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REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) WORK PLAN FOR OPERABLE UNIT 1 (OU 1) NORTH GRINDER LANDFILL NTC ORLANDO FL
3/1/1995
ABB ENVIRONMENTAL

# REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) WORKPLAN

## OPERABLE UNIT 1

## NORTH GRINDER LANDFILL

## NAVAL TRAINING CENTER
## ORLANDO, FLORIDA

Unit Identification Code (UIC): N65928

Contract No. N62467-89-D-0317

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March 1995

# FOREWORD

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

One of these programs is the Base Realignment and Closure (BRAC) Cleanup Plan (BCP). This program complies with the Base Closure and Realignment Act of 1988 (Public Law 100-526, 102 Statute 2623) and the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510, 104 Statute 1808), which require the DOD to observe pertinent environmental legal provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Executive Order 12580, and the statutory provisions of the Defense Environmental Restoration Program (DERP), the National Environmental Policy Act (NEPA), and any other applicable statutes that protect natural and cultural resources.

CERCLA requirements, in conjunction with corrective action requirements under Subtitle C of the Resource Conservation and Recovery Act (RCRA), govern most environmental restoration activities. Requirements under Subtitles C, I, and D of RCRA, as well as the Toxic Substances Control Act (TSCA), the Clean Water Act (CWA), the Clean Air Act (CAA), the Safe Drinking Water Act (SDWA), and other statutes, govern most environmental mission-related, operational-related, and closure-related compliance activities. These compliance laws may also be applicable or relevant and appropriate requirements (ARARs) for selecting and implementing remedial actions under CERCLA. NEPA requirements govern the Environmental Impact Analysis and Environmental Impact Statement preparation for the disposal and reuse of BRAC installations.

The BCP process centers on a single goal: expediting and improving environmental response actions to facilitate the disposal and reuse of a BRAC installation, while protecting human health and the environmental.

The Southern Division, Naval Facilities Command (SOUTHNAVFACENGCOM), the U.S. Environmental Protection Agency (USEPA), and the Florida Department of Environmental Protection (FDEP) collectively coordinate the cleanup activities through the BRAC Cleanup Team. This team approach is intended to foster partnering, accelerate the environmental cleanup process, and expedite timely, cost-effective, the environmentally responsible disposal and reuse decisions.

Questions regarding the BCP process at NTC, Orlando should be addressed to the SOUTHNAVFACENGCOM BRAC Environmental Coordinator (BEC) for NTC, Orlando, Mr. Wayne Hansel at (407)646-5294 or the Southern Division Engineer-in-Charge, Ms. Barbara Nwokike at (803)743-0566.

# EXECUTIVE SUMMARY

This RI/FS workplan has been developed by ABB Environmental Services, Inc. (ABB-ES), to enable proper conduct of work at OU 1, the North Grinder Landfill,y at NTC, Orlando. The workplan has incorporated elements of the Project Operations Plan (ABB-ES, 1994a), which contains the requirements of a Quality Assurance Project Plan, Health and Safety Plan, and elements of a Field Sampling Plan (FSP) related to sampling equipment, procedures, and sample handling and analysis. Other FSP elements specific to this site, including sampling objectives and sample location and frequency, will be addressed in this workplan.

This workplan is intended to be a dynamic document permitting flexibility during the conduct of this investigation at NTC, Orlando. The workplan has incorporated concepts promulgated by the Superfund Accelerated Cleanup Model (SACM) program, developed by the U.S. Environmental Protection Agency to streamline and standardize environmental investigations.

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## GLOSSARY

| | |
|---|---|
| ABB-ES | ABB Environmental Services, Inc. |
| AEA | Atomic Energy Act |
| AOC | area of concern |
| ARAR | applicable or relevant and appropriate requirements |
| AWQC | Ambient Water Quality Criteria |
| BCT | BRAC Cleanup Team |
| BEC | BRAC Environmental Coordinator |
| bls | below land surface |
| BRAC | Base Realignment and Closure Program |
| CART | Classification and Regression Trees |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CLP | Contract Laboratory Protocol |
| CLP-RAS | CLP Routine Analytical Services |
| COC | contaminant of concern |
| CPC | contaminants of potential concern |
| CPT | Cone Penetrometer Testing |
| CWA | Clean Water Act |
| DOT | Department of Transportation |
| DQO | data quality objective |
| ECAO | Environmental Criteria and Assessment Office |
| FGFWFC | Florida Game and Fresh Water Fish Commission |
| FR | Federal Register |
| FRED | Fast Retrieval of Environmental Data |
| FS | Feasibility Study |
| FSA | Field Staging Area |
| FSP | Field Sampling Plan |
| FWQS | Florida Water Quality Standard |
| GAC | Granular Activated Carbon |
| GPR | Ground Penetrating Radar |
| GPS | Global Positioning System |
| HEAST | Health Effects Assessment Summary Table |
| HI | hazard index |
| HQ | hazard quotient |
| IAS | Initial Assessment Study |
| IDW | Investigation-Derived Waste |
| IR | Installation Restoration |
| IRIS | Integrated Risk Information System |
| LDR | Land Disposal Restriction |
| LFG | Landfill Gas |

| | |
|---|---|
| MAC | Military Airlift Command |
| MCL | maximum contaminant level |
| MCLGs | maximum contaminant level goals |
| MHz | megahertz |
| ML | milliliters |
| MSL | mean sea level |
| NAAQS | National Ambient Air Quality Standards |
| NACIP | Naval Assessment and Control of Installation Pollutants |
| NCP | National Contingency Plan |
| NEPA | National Environmental Protection Act |
| NMFS | National Marine Fisheries Service |
| NPDES | National Pollutant Discharge Elimination System |
| NPL | National Priorities List |
| NTC | Naval Training Center |
| OAFB | Orlando Air Force Base |
| OSHA | Occupational Safety and Health Administration |
| OU | operable unit |
| PARCC | precision, accuracy, representativeness, comparability, and completeness |
| PCB | polychlorinated biphenyls |
| PCE | perchloroethene |
| PCi/g | piocuries per gram |
| PEL | Permissible Exposure Level |
| POP | Project Operations Plan |
| POTW | Publicly Owned Treatment Works |
| PPE | personal protective equipment |
| PVC | polyvinyl chloride |
| QA/QC | quality assurance/quality control |
| QC | quality control |
| RAD | radiological |
| RAGs | Risk Assessment Guidance for Superfund |
| RAO | remedial action objective |
| RCRA | Resources Conservation and Recovery Act |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation and Feasibility Study |
| ROD | Record of Decision |
| SACM | Superfund Accelerated Cleanup Model |
| SARA | Superfund Amendments Reauthorization Act of 1986 |
| SDWA | Safe Drinking Water Act |
| SVOC | semivolatile organic compound |
| TAL | target analyte list |
| TBC | to-be-considered |
| TBEL | technology based effluent limit |
| TCL | target compound list |

| | |
|---|---|
| TCLP | toxicity characteristic leaching procedure |
| TD-MS | thermal desorption-mass spectrometry |
| TSCA | Toxic Substances Control Act |
| UCL | upper confidence level |
| UMTRCA | Uranium Mill Tailings Radiation Control Act |
| USEPA | U.S. Environmental Protection Agency |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| UV | ultraviolet |
| VOC | volatile organic compound |
| WQBEL | water quality based effluent limit |
| WQS | Water Quality Standard |

# 1.0 INTRODUCTION

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

The IR program complies with the Base Closure and Realignment Act of 1988 (Public Law 100-526,102 Statute 2623) and the Defense Base Closure and Realignment Act of 1990 (Public Law 101-510, 104 Statute (1808), which require the DOD to observe pertinent environmental legal provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Executive Order 12580, and the statutory provisions of the Defense Environmental Restoration Program (DERP), the National Environmental Policy Act (NEPA), and any other applicable statutes that protect natural and cultural resources.

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),
- A site Inspection (SI) (formerly the PA and SI steps were called the Initial Assessment Study [IAS] under the NACIP program),
- Remedial Investigation and Feasibility Study (RI/FS), and
- Remedial Design and Remedial Action (RD/RA).

The goal of the BRAC program is to expedite and improve environmental response actions to facilitate the disposal and reuse of a BRAC installation, while protecting human health and the environment.

**1.2 FACILITY BACKGROUND**. Naval Training Center (NTC), Orlando encompasses 2,072 acres in Orange County, Florida, and consists of four discrete facilities: Main Base, Area "C", Herndon Annex, and McCoy Annex (Figures 1-1 and 1-2). The Main Base occupies 1,095 acres and is located approximately 3 miles east of Interstate 4 and north of State Road 50. The Main Base is surrounded by urban development, including single and multi-family housing, schools, and commercial buildings. Land uses directly west and northeast of the area are primarily residential. Small areas of commercial development occur to the southwest. Herndon Airport is located 1.5 miles south of the Main Base. No industrial facilities exist adjacent to the Main Base, with the exception of automotive repair facilities along Bennett Road on the southwest property line. Further discussions of Area "C", Herndon Annex, and McCoy Annex may be found in the Project Operations Plan (POP)(ABB-ES, 1994a).

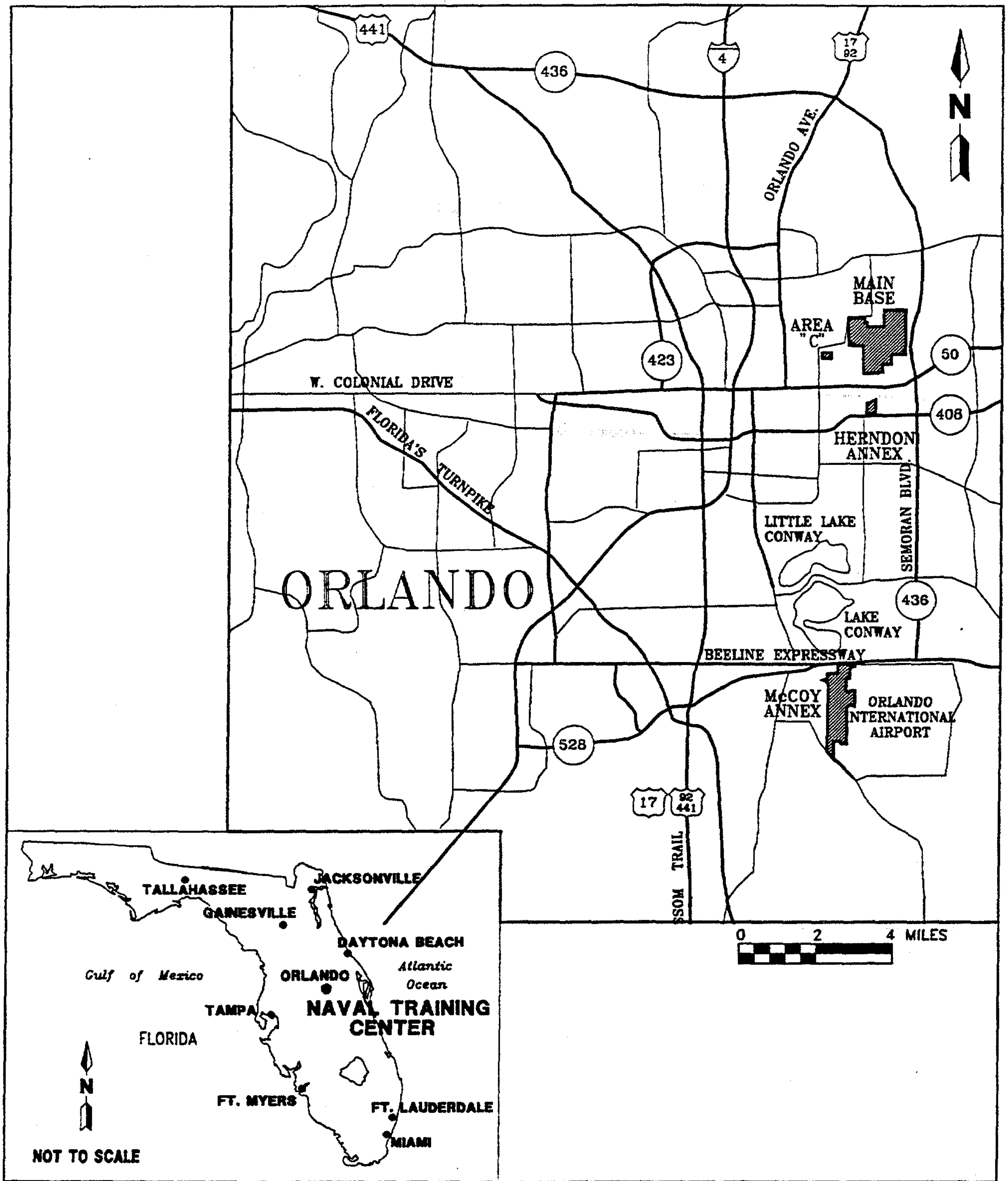


**FIGURE 1-1**
**VICINITY MAP**

**RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

**NAVAL TRAINING CENTER ORLANDO, FLORIDA**

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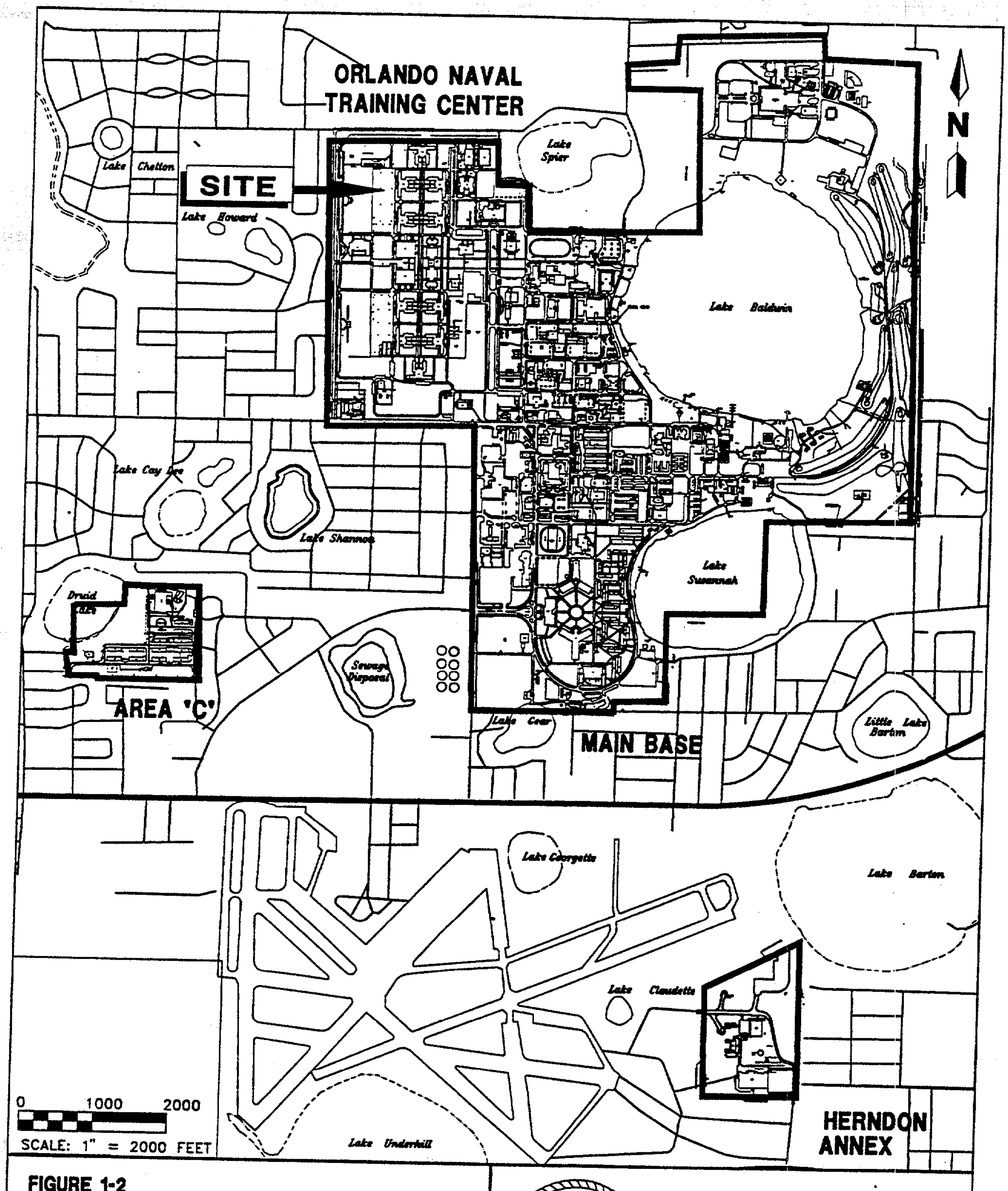


**FIGURE 1-2**
**MAIN BASE, HERNDON ANNEX, AND AREA 'C'**
**SITE LOCATION MAP**

**RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

**NAVAL TRAINING CENTER**
**ORLANDO, FLORIDA**

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The history of NTC, Orlando dates to the construction of the original Orlando Municipal Airport prior to 1940. In August 1940, the municipal airport was taken over by the U.S. Army Air Corps. Shortly thereafter, the construction program for Orlando Air Base began, culminating in its official opening on December 1, 1940. During the following 2 years, the Army Air Corps acquired additional property, and auxiliary landing fields were built in the surrounding area. The U.S. Army Air Corps conducted operations at the Main Base and Area "C" from 1940 to 1947.

In 1947, the U.S. Air Force assumed command of the facilities as the Orlando Air Force Base (OAFB). The base was deactivated on October 28, 1949, and remained on standby status until January 1, 1951, when it was reactivated as an Aviation Engineers' training site. Other Air Force units arrived, and the Military Airlift Command (MAC) assumed full jurisdiction of the base in 1953.

The Navy began moving its Training Device Center from Port Washington, New York, to OAFB on September 15, 1965, and finished the move in June 1967. In 1968, the Air Force ceased operations at OAFB, Area "C", and Herndon Annex. The property was commissioned as the Naval Training Center Orlando on July 1, 1968.

The stated mission of NTC, Orlando is to exercise command over, and coordinate the efforts of, the assigned subordinate activities in recruit training of enlisted personnel; provide initial skill, advanced, and/or specialized training for officer and enlisted personnel of the regular Navy and Naval Reserve; and to support other activities as directed by a higher authority (ABB-ES, 1994b). The Main Base is comprised primarily of operational and training facilities.

