil. Therefore, if excavation and soil covering were accomplished, land use controls would still be required at Site 14. Alternatives 1 and 2 would not reduce the toxicity or mobility of contaminants at the site because these alternatives do not involve treatment of contaminants in media at the site.