Previous NACIP investigative activities at NTC, Orlando include an IAS conducted in 1985 by C.C. Johnson (1985) and a Verification Study conducted in 1986 by Geraghty & Miller (1986).

Descriptions of IR and BRAC program investigative activities at NTC, Orlando can be found in the Project Operations Plan (ABB Environmental Services, Inc. [ABB-ES], 1994a, the BRAC cleanup plan (ABB-ES, 1994b), the background sampling plan (ABB-ES, 1994c), and the BRAC environmental baseline survey (ABB-ES, 1994d).

To facilitate their assessment, the IR program sites at NTC, Orlando have been separate into groups known as operable units (OUs). An OU is comprised of sites that:

- are in close proximity to each other,
- have similar contaminant exposure histories, and/or
- will likely require similar remedial measures.

ABB Environmental Services (ABB-ES) has prepared this workplan for conducting an RI/FS at a former landfill under the North Grinder Parade Area of the Main Base. known as the North Grinder Landfill and designated as OU 1.

The RI/FS will be conducted in accordance with the methods described in the U.S. Environmental Protection Agency (USEPA) *Conducting Remedial Investigations/Feasibility Studies for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Municipal Landfill Sites* (1991d), and *Streamlining the RI/FS for CERCLA Municipal Landfill Sites* (1990).

The objectives of the investigations are to:

- determine the nature and distribution of contaminants at the site,
- identify potential threats to public health or the environment posed by the potential release of contaminants from the site, and
- evaluate potential remedial alternatives based on engineering factors, implementability, environmental and public health concerns, and costs.

This workplan presents the technical scope of services necessary to achieve these objectives and the schedule for conducting field activities, preparing reports, and developing and evaluating remedial alternatives. The program has been designed to be as efficient and streamlined as possible to effect a rapid data acquisition and evaluation process during the RI/FS. To this end, investigators begin with the understanding that it will not be possible to completely characterize this site or any other similar site with even a very large number of explorations and chemical analyses. Rather, the approach will be to sufficiently characterize the site with a limited number of explorations and analyses that will permit development and refinement of a conceptual model based on reasonable conclusions drawn from those data. Remedial alternatives will be selected such that planned contingencies may be invoked at any time during the investigation when it becomes apparent that probable conditions have given way to deviations in those assumptions. Thus, a working hypothesis will have been formulated which will evolve and grow along with increased knowledge. In this way, a balance between managed uncertainties and the implementation of remedial alternatives is achieved, resulting in improved efficiencies.

The workplan consists of 10 chapters and 1 appendix. Chapter 1.0 provides an introduction to the process and a description of the components of the workplan. Chapter 2.0 summarizes the site background and setting and includes a description of the site and its history, hydrogeologic setting, and a summary of the results of previous investigations. Also in Chapter 2.0 is an approach overview that will present and discuss the concepts of streamlining and presumptive remedies (USEPA, 1990; 1993a) as they apply to municipal landfill sites, the value and applicability of the statistical sampling approach, and an evaluation of data needs. Chapter 3.0 provides the rationale and task-by-task approach for the field investigations at the North Grinder Landfill. Chapter 4.0 describes the laboratory analytical program. The risk assessment and waste management (investigation-derived wastes [IDW]) tasks are described in Chapters 5.0 and 6.0, respectively. Chapters 7.0 and 8.0 describe the RI and Feasibility Study (FS) reports. The project schedule and management plan are presented in Chapters 9.0 and 10.0, respectively. Appendix A contains a synopsis of potential Federal and State applicable or relevant and appropriate requirements (ARARs) that may apply during the OU 1 RI/FS.

The workplan has incorporated elements of the Project Operations Plan (ABB-ES, 1994a), which contains the requirements of a Quality Assurance Project Plan, Health and Safety Plan, and elements of a Field Sampling Plan (FSP) related to sampling equipment, procedures, and sample handling and analysis. Other FSP elements specific to this site, including sampling objectives and sample location and frequency, will be addressed in this workplan.

## 2.0 SITE BACKGROUND AND SETTING

2.1 SITE DESCRIPTION. The North Grinder Landfill (Figure 2-1) is located in the northwest corner of the Main Base and is under both lawn and an asphalt paved area known as the "grinder" parade area (there is also a South Grinder parade area that will be discussed below). The North and South Grinder parade areas are flat, although topography drops in elevation west, north, and east of the sites.

2.2 SITE HISTORY. The North Grinder Landfill appears on aerial photographs as a southwest to northeast "slash" comprised of several trenches (Figure 2-2). Aerial photographs indicate that landfilling operations started sometime after 1939 and before 1947 (ABB-ES, 1994b; 1994d). At that time, the property was wooded. The property was taken over by the U.S. Army Air Corps in 1940. The landfill eventually encompassed a 15-acre area and was closed in 1967 prior to the construction of two dormitories, Buildings 212 and 214. During their construction, landfill materials were discovered, excavated, and backfilled before foundation structures were established. The disposition of excavated materials is unknown.

The South Grinder parade area is located several hundred feet to the south and appears on at least one aerial photograph (Figure 2-2) as an area with sparse vegetation. Matador Missile test firing cells on the east side of the South Grinder parade area may account for some vehicular activity in the area, but landfilling activity is certainly a possibility given past disposal practices at NTC, Orlando. For purposes of this workplan and to avoid confusion in the discussions that follow, with the exception of a brief discussion of geophysical surveys in the South Grinder area in Section 3.1, it is assumed that the South Grinder area does not have a landfill nor has it had landfilling activities associated with it.

Figure 2-3 (U.S. Air Force, 1962) indicates that the North Grinder parade field not only was the site of a sanitary landfill, but also accommodated a fire-fighting training area and a skeet range. The fire-fighting training area was located just to the southwest of the present location of the training ship mock-up, Building 208, the *USS Bluejacket*, constructed in 1969 and designed to educate recruits in basic seamanship. The skeet range was located at the present locations of Buildings 212 and 234.

2.3 HYDROGEOLOGIC SETTING. This section presents a discussion of the hydrogeologic framework for the area of NTC, Orlando. A general characterization of the major lithologic units and aquifers at NTC, Orlando is presented along with a summary of available documented information for OU 1, the North Grinder Landfill. The POP (ABB-ES, 1994a) contains a detailed discussion of the regional physical characteristics (topography, geology, hydrogeology, soil, and surface water hydrology) of the NTC, Orlando. This information will not be reproduced in this workplan. Rather, a conceptual framework of the hydrogeologic setting, as it applies to the evaluation of contaminant migration in groundwater, will be described.

Three major lithologic units underlie NTC, Orlando (Figure 2-4). These are (1) the surficial sands and clays of Holocene and Pleistocene age; (2) the clays,

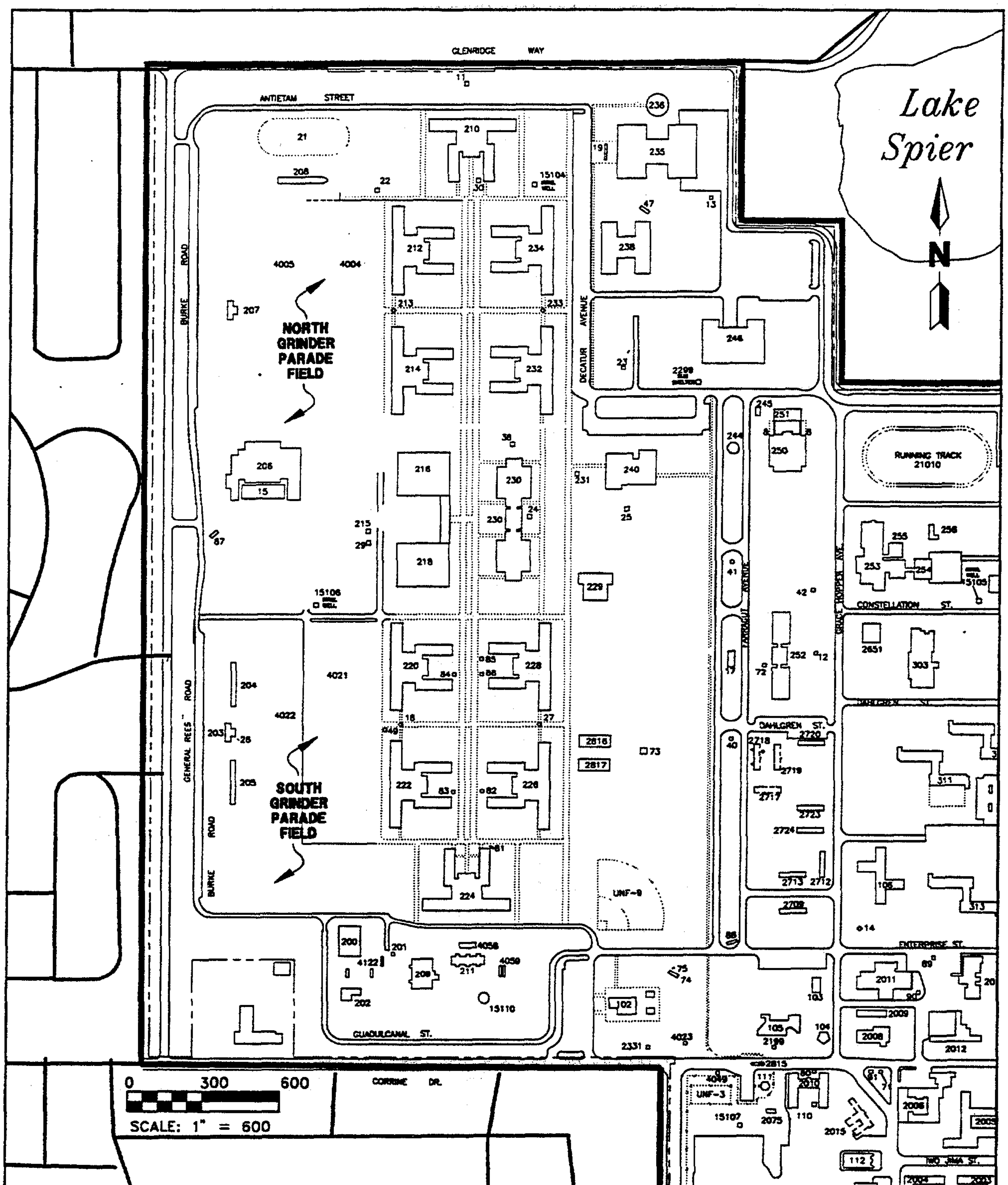


**FIGURE 2-1**
**NORTH GRINDER AREA LOCATION MAP**

**RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

**NAVAL TRAINING CENTER ORLANDO, FLORIDA**

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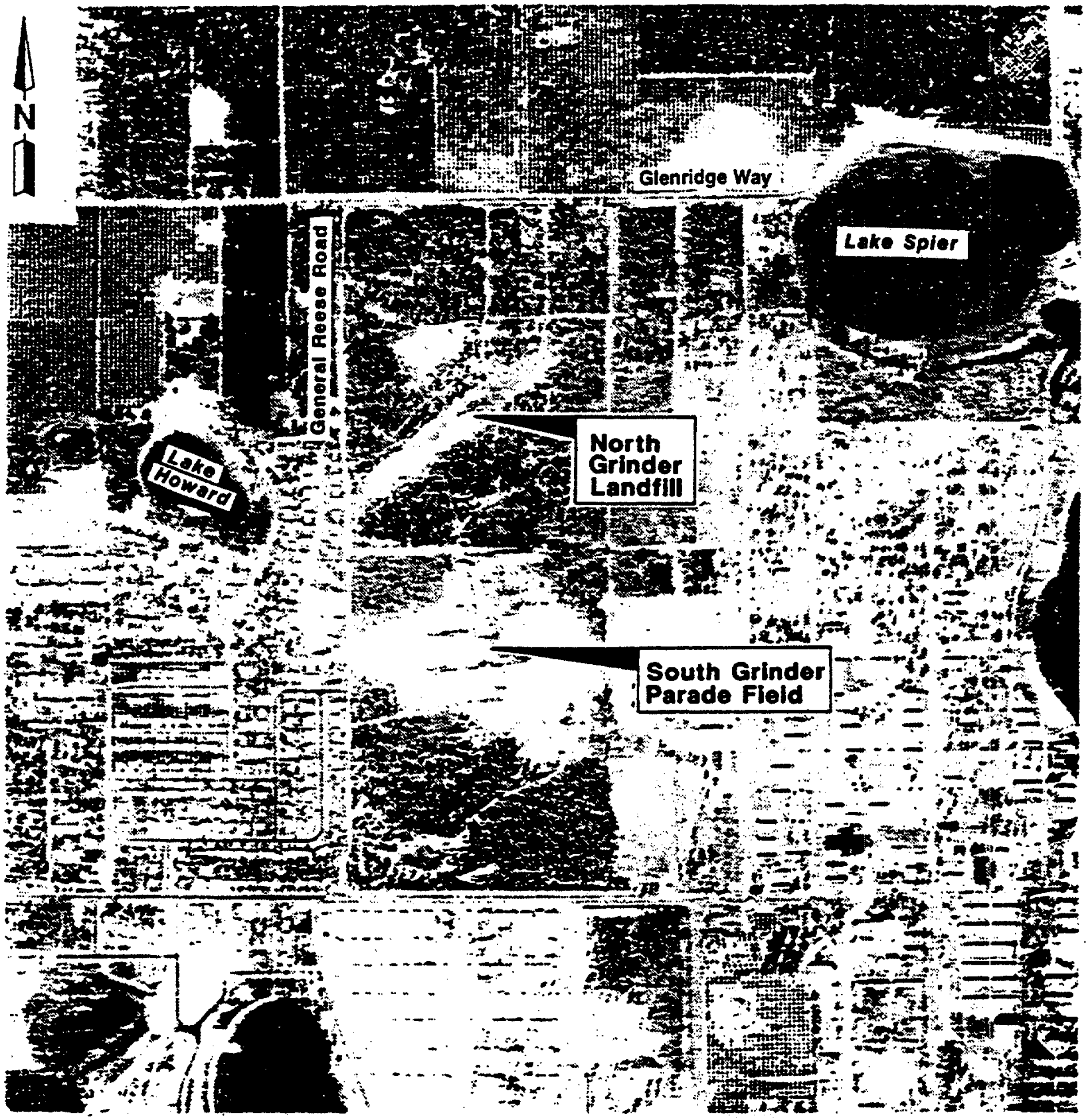


Approximate Scale:

0 500 1000 2000 Feet

Source: Pre-1962-vintage Air Force photograph

FIGURE 2-2

AERIAL PHOTOGRAPH OF
NORTH AND SOUTH GRINDER AREAS

SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND

RI/FS WORK PLAN, OPERABLE
UNIT 1, NORTH GRINDER LANDFILL

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

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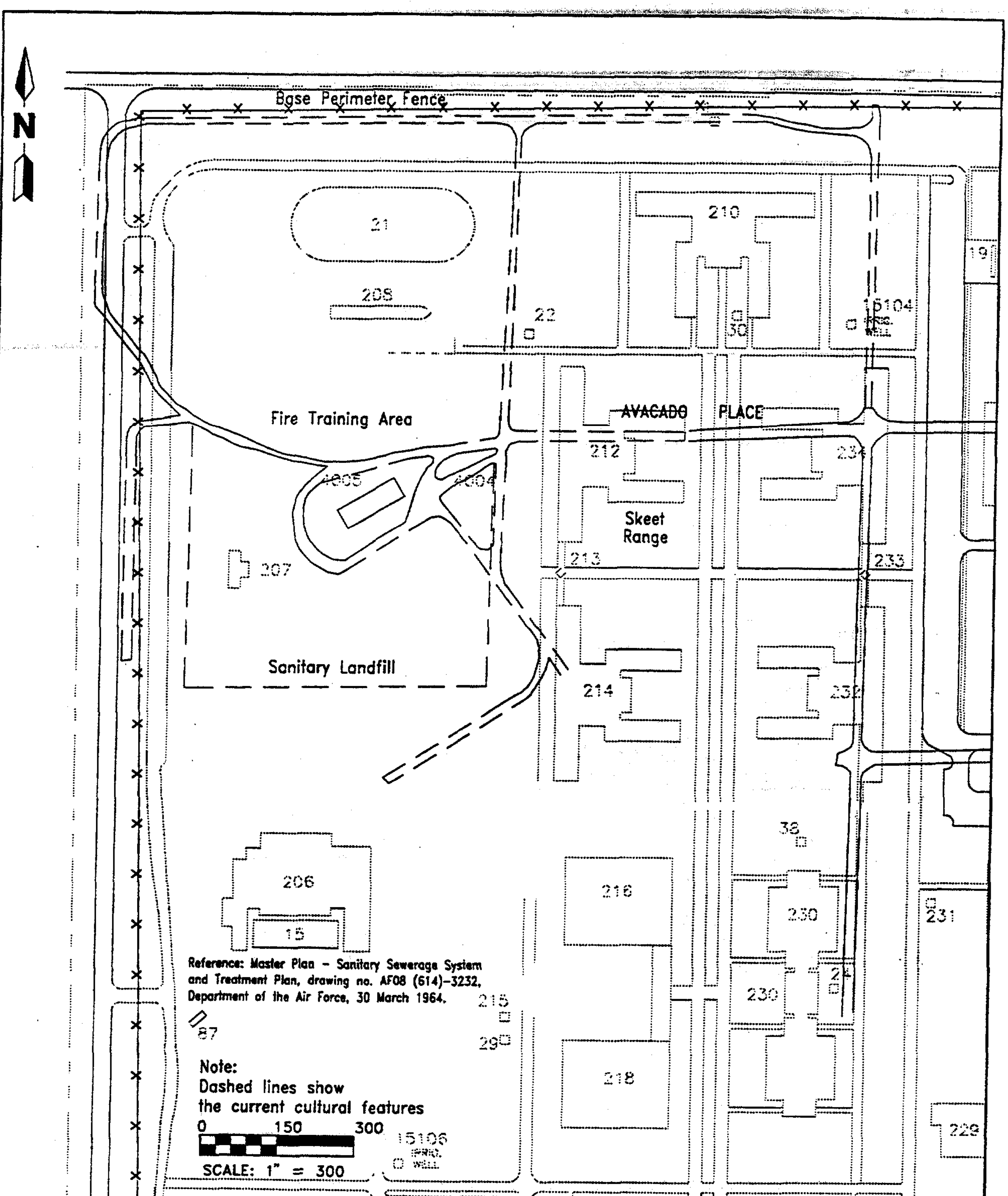


**FIGURE 2-3**
**HISTORICAL MAP (1964) OF NORTH GRINDER AREA**

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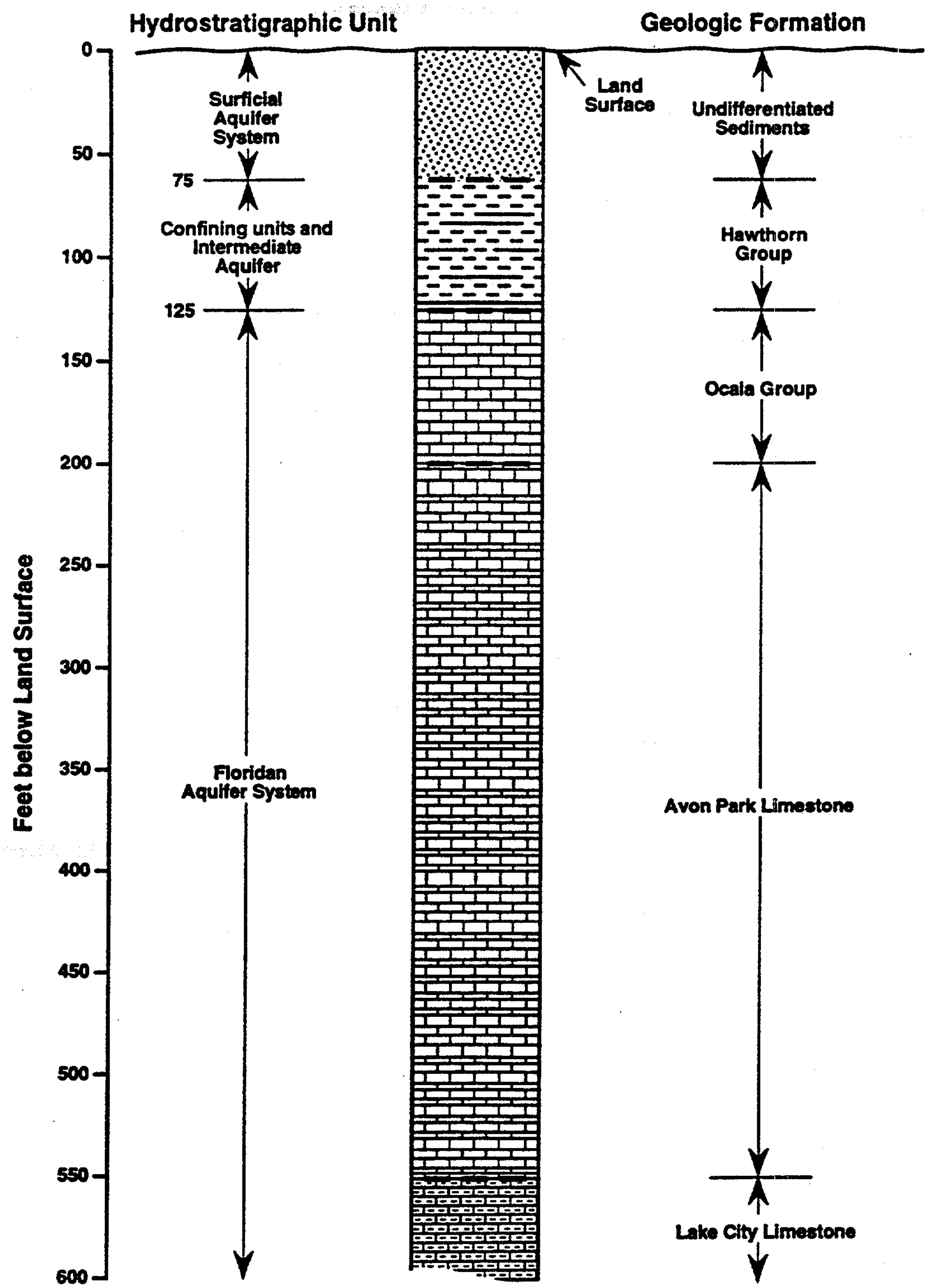
**RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

**NAVAL TRAINING CENTER ORLANDO, FLORIDA**




Source: ABB-ES, 1994a

FIGURE 2-4

GENERALIZED GEOLOGIC CROSS SECTION, NTC ORLANDO

RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL

NAVAL TRAINING CENTER ORLANDO, FLORIDA

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sands, and carbonates of the Hawthorn Group (Miocene); and (3) the underlying Eocene carbonates of the Ocala, Avon Park, and Lake City Limestones. The principal aquifers correspond to these lithologic units. The aquifers are (1) the surficial aquifer, (2) intermediate aquifer and confining zone within the Hawthorn Group (formerly referred to as the secondary artesian aquifer), and (3) the Floridan aquifer system.

The sediments of the Hawthorn Group contain the intermediate aquifer (which may have more than one water-producing zone) and collectively act as a confining unit for both the surficial aquifer and the Floridan aquifer system. The Hawthorn Group acts as a lower aquitard for the surficial aquifer by impeding the downward migration of groundwater and an upper aquitard for the Floridan aquifer system causing it to be confined or semi-confined. The Hawthorn Group is 80 to 100 feet thick on the eastern side of Orlando, as presented in geologic sections by Lichtler and others (1968).

The net effect of the Hawthorn Group in the hydrogeologic framework for the NTC, Orlando area is to restrict the vertical flow of groundwater in the surficial aquifer and cause the primary direction of groundwater flow (in the surficial aquifer) to be horizontal. This is important in the consideration of the potential transport of contaminants in groundwater. Horizontal flow in the surficial aquifer is a common occurrence in the northern and central parts of Florida where the Hawthorn Group is present. The potential does exist in the NTC, Orlando area for groundwater to migrate vertically into the intermediate aquifer and eventually into the Floridan aquifer system, depending on the elevation of the potentiometric surface for these two lower aquifers, relative to the elevation of the water table. The low vertical permeability of the clayey Hawthorn Group sediments, however, would result in extremely slow vertical flow rates (i.e., long travel times) relative to horizontal flow rates in the surficial aquifer. The prevalence of Karst activity and sinkhole development throughout the greater Orlando area must be considered in any hydrogeologic characterization.

For these reasons, the primary unit of hydrogeologic interest to the investigation of potential groundwater contamination at OU 1 will be the surficial aquifer. The Holocene and Pleistocene sediment that contains the surficial aquifer is primarily sand with varying amounts of silt and clay. On the eastern side of Orlando, the sediment ranges in thickness from approximately 60 to 90 feet, based on geologic sections presented by Lichtler and others (1968). Groundwater flow in the surficial aquifer, as discussed above, is generally horizontal, following topography to the nearest surface water body or drainage ditch that intersects the water table. Following is a discussion of the conceptual understanding of groundwater flow in the surficial aquifer at OU 1 on which the groundwater investigations will be planned.

As discussed above, the groundwater flow direction in the surficial aquifer is expected to be primarily horizontal, following the topography of the North Grinder Landfill. The landfill is located such that topography (of the land surface) falls to the west, the north, and the east toward nearby lakes. Additionally, field reconnaissance of the area indicates that surface water is virtually nonexistent in the North Grinder Landfill area. There are neither manmade drainage swales nor any erosional features over or near the location of the landfill; i.e., there are no ditches present that would complicate the assumption that flow is following topography. There is a stormwater sewer system to handle runoff from the parking lot. There is also a shallow swale along the western boundary of the North Grinder parade area to handle runoff from General Rees Road, but no standing water was observed anywhere despite heavy rains during the site visit and for the previous several days prior to that visit.

The OU 1 landfill topography and the lack of other drainage structures in the area create a situation in which groundwater flow (following topography) has the potential to travel west, north, and east away from the site. Potentiometric data presented in the Verification Study (Geraghty & Miller, 1986) is consistent with this interpretation of groundwater flow directions.

Existing groundwater monitoring wells at the OU 1 landfill have been completed in the upper part of the surficial aquifer to depths of 14 to 22 feet bls. Because of this shallow completion, lithologic data are not available for the remaining thickness of the surficial sands. Geologic sections presented by Lichtler and others (1968) indicate that clays have been identified in the surficial sands in the Orlando area. The presence of clayey horizons (layers) in the surficial sand at OU 1, however, has not been verified by subsurface borings. The variance in the elevations for lakes closest to the landfill, which range from approximately 91 feet above mean sea level (msl) to 66 feet msl (U.S. Geological Survey [USGS), 1980) suggests that some clayey horizons may be present locally, but other hydraulic factors may also be responsible for the presence of the lakes. For these reasons, the conceptual framework of groundwater flow at the OU 1 landfill will assume that the entire thickness of the surficial sand unit is available for the potential transport of contaminants in the surficial aquifer.

The conceptual understanding of the groundwater flow at OU 1 presented above is summarized below. This understanding will form the basis on which the groundwater investigation will be planned.

- The aquifer of primary interest to the groundwater investigation at OU 1 is the surficial aquifer.
- Groundwater flow in the surficial aquifer is primarily horizontal and follows topography.
- The topography of the area indicates that the potential exists for groundwater flow to leave the area in a westerly, northerly, or easterly direction and each of these directions will be assessed during the investigation.
- The entire thickness of the surficial sand (from the water table to the top of the Hawthorn Group) is available for the potential transport of contaminants and will be assessed during the investigation.

If groundwater contamination from the landfill exists at the base of the surficial sand unit, monitoring wells will be placed into the intermediate aquifer (the Hawthorn Group) to determine if contamination has migrated to that depth. Similarly, if it is discovered that contamination exists in the intermediate aquifer, investigations will be completed in the Floridan aquifer system to determine the total depth of the contamination.

2.4 LAND USE. The Main Base occupies approximately 1,095 acres within the Orlando city limits and is comprised mainly of operational and training facilities. The North Grinder parade field occupies approximately 15 acres in the northwest corner of the Main Base, and Buildings 212 and 214 occupy an additional 7.5 acres. The western part (approximately one-third) of the parade field is a grassy field and the remainder is asphalt. The parade field is used for physical training, assembly, marching, review, and ceremonial activities.

The operational and training facilities on the Main Base are used for training new and recently graduated recruits, as well as enlisted and officer personnel in the nuclear power engineering program. Land use at the Main Base is dominated by barracks, training facilities, administrative buildings, drill fields, and recreational areas. There are two lakes within the Main Base property (Lakes Baldwin and Susannah) and four lakes (Spier, Howard, Shannon, and Gear) located in the residential areas adjacent to the facility (Figure 2-5).

The area west, north, and east of NTC, Orlando is comprised primarily of single family residential homes. The Glenridge Elementary School is located north of the installation property line several hundred feet due north of the North Grinder parade field.

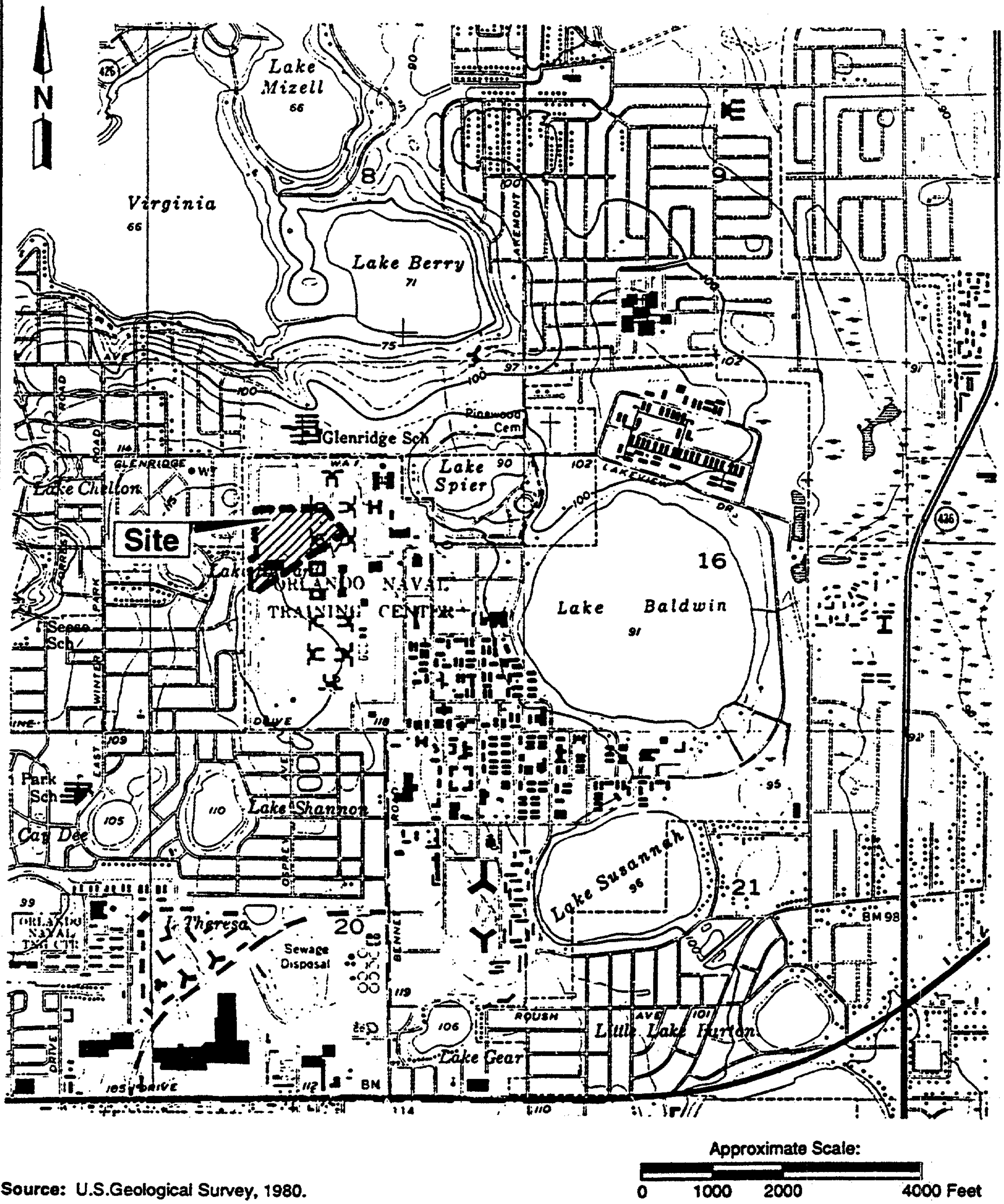
## 2.5 REVIEW OF EXISTING DATA.

2.5.1 Previous Investigations The first phase of the IR program at NTC, Orlando was the IAS conducted in 1985 (C.C Johnson, 1985). This program included an archival search and site walkovers at all four facilities of NTC, Orlando. Nine potentially contaminated sites were identified. The IR program sites are all located on three of the four NTC, Orlando facilities: Main Base, McCoy Annex, and Area "C". The sites included two trench and fill landfills (the North Grinder and McCoy Annex Landfills, Sites 1 and 3).

The Verification Study was performed in 1986 (Geraghty & Miller, 1986). The Verification Study recommended that the North Grinder Landfill at the Main Base (Site 1) be targeted for additional investigation. A brief workplan for the RI of the North Grinder Landfill (and three other IR program sites) was prepared in 1987; however, the workplan has not been implemented (ABB-ES, 1994b).

2.5.2 Types and Concentrations of Wastes The only analyses available for the North Grinder Landfill were made during the Verification Study (Geraghty & Miller, 1986). In the Initial Assessment Study of the previous year (C.C. Johnson and Associates, 1985), it was estimated that the volume of waste was 194,000 cubic yards. Approximately 1/3 of this volume was excavated during construction of Buildings 212 and 214 in 1967. The disposal location of the excavated waste is unknown. Landfill wastes reportedly included the following:

- film;
- photographic chemicals;
- paint thinner;
- garbage from mess halls;




Source: U.S.Geological Survey, 1980.

**FIGURE 2-5**

**TOPOGRAPHIC MAP OF NORTH GRINDER LANDFILL AND SURROUNDING AREA**

**RI/FS WORK PLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

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- cardboard boxes, paper, and plastic;
- biological wastes and syringes from hospital;
- tree limbs and construction materials; and
- perchloroethene (PCE) stillbottoms from laundry (stillbottoms are residues, or sludges, from dry cleaning operations, which use PCE as a cleaning agent).

Four monitoring wells (MW-1, MW-2, MW-3, and MW-4, Figure 2-6) were installed during the Verification Study (Geraghty & Miller, 1986). The wells were sampled for USEPA priority pollutants, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs), metals, cyanide, and total radiological activity (gross alpha and gross beta). A summary of the results is presented in Table 2-1. Elevated gross alpha values may be caused by naturally occurring radon and/or uranium. Without specific radionuclide activity values, a determination of the significance of these values cannot be made.

**Table 2-1**
**Summary of Results of Groundwater Analyses**

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
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| Compound | Location | Concentration | Federal MCL | State MCL |
|---|---|---|---|---|
| Iron | MW-1 | 1.5 ppm | N/A | 0.3 ppm[1] |
| Arsenic | MW-3 | 68 ppb | 50 ppb | 50 ppb |
| Gross alpha | MW-1 thru MW-4 | 20 to 41 pCi/L | 15 pCi/L | 15 pCi/L |
| Gross beta | MW-1 thru MW-4 | 28 to 38 pCi/L | 50 pCi/L[2] | 50 pCi/L[1] |
| Methylene chloride (dichloromethane) | MW-4 | 15 ppb | 5 ppb | 5 ppb |

[1]Secondary standard maximum contaminant level (MCL).
[2]Gross beta screening level is being referenced because specific nuclides must be known in order to convert to dose (whole body or organ) before a comparison to the 4 millirem per year Federal and State MCL can be made.

RI/FS = Remedial Investigation and Feasibility Study.
MCL = maximum contaminant level.
N/A = not applicable.
ppm = parts per million.
ppb = parts per billion.
pCi/L = picocuries per liter.

<u>2.6 APPROACH OVERVIEW</u>. The current system for Superfund cleanups is based on two programs, remediation and removal. The remedial program is traditionally structured towards long-term remedies that address risk as predicted under future scenarios. This traditional process has lead to long study-based investigations to enable detailed alternative selection and evaluation of proposed remedies.

Recognizing that the process is both slow and expensive, USEPA sought to encourage flexibility in the program through the Superfund Accelerated Cleanup Model (SACM) program (USEPA, 1992a). SACM encourages early actions, or ways to focus the RI/FS parts of an investigation. This is especially true for certain types of sites with similar characteristics, such as municipal landfills. The goal of SACM is to accelerate the entire remedial process.

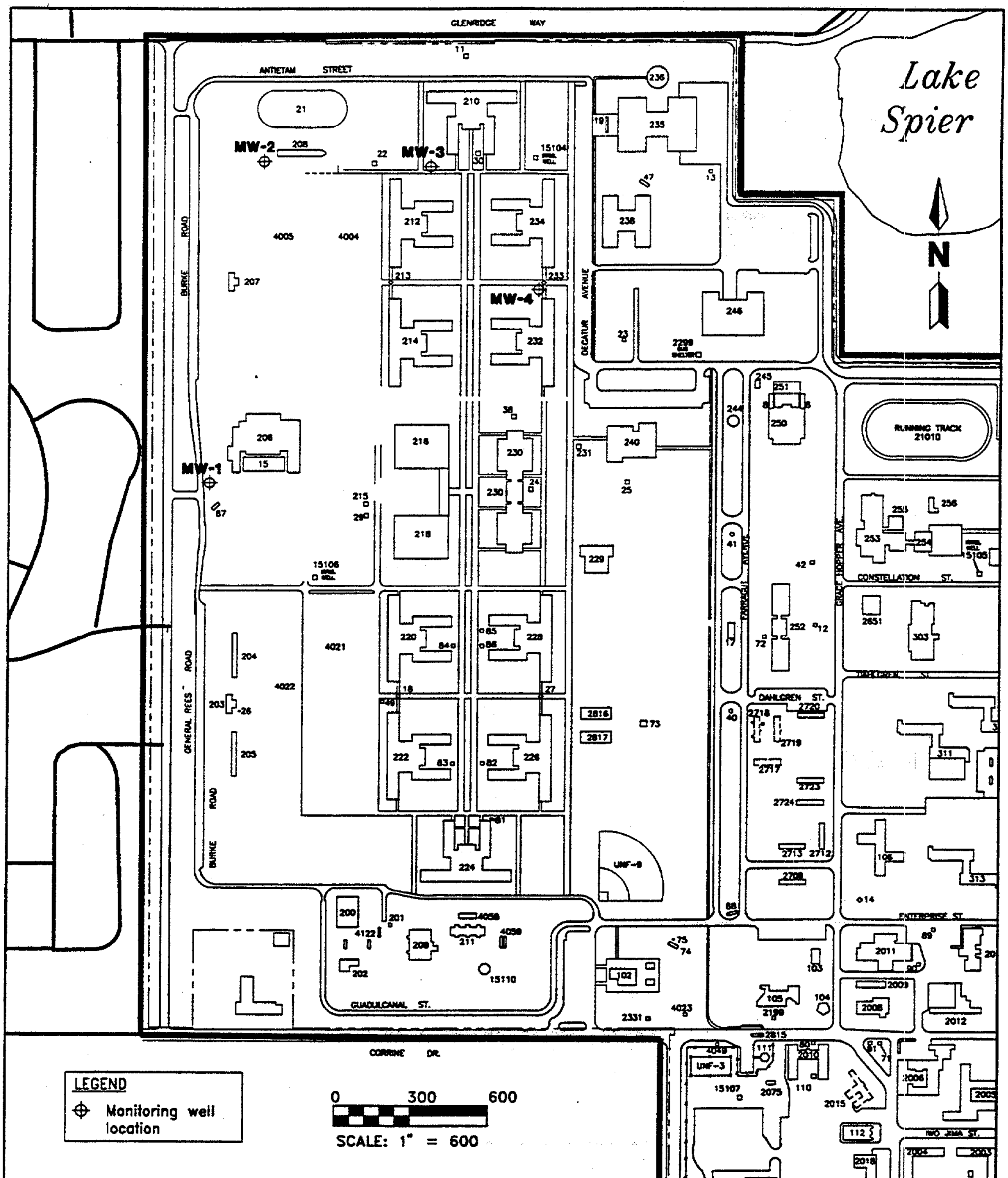


**FIGURE 2-6**
**LOCATION OF MONITORING WELLS INSTALLED IN VERIFICATION STUDY**

**RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

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Based on information collected from these types of sites previously investigated, presumptive remedies are considered a tool of acceleration within SACM that should be applied when appropriate. Presumptive remedies are preferred technologies for common categories of sites, based on historical RI/FS investigations within the Superfund program. They are a tool within SACM used to accelerate cleanup. Thus, past experience can streamline or focus the site investigation and remedy selection and reduce the cost and time required to clean up this type of site.

For this investigation of the North Grinder Landfill, the presumptive remedy of containment will be used within the approach of this workplan. It is anticipated that additional technologies may need to be added to the presumptive remedy to meet overall remedial objectives for the site.

To achieve the goals of SACM, uncertainties inherent in the RI/FS process must be recognized in the work planning phase. A common misconception is that uncertainties can be reduced early in the life of the project. It is reasoned that time and resources invested during the investigation and study phases can yield a high degree of certainty in the expected results, and thus prevent large expenses later. However, as has been demonstrated in previous Superfund projects, major technical uncertainties exist in all of the key components of hazardous waste site characterization and remediation. There remains uncertainty in characterizing the affected media, predicting contaminant fate and transport, assessing risk, and predicting technology performance. These uncertainties have the following consequences for the traditional approach to site remediation.

- It is traditionally assumed that more study will progressively reduce uncertainty by meaningful amounts. For all but the simplest of waste sites, this has not been the case. Because of the high degree of heterogeneity within the landfill and problems inherent in dealing with karst geology, the marginal value of collecting and analyzing more samples declines rapidly once general site conditions are ascertained.

- Traditionally, the expectation for remedial design is that the constructed remedy will closely resemble the alternative selected in the Record of Decision (ROD). Because of the high degree of uncertainty associated with complex hazardous waste sites, engineers and scientists inevitably enter the implementation phase with many unresolved questions. Under the traditional approach, many of these unknowns are not acknowledged and, thus, are only detected as a result of a failure of the remedy.

- In the presence of uncertainty, individuals adopt different assumptions and interpretations. The traditional approach does not ultimately distinguish between their interpretations, and the implementation phase recognizes only one interpretation: equally valid interpretations are not recognized.

Uncertainty need not handicap a project as long as it is recognized as a factor from the beginning and as long as it is possible to observe and continuously test the working model of the site as implementation proceeds. An approach is suggested to address uncertainties common at hazardous waste sites. This approach relies on robust and flexible designs that can be modified during implementation to meet conditions as they are found. It is far safer to recognize uncertainty and plan for it than to assume that state-of-the-art technology will make highly accurate predictions and provide the necessary answers. It is this premise that has spawned programs such as SACM and related concepts including presumptive remedies and streamlining.

The following steps lead to the identification of the most probable conditions and accounts for reasonable deviations for the site in the form of a conceptual to be used during design and implementation. Monitoring and contingent actions to take if deviations are detected are also identified.

1. Planning sessions are conducted to sort through issues, review existing data, and screen possible remedial actions and technologies. A workplan is developed to give direction to the following investigation and analyses.

2. Information is gathered and knowledge refined of general site conditions and the nature and extent of contamination. Investigations are complete when it is possible to identify probable conditions (including associated risk), differentiate among alternatives, set monitoring requirements, and identify reasonable deviations. Probable site conditions are identified as those most likely to be occurring. Reasonable deviations are other interpretations of site conditions that could reasonably be occurring.

3. The most probable site conditions and reasonable deviations are established. Through this identification, conceptual designs incorporating both a base action and a contingent action can be developed and an ROD signed. The designed alternatives will identify probable technology performance and reasonable deviations to the performance.

4. Following remedy selection, remedial designs based on the most probable site conditions, plus designs covering contingencies for the agreed-upon reasonable deviations are produced.

5. Items to observe during remediation to detect deviations during construction and operation are selected. Key indicators (chemical, physical, and others) are selected for observation during remediation for both expected and deviant conditions. The selected parameters are measured and necessary modifications (contingent action) are made if deviations occur. Decisions on changes to the remedial action will be made on the basis of detected deviations and contingent actions developed.

This proposed approach recognizes that complete site characterization is not possible or necessary and, therefore, it will be necessary to manage remaining uncertainties. This approach emphasizes the collection of data only to support decisions. At the North Grinder Landfill, because a presumptive remedy of containment will be used, the primary decisions will be (1) to determine if groundwater controls are needed to prevent groundwater migration, and (2) the type of cover that may be required to prevent exposure. To make these decisions, data must be available to support a human health risk assessment, a qualitative ecological risk evaluation, and a feasibility study.

To provide confidence that potential contamination has been identified and to verify the conceptual site model for sediment, surface water, and surface soil (evaluation of soil quality), two different sampling strategies will be applied to the different media within and surrounding the landfill.

- Samples to evaluate gas generation and migration from the landfill will be taken. Hydrologic, groundwater, and surface soil data will be collected on a systematic basis due to the potential heterogeneity involved.

- In areas where contamination is considered to be either unlikely or more homogeneously distributed (sediment and surface water), a statistically based sampling methodology will be applied.

The proposed statistical approach is based on the collection of randomly assigned samples within defined areas of relatively homogeneous contamination and/or environment. The number of samples to be taken within any homogeneous area is independent of its size and is based upon a nonparametric (distribution-free) statistical method that calculates the size of a sample (N) required to estimate a prespecified part of the sampled population with a prespecified level of confidence (Conover, 1980).

Nonparametric specification makes no assumptions about the underlying distribution of the chemical or compound. It does require specification of a desired level of confidence and a desired part of the population (quantile) being estimated. The level of confidence reflects the probability that the maximum concentration from a sample of a given size will equal or exceed the prespecified quantile that is preselected. For example, a prespecified confidence level of 75 percent and a prespecified 0.5 quantile means that the maximum concentration from the sample of size "N" will be greater than or equal to the median (due to chance alone) more than 75 times out of 100. Thus, "N" increases as either the preselected quantile (upper tolerance limit) or preselected level of confidence increases.

The effect of raising the quantile of interest dominates the increase in required sample size. For example, to be 90 percent certain that the maximum concentration from a sample exceeds the median of the population being sampled requires a sample size of 4; to be 95 percent certain requires a sample size of 5, a comparatively negligible increase in sample size. To be 95 percent confident that the maximum sample concentration is greater than the 0.95 quantile requires a sample size of 59. Table 2-2 tabulates sample size to meet ranges of prespecified coverage and prespecified confidence levels.

**Table 2-2**
**Sample Size as a Function of Coverage and Confidence Levels**

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
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| Estimated Quantile (Median) | 85% Confidence | 90% Confidence | 95% Confidence |
|---|---|---|---|
| 50th | 3 | 4 | 5 |
| 75th | 7 | 9 | 11 |
| 85th | 12 | 15 | 19 |
| 95th | 37 | 45 | 59 |

Notes: RI/FS = Remedial Investigation and Feasibility Study. % = percent.

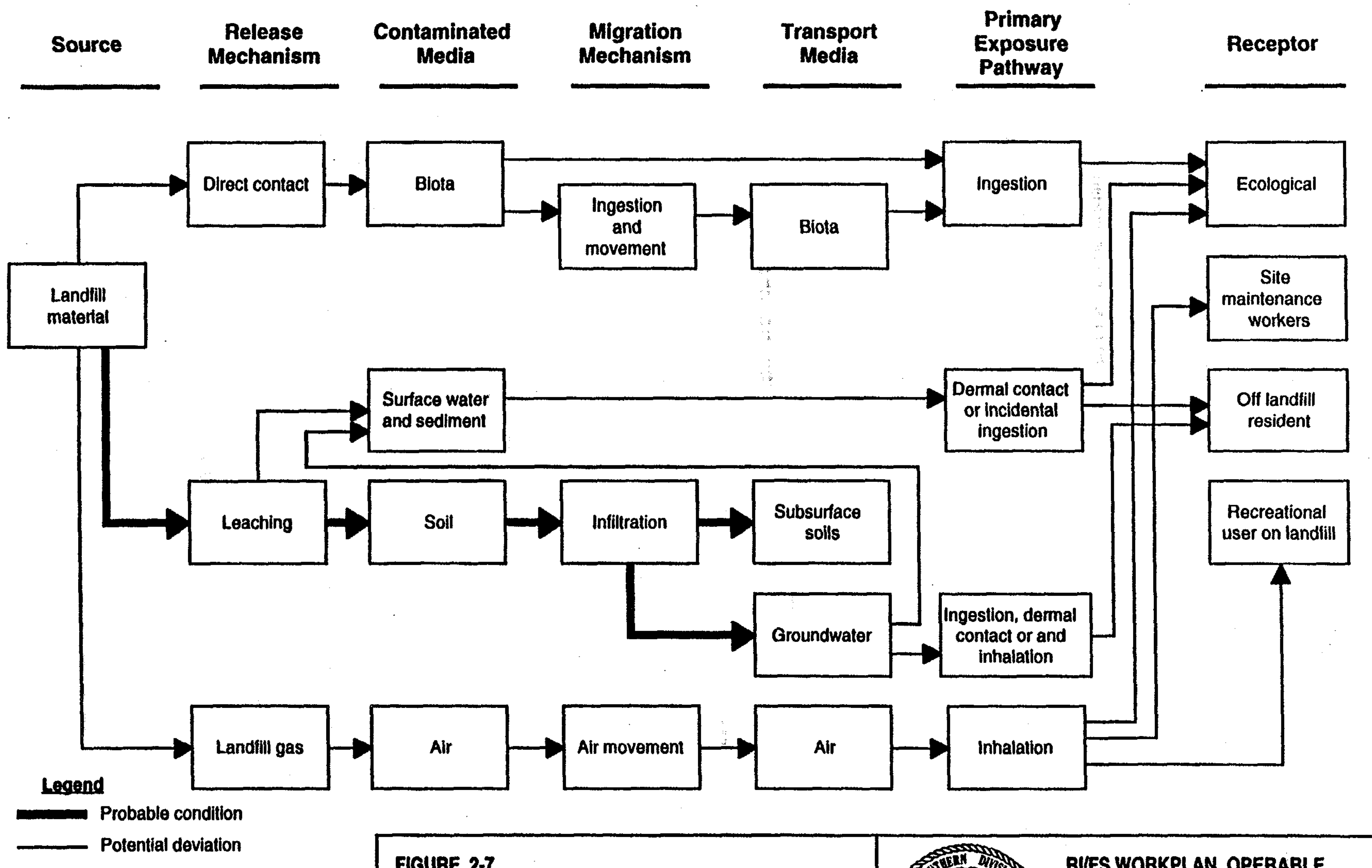
Selection of pre-specified quantiles and confidence limits is best determined on the basis of a number of factors: the conceptual site model, the media being sampled, potential exposure routes, the type of contaminants assumed to be present, and the specific uses to be made of the estimates derived from the sample results (i.e., comparison to regulatory standards or numeric criteria, estimation of background criteria, or estimates of average exposure concentrations). Greater coverage may be desired in areas where greater variability in either the number of contaminants or range of contaminant concentrations is expected. The median is often used as the pre-specified quantile when sampling is focused on estimating potential risks and contaminant concentrations to support the FS. A pre-specified confidence level of 95 percent on the median results in a sample size of five. Results from a sample size of five that are negative (less than contaminant criteria) should be adequate to support no further sampling. Results that exceed risk levels should be adequate to estimate the median concentration of contaminant levels within the area sampled.

The only strong assumption implicit with this proposed statistical method is that sampling is randomized. Randomization (which is not synonymous with arbitrary) means that any location carries an equal probability of being sampled and that sample locations are randomly assigned. Although an essential component to the proposed sampling strategy, randomization is not necessarily the most efficient way to assign sample locations. A useful constraint to randomization in environmental situations is to systematically sample from a randomized start point. This means that all points in an area to be characterized carry equal probability of being sampled but that the entire area is sampled to some extent. Examples include gridding an area with a randomized starting point and grid orientation. Applications of this strategy in an area that is linear would consist of equispaced samples along a transect, with the first sample located at a randomly selected starting point.

## 2.7 DATA NEEDS EVALUATION.

2.7.1 Conceptual Site Model The conceptual site model is a framework within which the environmental pathways of potential concern are identified and illustrated. The media to sample to evaluate whether a release has occurred can be identified from the model. The model also serves as a framework for conceptualizing response actions. The model includes a set of hypotheses about the contaminated media and environmental pathways that are selected on the basis of existing data and site understanding. The source areas are identified as those areas of waste deposition. A contaminant release mechanism is defined as a process that results in migration of a contaminant from a source area into the immediate environment. Once in the environment, contaminants can be transferred between media and transported away from the source and/or site.

Figure 2-7 illustrates the various media, transport pathways, and exposure pathways that could be affected by release of the source material within the North Grinder Landfill. This model represents current and predicted future conditions at the site assuming that the site, from a regulatory standpoint, will remain a landfill. In the conceptual site model, a distinction has been made between probable conditions and reasonable deviations. From the existing data, general site understanding, and the presumptive remedy of containment being applied, there is considerable confidence in the designation of probable conditions versus




**Assumption:** Landfill soil cover is existing and will be maintained, and no utilities exist that are in contact with landfill waste. Thus, the site exposure scenarios are under institutional and industrial controls. This model represents current and future uses.

**FIGURE 2-7**

**CONCEPTUAL SITE MODEL, NORTH GRINDER LANDFILL, OPERABLE UNIT 1**

**RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

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reasonable deviations. For the most part, data collected will be used to characterize the current nature and extent of contamination to support the human and ecological risk assessment and the FS.

Contamination of subsurface soil underlying the landfill is probable due to the history and nature of the landfill. The probable contaminants are organics, inorganics, and methane. Other contaminants that are potential (reasonable deviation) would be low level radiological waste associated with Air Force operations (to account for elevated gross alpha and beta activity in groundwater samples collected during the Verification Study). Radon gas and gamma radiation might also be present as a result of the radioactivity. Radon gas and some gamma emitters, however, are naturally occurring in the area.

In the site model, there are two probable release mechanisms for contaminants.

(1) Direct contact. Biota directly in contact with the source material can be exposed through ingestion and dermal contact. Because of the assumptions that the (1) landfill soil cover exists and will be maintained, and (2) that no utilities pass through the waste, direct contact by humans is not considered in any exposure scenario.

(2) Leaching. Contaminants can leach from the source (landfill) into surrounding soil and groundwater.

Four potential deviations resulting from the probable release mechanisms discussed above have been identified as follows.

(1) Contaminated offsite sediment and surface water. It is possible that leachate has migrated offsite to contaminate sediment and surface water in downgradient lakes and ponds.

(2) Contaminated offsite groundwater. It is possible that contaminants have leached into the groundwater from contact with landfill materials, and that area residents are currently withdrawing this water from the surficial aquifer and using it in sprinkler systems for irrigation (potential inhalation and dermal contact of contaminants) and/or as a potable water source.

(3) Affect on the biota food chain. As a result of biota being exposed to the contaminated materials (source material from the landfill or contaminated sediment and surface water from offsite), bioaccumulation and associated risks may be present as a result of biota ingesting other, contaminated biota.

(4) Gas release generated from the landfill wastes. Despite the age of the landfill, the decay of municipal waste disposed within the landfill may produce methane. Radon is not considered a potential deviation due to its short half-life (3.8 days) and resulting low potential for lateral migration.

Assuming that the landfill contents will remain onsite and the soil cover and/or cap will be maintained, direct exposure for humans is not included in the exposure pathway. Potential exposure might, however, occur through incidental ingestion and dermal contact of offsite sediment, surface water, and groundwater in downgradient lakes and ponds. Exposure to biota is probable onsite through burrowing terrestrial biota. Exposure is potential offsite by exposure to aquatic organisms and resulting ingestion by other biota. Exposure through ingestion of groundwater within the Floridan aquifer system is not considered probable or potential due to existing data and the presence of the Hawthorn Group, the principal aquitard impeding vertical flow between the surficial aquifer and Floridan aquifer system (Section 2.3, Hydrogeologic Setting). This will be verified, however, during the RI as discussed in Section 2.3.

The exposure potential to these probable and potential contaminated media is discussed in the next section, Preliminary Risk Evaluation.

### 2.7.2 Preliminary Risk Evaluation

**2.7.2.1 Hazard Identification** Wastes reportedly disposed in the North Grinder Landfill include film, photographic chemicals, PCE still bottoms, paint thinner, garbage from mess halls, cardboard boxes, biological wastes and syringes from the hospital, paper, plastic, tree limbs, and construction materials (ABB-ES, 1994a). Limited analytical data are available on the former landfill. Groundwater samples collected from four monitoring wells in the area of the former landfill indicate the presence of iron, arsenic, zinc, manganese, methylene chloride, phenols, and radionuclides (ABB-ES, 1994a). Based on the waste disposal history and limited monitoring data, potential hazards at the site appear to be organics, inorganics, and radionuclides.

#### 2.7.2.2 Human Health Preliminary Risk Evaluation

Potential Receptors. Potential receptors exposed to contamination associated with the North Grinder Landfill have been identified by considering present and future land and groundwater uses at the Site.

The North Grinder Landfill is within the Main Base, which is comprised mainly of operational and training facilities. Current land use at the Main Base consists of activities associated with the barracks, training facilities, administrative buildings, drill fields, and recreational areas. Two lakes are on Main Base property (Lakes Baldwin and Susannah) and four lakes (Spier, Forest, Shannon, and Gear) are in residential areas adjacent to the Main Base.

The Main Base is surrounded by urban development, including single and multi-family housing, schools, and commercial development. Land uses directly west and northwest of the facility are mainly residential. To the southwest of the Main Base, land use is commercial. Herndon Airport is located 1.5 miles to the south of the Main Base. No industrial facilities exist adjacent to the Main Base, except for automotive repair facilities on the southwest property line (ABB-ES, 1994a).

The Main Base obtains its drinking water supply from the Orlando Utilities Commission and Winter Park Utilities (ABB-ES, 1994a). One of the Orlando Utilities Commission's supply wells is located at the southeast corner of the Main Base. In addition, 10 irrigation wells are present on the Main Base.

All surface water in the vicinity of NTC, Orlando is classified by the State of Florida as Class III water suitable for fish and wildlife propagation and water contact sports (ABB-ES, 1994a). Groundwater in the surficial aquifer, and the Floridan aquifer system at NTC, Orlando is classified as Class G-II groundwater suitable for potable use.

NTC, Orlando is slated for closure as a BRAC facility. From a regulatory standpoint the North Grinder area will be treated as a closed landfill. However, current reuse scenarios include parks and recreation, with residential areas outside of, but adjacent to, the closed landfill. For purposes of this RI/FS workplan, it is assumed that no utilities pass through the former landfill. The potential exposures of maintenance workers in direct contact with landfill wastes is avoidable and risks to human health far outweigh the convenience of maintaining such utilities in the future.

Recognizing probable future uses of the landfill, the following potential receptors have been identified:

- A site maintenance worker who performs routine landfill maintenance activities (cap maintenance and sprinkler system repairs) that may allow inhalation of landfill gas,
- future recreational user of the site, and
- future area resident who extracts groundwater from beyond the landfill boundaries for potable use or irrigation.

Potential Exposure Pathways. An exposure pathway consists of four elements:

- a contaminant source,
- a transport mechanism,
- an exposure route (i.e., direct contact or ingestion), and
- a receptor.

The conceptual site model for the North Grinder Landfill was presented in the previous section. The exposure pathways anticipated for the North Grinder Landfill are shown in the conceptual model. Under what are considered to be the most probable site conditions, there are no exposure pathways for humans in the model.

Other potential pathways considered, although less likely to be completed pathways and therefore referred to as potential deviations, include the following.

- Dermal contact with and incidental ingestion of landfill-derived contaminants that have migrated to surface water and/or sediment beyond the landfill boundaries by an area (off-landfill) resident was considered.
- Ingestion of and direct contact with groundwater by a future area (off-landfill) resident was considered. The groundwater is assumed to be extracted from the surficial aquifer at a location beyond the boundaries of the landfill at some point in the future. If volatile contaminants are present, the inhalation exposure route will be included.

- Inhalation of landfill gas by a site maintenance worker or recreational user of the site in the future was considered.

Existing data suggest that exposure through ingestion of groundwater from within the Floridan aquifer is not probable or potential due to the presence of the Hawthorn Group, the principal aquitard impeding vertical flow between the surficial aquifer and the Floridan aquifer system. However, this will be verified during the remedial investigation.

Exposure Pathways Under the Presumptive Remedy. The USEPA's directive on presumptive remedies for CERCLA municipal landfill sites (USEPA, 1993a; 1993b) states that those exposure pathways addressed by the presumptive remedy need not be evaluated quantitatively in the RI/FS risk evaluation. The presumptive remedy of source containment is assumed to adequately address or mitigate the potential risks associated with those exposure pathways. The presumptive remedy, as described in the directive, includes the following components:

- landfill cap,
- source area groundwater control,
- leachate collection and treatment,
- landfill gas collection and treatment, and
- institutional controls.

The remedy selected for OU 1 will be determined based on the results of the RI; some, all, or none of the above components may be selected.

Following USEPA directives, a landfill cap is assumed to prevent human receptors from coming into direct contact with landfill material and contaminated surface soil, thereby eliminating this exposure pathway. In the RI, the adequacy of the existing soil cover and pavement will be evaluated to determine if it is sufficient to prevent exposure. Source area groundwater control and/or leachate collection and treatment will prevent further migration of contaminants from the source to potential downgradient groundwater receptors including potential points of groundwater discharge. Further investigation is needed to determine the presence and/or extent of groundwater contamination. Landfill gas collection and treatment, if necessary, will prevent the buildup and/or release of gases from the landfill, therefore eliminating this pathway. The RI will investigate the presence or absence of landfill gases. Institutional controls (for example, deed restrictions) restricting site usage related to future excavation, construction, and/or groundwater extraction may also be selected as remedies to control future site use.

2.7.2.3 **Ecological Preliminary Risk Evaluation** A preliminary risk evaluation was conducted to provide input for the development of this RI workplan and the upcoming RI. This section presents the results of the evaluation and contains a brief discussion of the potential ecological receptors and exposure pathways present at the North Grinder Landfill (OU 1) through which ecological receptors could be exposed to the contaminants of potential concern (CPCs) discussed in Paragraph 2.7.2.1.

Potential Ecological Receptors.

Terrestrial Habitat and Receptors. Approximately 5 percent of the NTC, Orlando installation (roughly 100 acres basewide) is undeveloped, providing a limited amount of habitat for ecological receptors. The majority of the ground surface overlying the North Grinder Landfill is currently paved, with an area of planted and mowed grass.

Three tree species provide the predominant vegetative cover at the base: live oak (*Quercus virginiana*), slash pine (*Pinus elliottii*), and cabbage palm (*Sabal palmetto*). Wetland habitat, located primarily in other parts of the installation, is dominated by bald cypress (*Taxodium distichum*)(C.C. Johnson and Associates, 1985). Red maple (*Acer rubrum*) and pines (*Pinus* spp.) are additional dominant wetland tree species noted by ABB-ES ecologists during a brief reconnaissance of the installation. Additional information regarding vegetative cover types in the vicinity of the North Grinder Landfill is not currently available, but will be obtained and incorporated into the habitat characterization of the RI, as discussed in Chapter 5.0.

Limited information is available regarding terrestrial fauna at NTC, Orlando. Because the majority of the land in the vicinity of the North Grinder Landfill is paved or covered by buildings, the potential wildlife habitat appears to be limited to the areas of planted grasses and ornamental trees and shrubs.

Small mammals that may exist at the site include the eastern cottontail rabbit (*Sylvilagus floridanus*), hispid cotton rat (*Sigmodon hispidus*), and cotton mouse (*Peromyscus gossypinus*). Predatory mammals such as the red fox (*Vulpes vulpes*) and gray fox (*Urocyon cinereoargenteus*) may feed on small mammals at the base.

Birds of prey such as the black vulture (*Coragyps atratus*), turkey vulture (*Cathartes aura*), red-tailed hawk (*Buteo jamaicensis*), and red-shouldered hawk (*B. lineatus*) may forage for prey items in the vicinity of the landfill. Granivorous birds such as the mourning dove (*Zenaida macroura*) are likely to be found occasionally in the grassy areas or ornamental shrubs and trees that comprise the majority of habitats at the site. Other bird species that may exist at NTC, Orlando include the brown-headed cowbird (*Molothrus ater*), brown thrasher (*Toxostoma rufum*), bobwhite quail (*Colinus virginianus*), mockingbird (*Mimus polyglottus*), common grackle (*Quiscalus quiscula*), killdeer (*Charadrius vovoferus*), northern cardinal (*Cardinalis cardinalis*), blue jay (*Cyanocitta cristata*), rufous-sided towhee (*Pipilo erythrophthalmus*), common flicker (*Colaptes auratus*), and red-bellied woodpecker (*Centurus carolinus*).

Several species of venomous snakes may exist in the area, including the eastern coral snake (*Micururus fulvius fulvius*), dusky pygmy rattlesnake (*Sistrurus miliarus barbouri*), and eastern diamondback rattlesnake (*Crotalus adamanteus*). These snakes are among the top predators in the food chain at the installation. Rattlesnakes feed on rodents, birds, amphibians, and small reptiles. Coral snakes ingest other snakes, lizards, and amphibians.

<u>Aquatic Habitat and Receptors</u>. All surface water in the vicinity of NTC, Orlando are classified by the State of Florida as Class III waters, suitable for fish and wildlife propagation and water contact sports.

The majority of aquatic habitat in the vicinity of the North Grinder Landfill is located in the series of lakes, ponds, and swamps located in surrounding parts of the base and nearby off-base. These lakes and ponds, and swamps with sufficient water, provide habitat for a number of fish species, including smallmouth bass (*Micropterus salmoides*), bluegill sunfish (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), golden shiner (*Notemigonus crysoleuca*), yellow bullheads (*Ictalurus natalis*), and killifish (*Fundulus* spp.), as well as aquatic invertebrates (C.C. Johnson and Associates, 1985). According to the NTC, Orlando Master Plan Update (SOUTHNAVFACENGCOM, 1985), grass carp (*Ctenopharyngodon idella*) have been introduced into several of the larger lakes to control Florida elodea (*Hydrilla verticillata*), an invasive, rapidly growing aquatic weed that chokes waterways, rendering them impassable to boat traffic (C.C. Johnson and Associates, 1985).

Amphibians that may live in the vicinity of the North Grinder Landfill include frogs (e.g., members of the genera *Hyla*, *Rana*, and *Pseudacris*) and toads (*Bufo* spp.), and possibly some salamanders. The Florida cottonmouth (*Agkistrodon piscivorus*), a venomous aquatic snake inhabiting lakes, rivers, swamps, and ditches, also could exist in small, intermittent surface water bodies, such as the subtle drainage swales that exist along the roads west and north of the landfill. Cottonmouths feed on fish, amphibians (e.g., frogs and salamanders), small- to medium-sized reptiles (e.g., lizards, small turtles, and baby alligators), small birds, and mammals. Turtles and other aquatic and semiaquatic reptiles (e.g., the American alligator, *Alligator mississippiensis*) may exist in some of the lakes and other water bodies at the installation but are unlikely to exist in the vicinity of the North Grinder Landfill.

Rare, Threatened, and Endangered Species. Limited information is currently available regarding rare, threatened, and endangered species at NTC, Orlando. Additional information regarding rare, threatened, and endangered plants and animals will be requested from State and Federal authorities (i.e., Florida's Natural Heritage Program, the Florida Game and Fresh Water Fish Commission, and the U.S. Fish and Wildlife Service) during the RI. Based on the information available in the 1985 Master Plan Update (SOUTHNAVFACENGCOM, 1985) and in the IAS of NTC, Orlando (C.C. Johnson and Associates, 1985), Table 2-3 presents the species that may currently (or have historically) exist at NTC, Orlando.

**Table 2-3**
**Rare, Threatened, and Endangered Species**

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Common Name | Scientific Name | Status | |
|---|---|---|---|
| | | Federal | State |
| Florida mouse | *Podomys floridanus* | C2 | SSC |
| Southeastern kestrel | *Falco sparverius paulus* | C2 | T |
| Short-tailed snake | *Stilosoma extenuatum* | C2 | T |
| Eastern indigo snake | *Drymarchon corais couperi* | T | T |
| Gopher tortoise | *Gopherus polyphemus* | C2 | SSC |
| American alligator | *Alligator mississippiensis* | T(S/A) | SSC |

Source: Florida Game and Fresh Water Fish Commission (FGFWFC, 1991).

Notes: RI/FS = Remedial Investigation and Feasibility Study.
C2 = Federal candidate species.
T(S/A) = threatened due to similarity of appearance.
SSC = species of special concern.
T = threatened.

Potential Ecological Exposure Pathways. In this section, potential ecological exposure pathways are discussed for the North Grinder Landfill. A complete exposure pathway contains the following four components:

- a contaminant source,
- a transport mechanism to a medium of ecological exposure,
- an exposure route (i.e., direct contact or ingestion), and
- a receptor.

Potential exposure pathways for the North Grinder Landfill are summarized in a conceptual site model shown in Figure 2-7. The contaminant source is considered to be the landfill material. Contaminants from the source may migrate into environmental media. The contaminated media providing potential exposure points for ecological receptors include soil, sediment, and surface water. Groundwater is not considered to be a medium for exposure except as it contributes to sediment and surface water contamination.

Exposure of ecological receptors to contaminants can occur directly via contact with contaminated media or indirectly via the food chain. Significant exposures via the food chain, however, are only expected for chemicals known to bioaccumulate (i.e., some inorganic chemicals such as mercury and lead, PCBs, and certain organochlorine pesticides).

Exposure pathways shown in Figure 2-7 are identified as either a probable condition (i.e., exposure pathways that are likely to exist) or a possible deviation (i.e., exposure pathways that are unlikely to exist based on currently available information).

Terrestrial Exposure Pathways. Probable ecological exposure pathways for terrestrial species in the vicinity of the North Grinder Landfill include the following:

- food chain exposure and

- direct contact and incidental ingestion of landfill material.

Additional ecological exposure pathways for terrestrial species that are identified as possible deviations in the conceptual site model include:

- dermal contact and incidental ingestion of contaminated sediment by terrestrial wildlife,

- dermal contact and ingestion of contaminated surface water by terrestrial wildlife, and

- inhalation of landfill gas.

Plants and soil invertebrates (e.g., earthworms) may be exposed to chemicals in surface soil via direct contact and uptake into tissue. Soil invertebrates also ingest soil and, therefore, may be exposed via ingestion of contaminated soil. Other terrestrial species are not in constant contact with soil, but they still may be exposed via direct contact and incidental ingestion of surface soil as a result of foraging or grooming activities. Higher trophic level species could be exposed to chemicals known to bioaccumulate via the food chain. However, given the very limited habitat at the landfill, prey items from the landfill are likely to comprise very little, if any, of the total daily intake for most predatory species.

Significant contact with subsurface soil is considered unlikely for the majority of ecological receptors. Burrowing animals, however, such as the gopher tortoise and a number of small mammal species, could potentially burrow into landfill material and be exposed. At the North Grinder Landfill, subsurface exposure is unlikely due to the presence of pavement over much of the landfill surface.

Aquatic Exposure Pathways. Based on site conditions and the conceptual site model for the North Grinder Landfill, there are no complete exposure pathways for aquatic life under the most probable site conditions. A possible deviation in the conceptual site model suggests that a potential exposure pathway may include dermal contact and ingestion of surface water and sediment by aquatic life.

Aquatic and semiaquatic organisms, including invertebrates, fish, amphibians, and some reptiles, could potentially be exposed to contaminants in surface water and sediment in the vicinity of the landfill. The available site data are currently insufficient to determine which surface water bodies have been, or may be, contaminated by landfill-related contaminants; this data gap has been identified and will be addressed during the RI. If this exposure pathway is complete, potential food chain exposures and risks to predatory species will be evaluated.

Exposure Pathways Under the Presumptive Remedy. Following USEPA directives on presumptive remedies for CERCLA municipal landfill sites (USEPA, 1993a; 1993b), those exposure pathways that are addressed by the presumptive remedy will not be evaluated in the RI/FS risk evaluation. The presumptive remedy of source containment will be assumed to adequately address or mitigate the potential risks associated with those exposure pathways. The presumptive remedy includes the following components:

- landfill cap,
- source area groundwater control,
- leachate collection and treatment,
- landfill gas collection and treatment, and
- institutional controls.

The remedy selected for OU 1 will be determined based on the results of the RI; some, all, or none of the above components may be selected.

The landfill cap will prevent ecological receptors from direct contact with landfill material and contaminated surface soil, thereby eliminating this exposure pathway. The RI will investigate the existence and integrity of the current soil cover, and determine if a soil cap exists that is sufficient to prevent exposure to contaminated soil and landfill materials. Source area groundwater control and/or leachate collection and treatment will prevent further migration of contaminants from the source to surface water and sediment. Migration of contaminants to surface water bodies may have already occurred. Therefore, further investigation is needed to determine if migration to surface water has occurred and to identify and investigate any potentially affected surface water bodies. Landfill gas collection and treatment, if necessary, will prevent the buildup and/or release of gases from the landfill; therefore, eliminating this pathway. The RI will investigate the presence or absence of landfill gases.

Institutional controls (e.g., deed restrictions) are not an effective means for protecting ecological receptors to contaminated surficial media (surface water, surface soil, and sediment). Deed restrictions preventing excavation and construction, however, may protect ecological receptors against future exposures to subsurface contamination within the landfill.

<u>2.7.3 Preliminary Identification of Remedial Action Technologies</u> The identification of preliminary remedial action technologies required the identification of ARARs, remedial action objectives (RAOs), and probable treatment technologies.

**2.7.3.1 Applicable or Relevant and Appropriate Requirements (ARARs)** The ARARs are used to determine the appropriate extent of the required remedial action, develop remedial action alternatives, and direct the remedial action. Section 121 of the Superfund Amendments and Reauthorization Act (SARA) of 1986 and the National Oil and Hazardous Substances Contingency Plan (NCP) specifies that remedial actions for cleanup of hazardous substances must comply with requirements or standards under Federal, or more stringent State, environmental laws that are ARARs to the hazardous substances or particular circumstances at a site. NTC, Orlando is not classified as a CERCLA (NPL) site; however, the identification of ARARs will follow this CERCLA guidance to ensure strict conformance with regulatory criteria.

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 law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances found at a CERCLA site" (55 Federal Register [FR] 8814, March 8, 1990 [NCP]). Examples of applicable requirements include cleanup standards and standards of control for a hazardous substance. Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal or State environmental or facility siting law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (55 FR 8814). For example, the maximum contaminant levels (MCLs) promulgated under the Safe Drinking Water Act would be considered relevant and appropriate at a site where surface or groundwater contamination could affect a potential (not actual) drinking water source.

Requirements under Federal or State law may be either applicable or relevant and appropriate to CERCLA cleanup actions, but not both. However, requirements must be both relevant and appropriate for compliance to be required. In the case where a Federal and a State ARAR are available, or when there are two potential ARARs addressing the same issue, the more stringent requirements must be met.

In the absence of Federal or State promulgated regulations, there are other criteria, advisories, guidance values, and proposed standards that are not legally binding, but may serve as useful guidance for setting protective cleanup levels. These are not potential ARARs, but are "to-be-considered" (TBC) guidance.

A table is presented in Appendix A of this workplan that represents a preliminary compilation of potential ARARs, of which subsets will be used or additional ARARs added as site-specific contaminants are identified and remedial actions are evaluated during the FS. This list is separated into the following three categories: chemical-, location-, and-action specific ARARs.

- "Chemical-specific requirements set health or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, or contaminants" (55 FR 8814). These requirements generally set protective cleanup levels for the contaminants of concern in the designated media; or indicate a safe level of discharge that may be incorporated when considering a specific remedial activity. Little legislation or guidance is available governing cleanup criteria for contaminated soil or sediment.

- Location-specific requirements "are restrictions placed upon the concentration of hazardous substances or the conduct of activities solely because they are in special locations. Some examples of special locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats." (53 FR 51437, proposed NCP, 1988).

- Performance, design, or other action-specific requirements set controls or restrictions on particular kinds of activities related to the management of hazardous waste (55 FR 8814). Selection of a particular remedial action at a site will invoke the appropriate action-specific ARARs that may specify particular performance standards or technologies, as well as specific environmental levels for discharge or residual chemicals.

The list of ARARs in Appendix A was used for the development of the probable remedial actions required at the North Grinder Landfill.

**2.7.3.2 Preliminary Remedial Action Objectives (RAOs)** Preliminary RAOs were identified through the development of the conceptual site model and preliminary list of ARARs for the North Grinder Landfill site. The intent of the RAOs is to determine the specific media, contaminant, and probable exposure pathway that must be addressed through a remedial action to protect the public and environment. These RAOs were developed to protect the public and environment for both existing and future site conditions as presented by the conceptual site model. Under CERCLA guidance, RAOs required to protect the public health and environment are calculated based on the list of CPCs detected in the media and corresponding acceptable exposure levels and routes, on a cumulative basis. These criteria establish specific maximum allowable concentrations for each CPC detected at the North Grinder Landfill site.

The probable contaminated media are subsurface soil within and beneath the landfill material and groundwater beneath the landfill; potential contaminated media include air, surface water, and sediment.

The likely CPCs at the North Grinder Landfill include organics, inorganics, chemicals derived from biomedical waste, and possibly radionuclides. Based on the list of ARARs, probable contaminated media, and exposure pathways, specific RAOs for each of the CPCs will be developed for the landfill site and presented within the FS. However, general RAOs will be assumed based on probable exposure pathways to support the development of the RI sampling requirements and contingent actions.

The RAOs for the North Grinder Landfill include the elimination of dermal contact for maintenance workers and future recreational users through maintenance of the soil cover and cap and elimination of any utilities that pass through landfill wastes. RAOs will also include the containment of landfill gases and radioactivity emissions and the containment and/or treatment of contaminated groundwater, surface water and sediment, if found to exist.

2.7.3.3 **Preliminary Remedial Action Technologies** A limited evaluation of potential remedial action technologies was conducted to support the identification of data needs and development of remedial investigative requirements. The potential list of remedial technologies was developed based on the conceptual site model prepared for the North Grinder Landfill presented in Figure 2-7. This site model identified the probable and potential contaminated media, and the potential exposure pathway(s) and receptor(s) to these contaminated media.

Once the media and probable exposure pathway(s) were identified, a list of treatment technologies was developed and evaluated based on site-specific characteristics at the landfill. The identification of remedial technologies included the review of the USEPA presumptive remedies for municipal landfill sites (USEPA, 1993a; 1993b), historical feasibility studies, and technical literature. Potential treatment technologies were also identified to address the potential deviations associated with the conceptual site model (Figure 2-7).

The USEPA guidance list of presumptive remedies was based on the evaluation of historical feasibility studies and RODs for municipal landfills and identification of most commonly implemented and effective remedial action technologies included in the RODs. The major components of the presumptive remedies included landfill caps, source area groundwater control, leachate collection and treatment, landfill gas collection and treatment, and institutional controls to maintain the integrity of the cap and treatment systems. The design of the cap materials and implementation of collection and treatment systems are based on site-specific requirements of the landfill.

Institutional Controls. These remedial actions include the implementation of land use restrictions for a specific land area and can include limitations on intrusive activities into the landfill cap material. Institutional controls may also include the development of required monitoring and maintenance requirements at the sites. Other limited actions would need to be incorporated with the legal restrictions to ensure the safety of the public and environment, such as the installation of fencing and warning signs around a specific area.

Capping. Capping has been assumed as the probable remedial action for the North Grinder Landfill. It is possible that a sufficient soil cover exists at the landfill such that no further construction of a cap is required. Evaluation of the existing soil cover will be performed during the RI field activities as primary data needs. If it is determined that additional capping materials are required to reduce the probable and/or potential exposure pathways, multiple alternatives exist for the modification of the existing soil cover material. These capping technologies include:

- multi-layer cap,
- clay cap,
- asphalt cap,
- concrete cap,

- synthetic liner cover, and
- chemical seal.

All of these capping materials would be acceptable for use at the North Grinder Landfill. Soil cover could then be installed over the capping material at the landfill to support future recreational use of the site.

Containment. Vertical containment of the landfill material is considered as a probable remedial action to support the diversion of groundwater flow around a limited part of the North Grinder Landfill. Vertical containment can be accomplished by the use of the following methods:

- slurry wall,
- grout curtain,
- sheet piling,
- grout injection, or
- polywall barrier.

The ability to install an effective containment system around a part of the landfill would be based on the evaluation of the subsurface lithology and locating a suitable impervious soil layer beneath the landfill to key in the containment system. Additional soil lithology data will need to be collected during the RI to support the use of these technologies for limited containment of the landfill material.

Potential remedial actions may include the installation of a bottom seal under the landfill to reduce or eliminate the migration of contaminated leachate from the site.

Collection and Treatment of Surface Water. Remediation of surface water bodies near the North Grinder Landfill is not considered practical regarding implementability and economics.

Sediment. Remediation of the sediment in the surface water bodies near the North Grinder Landfill is considered to be a potential deviation. If necessary, sediments would be removed and disposed. Treatment technologies to remediate sediments are well proven and readily available.

Collection and Treatment of Leachate and Groundwater. The release of contaminated leachate or groundwater from the landfill has been considered as a potential exposure pathway. Collection of the leachate and shallow groundwater downgradient of the landfill can be successfully accomplished by subdrain trenches and/or horizontal wells. Once the leachate has been collected, it must be treated prior to discharge. Treatment methods may include either physical (e.g., air stripping) or chemical (e.g., ultraviolet light and oxidation [UV/oxidation]) treatment technologies. Discharge options include: injection and recirculation; discharge to a publicly owned treatment works (POTW), and surface water discharge. Data collection during the RI will determine the need for this remedial action and support the evaluation of multiple treatment alternatives.

Landfill Gas Collection and Treatment. The potential emission of landfill gases is anticipated to be addressed by the installation and maintenance of a landfill cap. However, if significant landfill gases within the landfill are being produced and emitted causing an exposure pathway to the public or the environment, a collection and treatment system will need to be evaluated. This potential remedial action would require the installation of soil gas extraction wells (vertical or horizontal) and physical (e.g., vapor-phase granular activated carbon [GAC]) or thermal (e.g., incineration) treatment prior to release to the atmosphere. These are well proven technologies for the remediation of landfill gases. Data collection during the RI will determine the need for this remedial action and support the evaluation of multiple treatment alternatives.

A preliminary list of remedial technologies and process options has been prepared to address the RAOs based on the type of contaminated media. Within each technology there may be several process options, such as biological treatment (technology) of contaminated groundwater by aerobic and anaerobic processes. These remedial technologies and process options are presented in Figure 2-8. Additional technologies and process options may be identified following the remedial investigation. The screening of the remedial technologies and development of remedial alternatives is discussed in Chapter 8.0 of this workplan.

<u>2.8 SUMMARY OF DATA NEEDS</u>. There are three purposes for collecting data at the North Grinder Landfill:

- to verify the probable conditions and reasonable deviations (i.e., verify the conceptual site model),

- to support the human health risk assessment and ecological evaluation, and

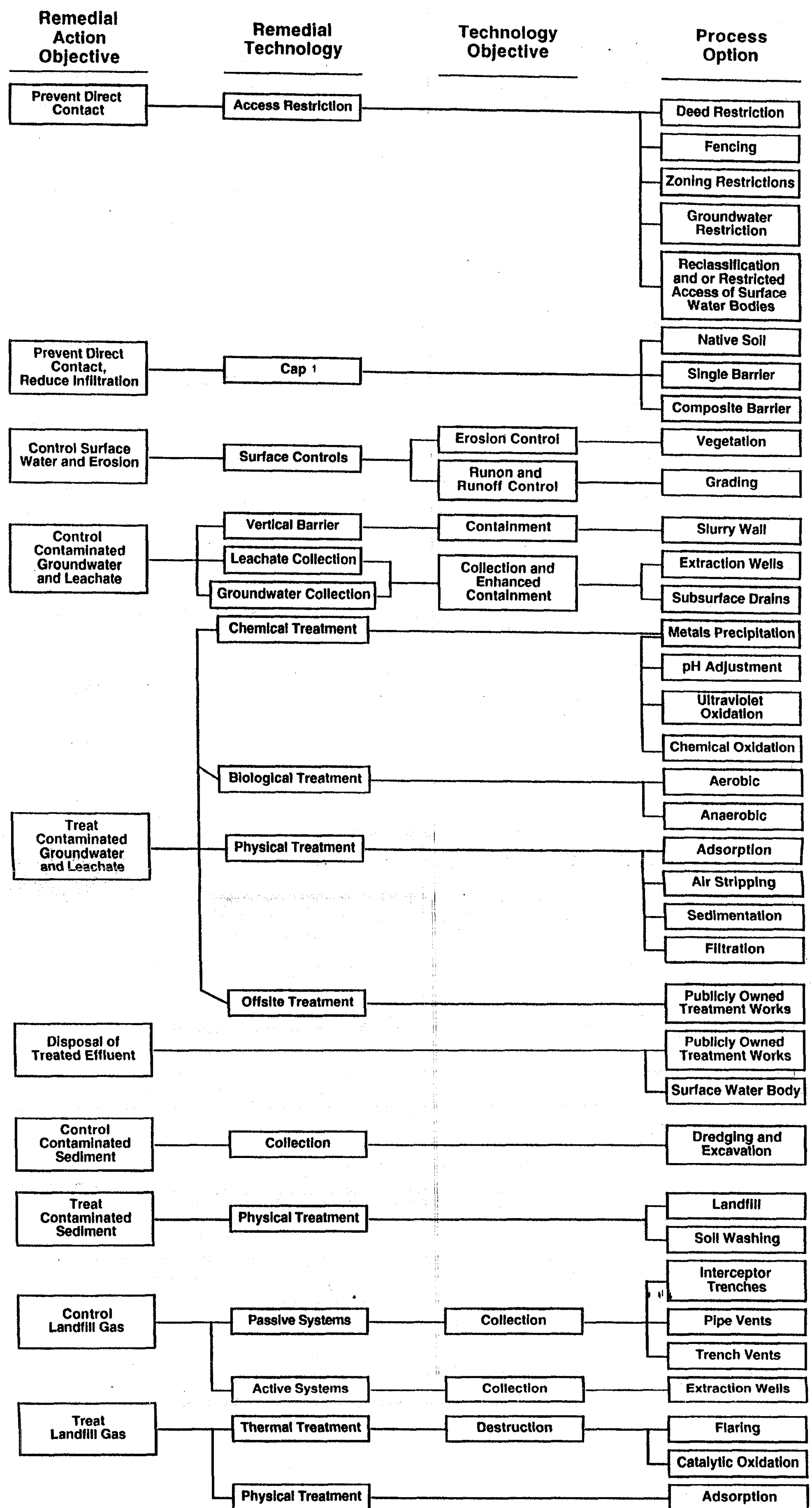
- to support the FS.

Only those probable conditions and reasonable deviations that will affect the outcome of the risk assessment and evaluation or the FS will be identified.

To identify data to collect during the RI, uncertainties in terms of probable conditions and reasonable deviations have been identified with respect to technology performance uncertainties (Table 2-4), site condition uncertainties (Table 2-5), and regulatory uncertainties (Table 2-6). Preliminary base actions and contingent actions to address the deviations have also been identified. Data needs to resolve unacceptable uncertainties with respect to site conditions, technology performance, and regulatory issues are identified in the tables. These data needs are consolidated with existing information to identify what data should be collected during the RI. Some of the data needs are offsite, and for these data it is assumed that the Navy will provide any access that may be required.

The following information will be collected during the RI.

- Soil gas. Soil gas samples will be collected from within the landfill soil cover to determine if gases are being generated from the landfilled waste. Soil gas samples will also be collected from areas immediately surrounding the landfill to evaluate horizontal migration of gases. Ambient air samples may also be collected to determine if soil gases are venting through the soil cover. This information will be used in the FS. Soil gas may also help to identify "hot spots."




1 Landfill cap will likely be implemented in conjunction with access restrictions, surface water controls, and erosion controls.

**Reference:** U.S. Environmental Protection Agency, 1991d, p. 2-22

**FIGURE 2-8**

**PRELIMINARY REMEDIAL TECHNOLOGIES AND PROCESS OPTIONS**

**RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

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## Table 2-4
## Technology Performance Uncertainties

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Technology | Probable Conditions | Data Needs | Potential Deviation | Contingent Action | Additional Data Needs |
|---|---|---|---|---|---|
| **Institutional Controls** | Implementation of zoning and deed restrictions for future land use and required maintenance of cap and containment alternatives. | Determine regulatory requirements for implementation of land use restrictions and future long-term liability for operation and maintenance (O&M). | Additional requirements for limitations on use of groundwater or adjacent surface water bodies. May also require FDEP reclassification of surface water bodies. | Limit surface water body access and provide potable water supply if needed. | Collection of groundwater samples from the perimeter of the landfill area, characterization of both surface water flow and groundwater flow direction, and quantification of the surface water and sediment quality. |
| **Capping** | Cap provides sufficient barrier to reduce: direct contact exposure pathway to contaminated landfill material, infiltration of precipitation and resulting groundwater contamination, and leaching of contaminants into surface water bodies. Capping will also reduce air emissions of potential landfill gases and beta and gamma radionuclide activity. | Verify existing soil cover integrity and construction for modification or upgrade of existing cap design. Obtain direct gamma survey results at ground surface and radionuclide concentration in shallow surface soil to determine barrier requirements. Determine surface water flow patterns of stormwater runoff for containment of leachate. Determine groundwater flow characteristics into and out of the landfill for diversion of upgradient groundwater sources and containment of groundwater contamination and migration. | Emissions of landfill gases and/or radionuclides continue after containment. | Modify design and material of cap; implement soil gas collection and treatment. | Conduct soil gas survey and analyze content and concentrations of contaminants for risk and regulatory evaluation. |
| **Containment** | Physical containment around and beneath the landfill: reduces leachate migration from the landfill, provides additional structural stability of the cap, reduces potential leachate contamination of groundwater and flow of groundwater into the landfill material, and diverts groundwater flow around landfill area. | Assess soil lithology around the perimeter of the landfill area, structural and permeability characteristics of subsurface soil and interaction of contaminants of potential concern (CPCs) with containment materials. | Mounding of groundwater upgradient of containment barriers overtopping surface cap. Contaminated leachate entering groundwater table beneath the landfill. | Collect groundwater upgradient of landfill area. Seal the bottom of the landfill above the existing groundwater table, implement hydraulic containment within the landfill, or implement leachate collection and treatment system. | Determine required influent rates, discharge options, and associated treatment criteria for treated groundwater and leachate collected upgradient and at perimeter of the landfill. |

Notes: RI/FS = Remedial Investigation and Feasibility Study.
FDEP = Florida Department of Environmental Protection.

**Table 2-5**
**Site Condition Uncertainties and Data Needs**

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Media | Probable Condition | Base Action | Data Needs | Reasonable Deviation | Contingent Action | Additional Data Needs |
|---|---|---|---|---|---|---|
| Soil cover and Surface Soil | Soil cover exists. Soil cover thickness is sufficient to prevent exposure from contaminants. Soil cover is maintained. | Institutional controls. | Verify probable condition. Use GPR to evaluate soil cover thickness and distribution. Collect samples to evaluate composition of cap material. Data will support institutional controls evaluation. | Soil cover is sparse and insufficient to prevent exposure to receptors. | Install proper cap. | Same as base action. |
| Sediment | Sediment in off-landfill water bodies has not been adversely affected by leachate from landfill. | No action. | Verify probable condition through sampling sediment randomly. Sample surface water to evaluate leachability of sediment. | Sediment has been contaminated by leachate from landfill. | Evaluate containment or source removal. | Estimate approximate area and depth of sediment contamination. Conduct ecological characterization of aquatic organisms. Evaluate risks and exposures associated with contamination. |
| Groundwater | Contaminated groundwater has not migrated offsite. | Monitoring and containment. | Collect hydrologic and groundwater data to design and evaluate hydraulic controls and/or containment. | Contaminated groundwater has migrated offsite. | Source control or implement groundwater remedial system. | Conduct groundwater modeling to evaluate remedial systems. Conduct groundwater pumping test to calibrate model. |
| Air | Gases are not being generated by the landfill; thus, no gas is migrating from the existing soil cover. | No action. | Collect data to evaluate if soil gases are being generated and/or migrating through the soil cover. | Soil gas is migrating through soil cover. | Install proper cap and evaluate venting. | Same as base action. |
| Biota | Biota uptake does not pose a risk to human health or terrestrial fauna due to the soil cover and current and future land uses. | No action. | Same as soil cover and surface soil. | Terrestrial fauna are being exposed to contaminated materials; thus, producing a possible risk to the food chain. | Install and maintain proper cap. | No additional data needed. |

Notes: RI/FS = Remedial Investigation and Feasibility Study.
GPR = ground penetrating radar.

## Table 2-6
## Regulatory Uncertainties and Data Needs

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Issue | Probable Condition | Base Action | Data Needs | Reasonable Deviation | Contingent Action | Additional Data Needs |
|---|---|---|---|---|---|---|
| Disposal | Disposal locations available for low level radiological waste. | Dispose in identified locations. | Requirements of potential disposal location. | Waste is mixed or disposal locations unavailable. | Temporary storage or contain in place | Evaluate potential for waste to be mixed waste. |
| Wetlands | Wetland regulations are an ARAR due to the presence of wetlands. | Modify action to consider impact on wetlands. May include wetland restoration. | Verification of wetlands. | Wetlands are not present within affected study area. | No limitations. | None. |
| Flood-plains | Floodplain restrictions limit feasible remediation, but can be mitigated. | Modify actions to compensate for increase in flood risk. | Floodplain and riparian zone delineation. | Unique riparian characteristics prohibit disturbance. | Sediment traps and institutional controls. | None. |
| Radiation remedial action levels | Existing ARARs specify sufficient remedial action level. | Cap or removal and disposal. | Evaluation of regulations. | New regulations specify different remedial action levels or approval for existing regulation cannot be obtained. | Modify action. | None. |

Notes: RI/FS = Remedial Investigation and Feasibility Study.
ARAR = applicable or relevant and appropriate requirements.

- Soil. Soil samples will be systematically collected from the existing soil cover (0 to 12 inches) to evaluate the quality and thickness of cover material used.

- Groundwater. Groundwater quality data and hydrologic information will be collected through installation of monitoring wells, piezometers, and other intrusive technologies (e.g., direct push technologies) to evaluate the nature and extent of potential groundwater plumes, to evaluate the hydrogeologic environment surrounding the landfill, and to facilitate possible groundwater modeling. This information will be used to support the risk assessment and evaluation and FS.

- Geophysics. Magnetics, terrain conductivity, ground penetrating radar, and potentially other geophysical techniques will be used to map the boundary of the landfill, the thickness and extent of the existing soil cover, and to define any "hot spots" that may exist within the landfill. This information will support the FS.

- Sediment. Off-base sediment samples may be collected randomly from downgradient water bodies to evaluate possible contamination deposited as a result of leachate migration from the landfill. Leachability of the sediment will also be evaluated. This information will support the risk assessment and evaluation and the FS.

- Surface Water. Off-base surface water may be sampled randomly to evaluate potential impact from contaminants that may have leached from the sediment to support the risk assessment and evaluation and the FS.

- Biota. An ecological characterization will be conducted in areas impacted by and surrounding the landfill. This information will support the qualitative ecological risk evaluation.

To support the evaluation of the data, background values will be collected as part of this investigation and as part of a parallel background soil and groundwater investigation for the following media: site soil (surface and subsurface), offsite sediment and offsite surface water (if necessary), and offsite groundwater.

<u>2.9 PROJECT DATA QUALITY OBJECTIVES</u>. Data quality objectives (DQOs) are qualitative or quantitative statements developed by the data user to specify the quality of data needed from a particular data activity to support specific decisions. The DQOs are the starting point in the design of an investigation. The DQO development process matches sampling and analytical capabilities to the data targeted for specific uses and ensures that the quality of the data does not underestimate project requirements. The USEPA has identified five general levels of analytical data quality as being potentially applicable to field investigations conducted at potential hazardous waste sites under the CERCLA. These levels are summarized below and discussed in the POP, Section 3.2, Data Quality Objectives (ABB-ES, 1994a).

(1) Level I, Field Screening. Characterized by use of portable field instruments that can provide real time data both for personnel health and safety and to optimize locating sampling points.

(2) Level II, Field Analysis. Characterized by use of portable analytical instruments for onsite use or in mobile laboratories near a site.

(3) Level III, Laboratory analysis. Characterized by use of methods other than the Contract Laboratory Program (CLP) Routine Analytical Services (CLP-RAS), but which may be equivalent without the CLP requirements for documentation.

(4) Level IV, Laboratory Analysis CLP-RAS. Characterized by rigorous quality assurance and quality control (QA/QC) protocols and documentation, providing qualitative and quantitative analytical data.

(5) Level V, Non-standard methods. Includes analyses that may require modification and/or development.

The objectives of data collection are as follows.

- Soil cover and soil gas information will be collected to evaluate the existing soil cover consistent with the presumptive remedy of containment and to support the FS in the design of an appropriate cover.
- Hydrogeologic information will be collected to evaluate groundwater migration, flow gradients, and stratigraphy to evaluate if exposure potential from contaminant plumes exists and/or to predict if contaminant migration will likely occur in the future. As indicated in the conceptual site model, a potential exists for ingestion by ecological receptors, and inhalation by humans and ecological receptors.
- Sediment and surface water samples will be collected to support exposure and risk evaluations for human health and ecological receptors and to evaluate impacts from potential remediation. The conceptual site model indicated a potential for exposure by ecological receptors via dermal contact and incidental ingestion. Additionally, data will be collected to evaluate leachability of potential contaminants in the sediments.
- Biota and habitat in the landfill and surrounding areas will be characterized to identify potential receptors to contaminants and to identify impacts on the ecosystem due to the landfill and from potential remediation.

# 3.0 TECHNICAL APPROACH

The technical approach to all of the individual tasks that comprise the field investigation is described below. Each of the field investigative tasks included in the approach is designed to support the conceptual site model (Figure 2-7) and the data needs identified in Tables 2-4, 2-5, and 2-6.

**3.1 GEOPHYSICAL SURVEY PROGRAM**. A geophysical survey program will be conducted to:

- determine the "footprint" of the North Grinder Landfill;
- determine whether the South Grinder parade area shows any geophysical anomalies that indicate it is a former landfill (in Section 2.2, Site History, the possibility of a landfill under the South Grinder parade area was posed due to an apparent lack of vegetation in an aerial photograph of the area);
- locate "hot spots" in the North Grinder Landfill that might indicate concentrations of buried conductive and/or ferrous wastes and, therefore, areas within the landfill that might warrant source removal to support the selected remedial alternative; and
- characterize, to the extent possible with remote sensing techniques, the landfill cover thickness and continuity.

The first objective will be completed with a magnetometer and terrain conductivity survey over the presumed location of the landfill (Figure 3-1). The magnetometer will include a vertical gradiometer capability for better resolution of buried ferrous debris, which is typically found in municipal landfills in sufficient quantities to clearly define landfill boundaries. Geophysical investigations will initially be performed on a 20-foot by 20-foot grid over an assumed area of approximately 15 acres. Measurements will be adversely affected by the proximity of buildings and buried utilities, so magnetometer and terrain conductivity data will likely be unusable near Buildings 212 and 214, as well as in areas where wire mesh was used to reinforce concrete sidewalks and driveways. Following review of preliminary data, the grid size may be reduced to 10-feet by 10-feet in selected areas. A location survey will be completed with a Global Positioning System (GPS) rover and base station system capable of sub-meter accuracy. Several semi-permanent markers will be established to facilitate future investigations of any parts of the site where geophysical anomalies are located.

The South Grinder parade area will also be evaluated with a magnetometer and terrain conductivity survey with several widely spaced (50 feet apart) north to south traverse lines located in the vicinity of the sparse vegetation indicated on Figure 2-2 and outlined on Figure 3-1. The lack of any geophysical anomalies over this area with characteristics similar to those observed over the North Grinder Landfill would rule out trench and fill disposal activities under the South Grinder parade area. If landfill activities are indicated, a similar geophysical survey to that completed in the North Grinder Landfill would be appropriate. However, for purposes of this workplan, it is assumed that no

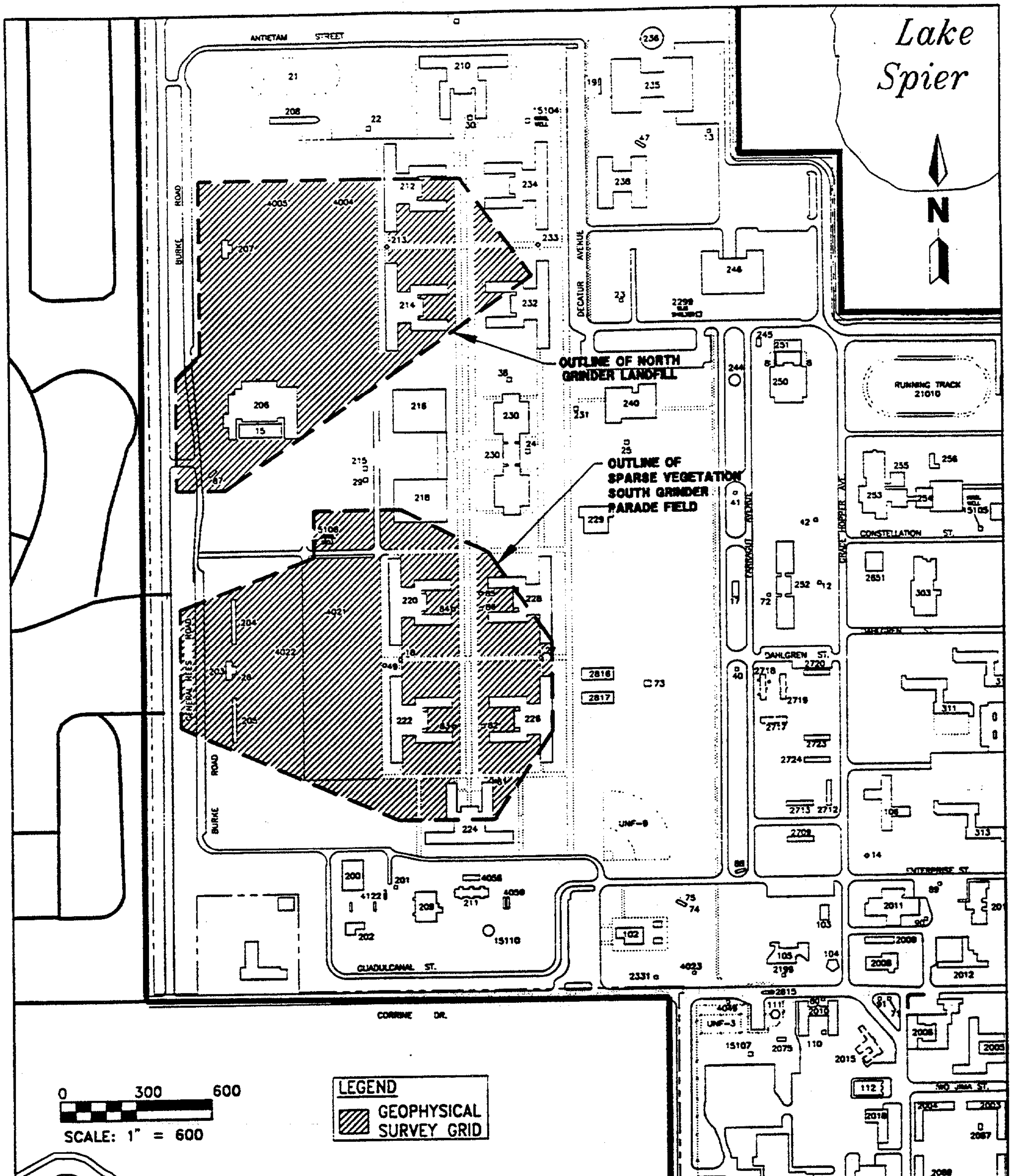


**FIGURE 3-1**
**NORTH GRINDER LANDFILL, GEOPHYSICAL SURVEYS**

**RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

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indications of a South Grinder landfill are discovered during the reconnaissance geophysical survey.

The third objective would be fulfilled by the magnetometer and terrain conductivity survey at the North Grinder Landfill. "Hot spots" would be indicated on geophysical contour maps by zones where the vertical gradient magnetic contours (in gammas per meter) or conductivity contours (in millimhos per meter) are of much higher amplitude than elsewhere within the landfill. Any "hot spots" will be confirmed with ground penetrating radar (GPR) to better define spatially any potential source areas.

The last objective would be obtained with a series of parallel GPR traverses (north to south) with a 500 megahertz (MHz) antenna to obtain detail in the first 5 feet or so of cover materials or landfill wastes. GPR should define the interface between the cover material and waste, although the contact may be somewhat gradational as the waste may have mixed to some extent with the cover material. In the event that GPR is not successful in defining the thickness of the landfill cover material, 25 hand-dug auger holes will be completed to acquire this information (Section 3.2).

<u>3.2 SOIL GAS PROGRAM</u>. The objectives of the soil gas program are to:

- characterize chemical CPCs present in the soil cover so that a proper soil gas collection system can be designed (if needed) and to allow for proper cap design;
- characterize volatile and semivolatile constituents that have migrated to the landfill soil cover to locate potential "hot spots," which may need to be evaluated with regards to source removals to support remedial objectives; and
- evaluate the presence of methane, which may still be problematic despite the age of the landfill.

The passive soil gas technique that will be used is a remote sensing, near surface screening method that directly collects and identifies a large range of chlorinated, aliphatic, and aromatic contaminant vapors migrating to the surface from, in this case, buried landfill wastes or contaminated groundwater. The sampler consists of two ferromagnetic wire collectors that are coated with activated charcoal inside an open (and resealable) glass vial. The sampler is placed approximately 16 inches below the surface and left for a period of time ranging from a few days to a few weeks, depending on the anticipated soil conditions. Samplers are then retrieved and analyzed offsite by thermal desorption and mass spectrometry (TD-MS). In this process, the wire collectors are heated to desorb VOCs and SVOCs, which are ionized, separated according to their mass, and counted. Identification is made by comparing data from each collector to a library of compounds and common mixtures of compounds. Concentrations of identified compounds are regarded as qualitative.

For the OU 1 North Grinder Landfill, the passive soil gas program will address exposure pathways presented on the conceptual site model, Figure 2-7, including the pathway presented as a probable condition (direct contact by biota) and the exposure pathway listed as a potential deviation (generation of landfill gas and inhalation by biota and humans). The passive soil gas results will contribute to the evaluation of the existing soil cover integrity and the evaluation of CPCs as required by the uncertainties and data needs defined in Tables 2-4 and 2-5.

Passive soil gas samplers will be deployed on a 50-foot grid within the footprint of the landfill as determined by the geophysical survey. It is estimated that up to 275 samplers will be required during this effort (Figure 3-2). In the event that GPR is not successful in defining the thickness of the landfill cover material, 25 hand-dug auger holes will be completed to acquire this information as part of the soil gas program.

As part of the soil gas survey, a methane sampler will be used to evaluate whether the OU 1 North Grinder Landfill is producing methane. The survey will be conducted with an industrial scientific MX251 combustible gas analyzer or equivalent. The sampling will be executed as the passive soil gas samplers are installed, and repeated as they are retrieved. This information will be used to satisfy the data needs defined in Table 2-4.

## 3.3 DIRECT PUSH TECHNOLOGIES.

3.3.1 TerraProbe℠ Program To better define any contaminant plume that may be present at the North Grinder Landfill, a TerraProbe℠ survey will be conducted around the western, northern, and eastern boundaries of the North Grinder Landfill. The TerraProbe℠ system consists of a hydraulic ram unit with the capability of driving 3/4-inch diameter rods and stainless-steel sampling probes into the subsurface for sample collection. Further details can be found in the POP, Section 4.4, Field Investigation Techniques and Procedures (ABB-ES, 1994a). Prior to implementing the TerraProbe℠ program, ABB-ES will sample the existing wells and screen the samples with a field gas chromatograph. This limited effort will provide initial direction for the TerraProbe℠ investigation.

Groundwater samples will be obtained at shallow and intermediate depths (at the water table and at refusal, or 30 feet whichever is shallower). A mobile field laboratory will be used to analyze the samples using gas chromatography with purge and trap concentrations for trace level detection of selected volatile organic compounds. Samples will be collected in 40 milliliters (ml) Teflon™-sealed glass vials and analyzed onsite using modified USEPA SW-846 Method 8010/8020.

Quality control analyses will consist of a three point calibration of each analyte, method blank, matrix spike, and matrix spike duplicate and a continuing check calibration standard at a minimum of one per day.

The TerraProbe℠ system can obtain 10 to 20 samples per day and will provide guidance for the DPT electric cone penetrometer program and monitoring well installations to follow. A total of 60 TerraProbe℠ locations are proposed (Figure 3-3), with two groundwater samples at each location for a total of 120 samples. The data obtained during these activities is considered Level II DQOs and will be used for siting DPT electric cone penetrometer explorations and monitoring wells and for characterizing hydrogeologic conditions at OU 1. For purposes of this workplan, it is assumed that the shallow sample will be obtained at a depth of 10 feet, and the intermediate sample will be from approximately 30 feet.

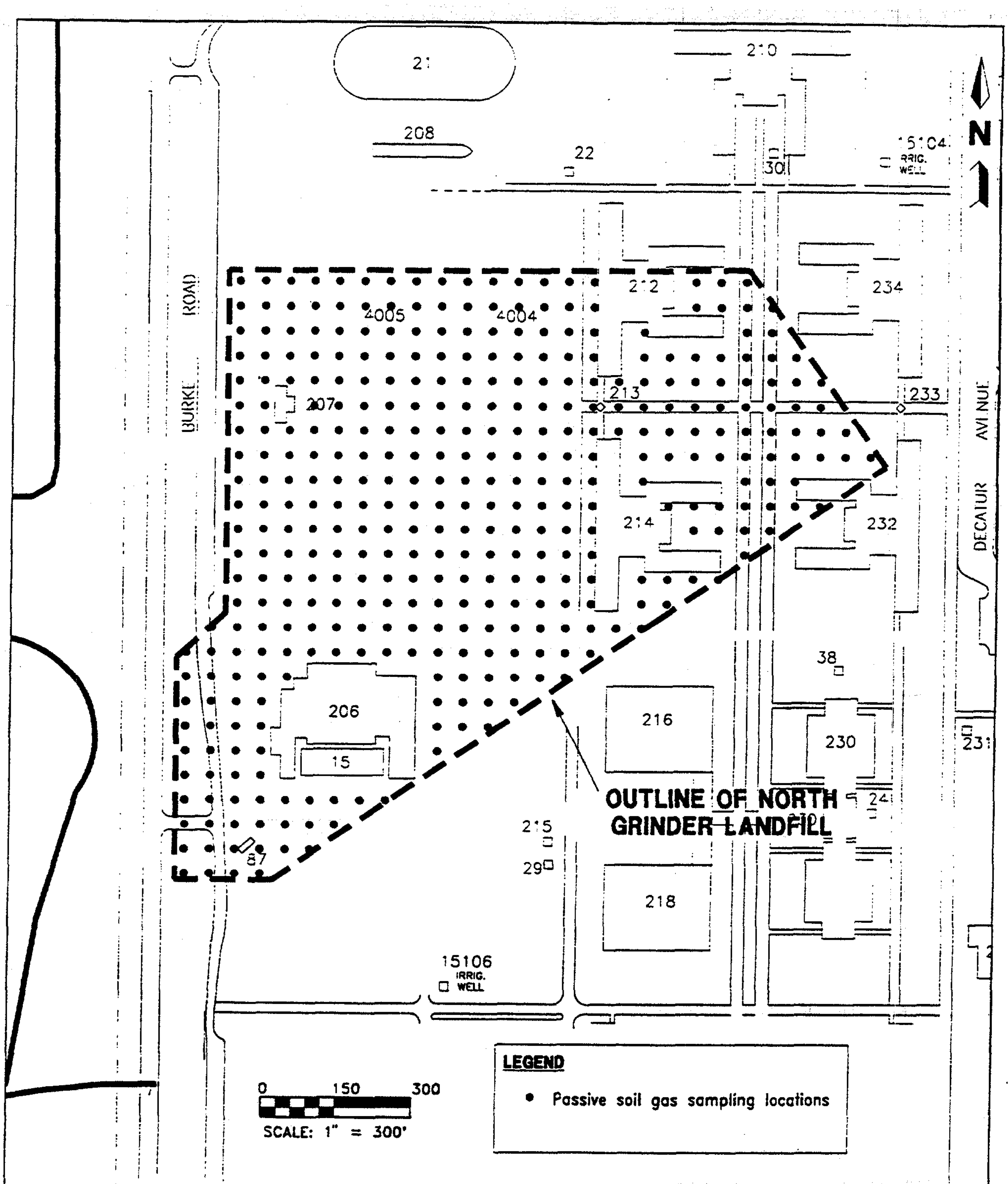


**FIGURE 3-2**
**PASSIVE SOIL GAS SURVEY SAMPLING LOCATIONS**

**RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

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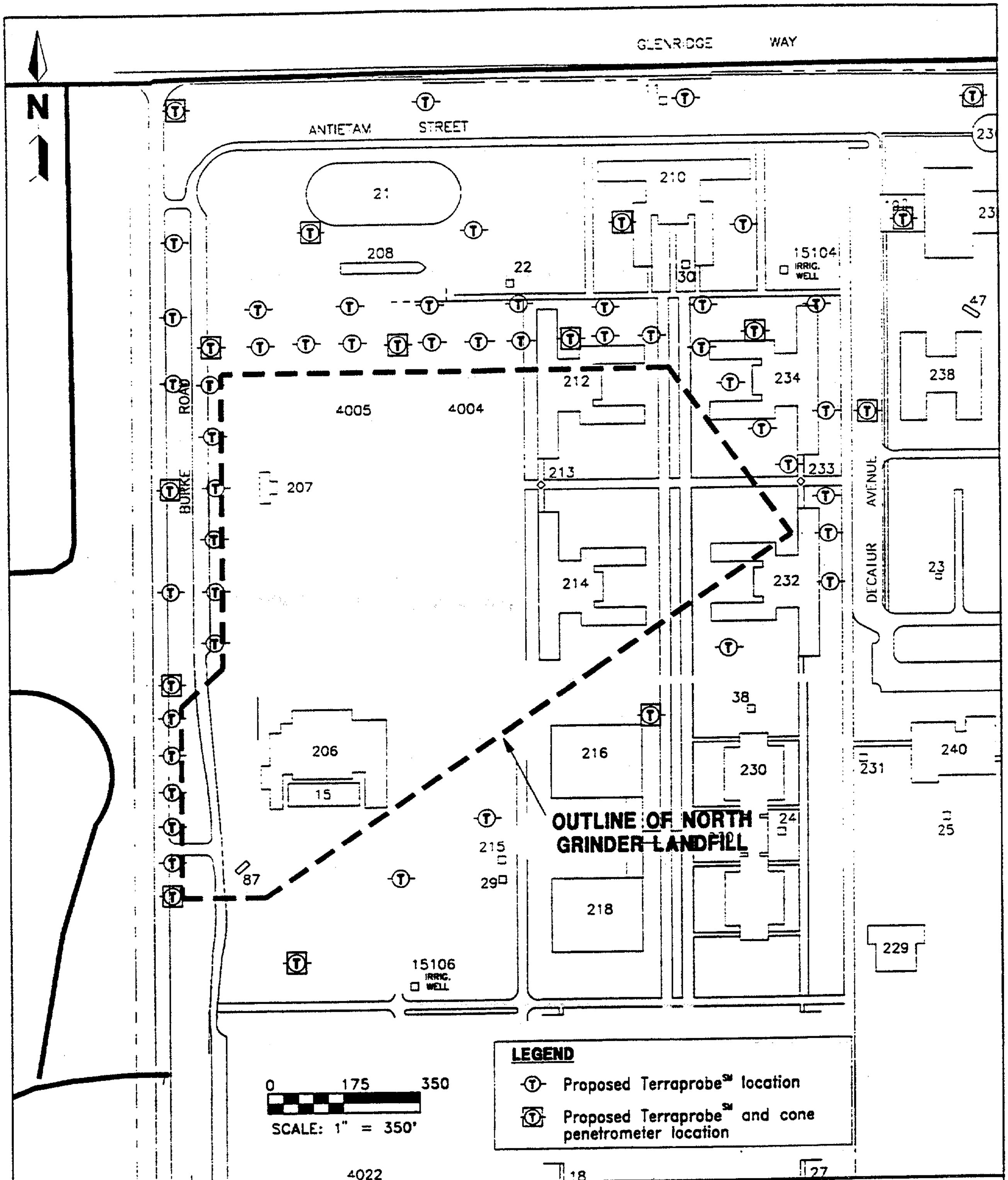


**FIGURE 3-3**
**DIRECT PUSH TECHNOLOGY PROGRAM**

**RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

**NAVAL TRAINING CENTER ORLANDO, FLORIDA**

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Each TerraProbe℠ location will be scanned with a gamma scintillation detector to determine the presence of gamma emissions. The ground surface will be scanned prior to each push, and the rods and water samples will also be scanned after they are brought up. These data will be used for personnel protection to qualitatively evaluate the presence and extent of radioactivity beneath the soil cover.

The TerraProbe℠ will also be used to install 60 soil vapor sampling implants around the perimeter of the landfill (approximately one every 50 feet). The implant is lowered down the inside diameter of the probe rods, which have been pushed to the desired sampling depth. The sampler consists of a double woven stainless-steel wire screen that is 6 inches long and 1/4-inch in diameter with flexible tubing riser to the surface. The screening size is 0.0057 inches. After the probe rods are pulled, the probe hole is backfilled and grouted to seal the sub-surface from ambient air and sealed at the surface with a flush mount protective cap. Repeated sampling will be performed at a frequency appropriate to the contaminants and concentrations found during the first sampling episode. For purposes of this workplan, a single sampling event has been budgeted. Analyses will be performed with a mobile field laboratory using purge and trap gas chromatography capable of detecting trace level concentrations of selected volatile organic compounds as described above.

A location survey for all TerraProbe℠ explorations will be completed with a GPS rover and base station system capable of sub-meter accuracy.

<u>3.3.2 Cone Penetrometer Testing (CPT) Program</u> Due to potentially complex geologic conditions at the North Grinder Landfill, a CPT investigation will take place to characterize the surficial aquifer. A CPT rig is a mechanism for hydraulically pushing instruments into the subsurface with more than 60,000 pounds of thrust. Computer systems monitor instruments attached to the tip of the leading rod and output measurements as a function of depth to a tape drive for processing and interpretation. The CPT rig will be used to measure the engineering soil parameters and to assist in lithologic mapping of the subsurface. The tip pressure and sleeve friction values will be used to classify the soil type, along with pore pressure, relative density, and bearing capacity. Detailed logs showing the depths at which any of these changes occur are also provided. This technology will also be used to obtain water samples at discrete depth intervals to determine the vertical and horizontal distribution of contaminants at selected locations. It is anticipated that the equipment will be capable of exploring the entire thickness of the surficial aquifer.

The CPT program will be used to measure the following engineering soil parameters.

- soil type,
- pore pressure,
- relative density,
- bearing capacity,
- settlement potential, and
- horizontal permeability values.

For purposes of this workplan, 15 CPT locations have been budgeted (Figure 3-3). Shallow groundwater samples will be obtained at each location. In addition, at six locations, water samples will be obtained at 10-foot intervals to the top of the Hawthorn Group. All CPT locations will be selected based on TerraProbe℠ results or decisions made in the field following onsite laboratory analysis.

Analyses will be performed with a mobile field laboratory using gas chromatography with purge and trap concentrations for trace level detection of selected volatile organic compounds as described above in Subsection 3.3.1. The data obtained during these activities is considered Level II and will only be used for optimally siting monitoring wells and characterizing hydrogeologic conditions at OU 1. A location survey for all CPT explorations will be completed with a GPS rover and base station system capable of sub-meter accuracy.

## 3.4 SURFACE SOIL, SURFACE WATER, AND SEDIMENT SAMPLING PROGRAM.

3.4.1 Surface Soil Sampling The surface soil sampling program will be conducted based on the sampling methodology presented in Section 2.6. For the North Grinder Landfill, it is proposed that one surface soil sample per acre be taken (approximately 15) within the depth range of 0 to 1 foot bls. Samples would be collected from within the landfill cover material and samples should be collected systematically throughout the landfill footprint. Each sample would be composited from five locations within the central part of each 1-acre block as indicated in the composite pattern presented on Figure 3-4. Samples taken for VOCs would not be composited, but would be taken from the central node of the composite pattern.

Primary parameters that will be analyzed include CLP target analyte list (TAL) metals, and target compound list (TCL) organics (Table 3-1). Dioxins will be analyzed only if PCBs are detected. Pesticide levels will be compared to background values during evaluation. In addition, other secondary parameters that may be analyzed include total organic carbon, sulfate, nitrate, nitrite, phosphate, and hydrogen sulfide. These secondary parameters will be obtained for risk and treatability evaluations. Analyses for primary parameters will be completed in accordance with USEPA Level IV DQOs.

The surface soil sampling data will be compared to the base background data as described in the background sampling plan (ABB-ES, 1994c).

3.4.2 Surface Water and Sediment Sampling Surface water and sediment sampling will only be completed if groundwater analyses from monitoring wells (Section 3.5) indicate that the surficial aquifer or underlying aquifers are contaminated and it is likely that contaminants have migrated to the surface water body. In accordance with the conceptual model, if the aquifer(s) is not contaminated, then there is no risk to downgradient receptors.

ABB-ES knows of no areas adjacent to the landfill that may have received storm water runoff from the landfill. More than one-half of the area over the former landfill is paved, and well-maintained grass with no signs of stress constitutes the remaining portion of the landfill. However, if such areas are discovered during the remedial investigation, appropriate samples will be collected.

In the event that contamination in the shallow aquifer and underlying aquifers is confirmed, then offsite surface water and sediment sampling in downgradient surface water bodies will be required. In accordance with the conceptual model, if there is no contamination in the surficial aquifer, then there is no risk, and there is no need to characterize the Hawthorn Group or the Floridan aquifer system. Hydrologically, there is a far greater likelihood of contaminants moving

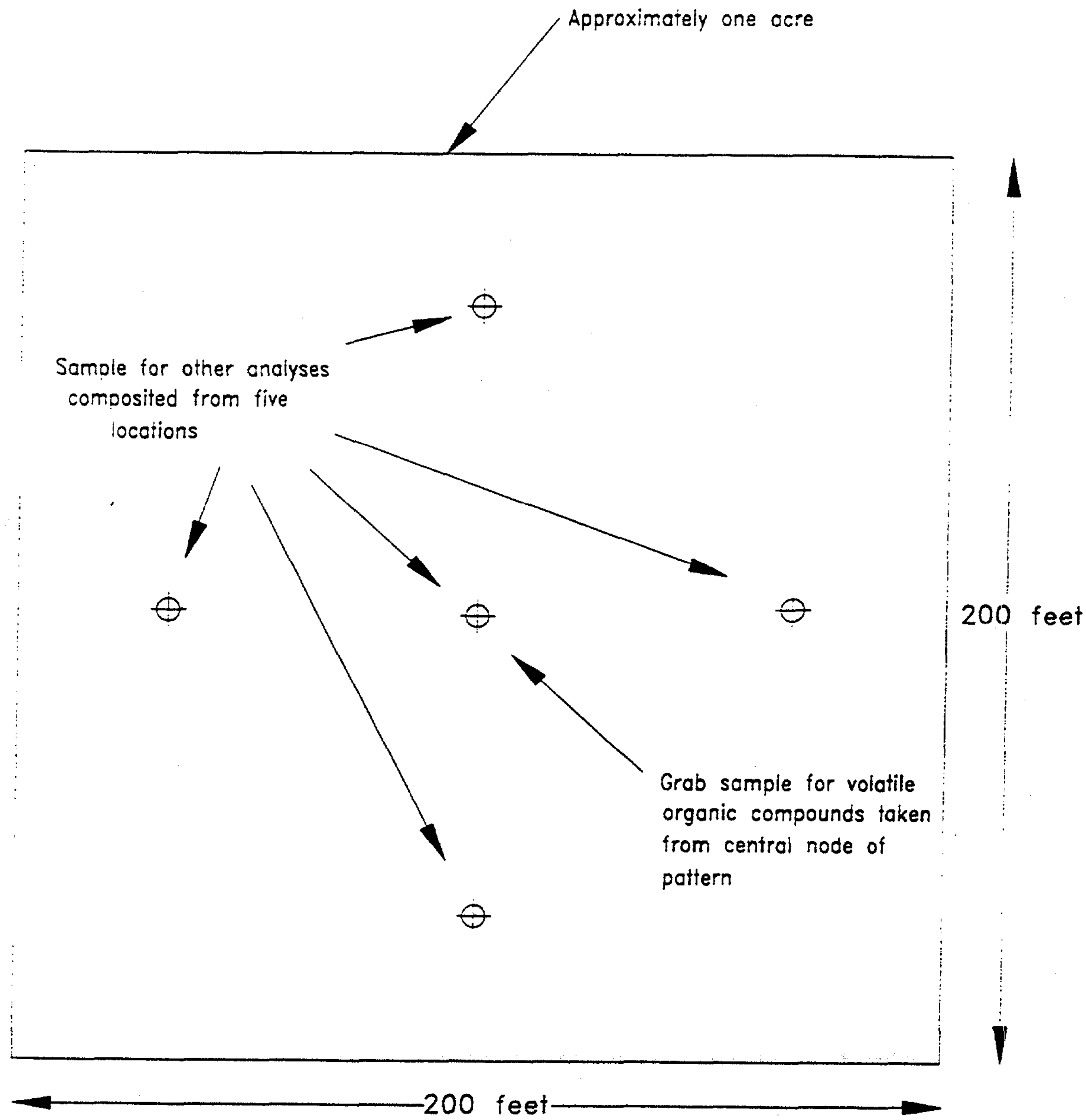


**FIGURE 3-4**
**COMPOSITE PATTERN FOR SURFACE SOIL SAMPLING NORTH GRINDER LANDFILL**

**RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

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**Table 3-1**
**Analytical Program Summary**
**OU 1, North Grinder Landfill**

Naval Training Center, Orlando
Orlando, Florida

| Sample Identification | Quantity | CLP/TCL VOCs | CLP/TCL SVOCs | CLP/TAL Inorganics | CLP/TCL Pesticides/PCBs[1] | Herbicides | TPH | Radionuclides[4] | Other Secondary Parameters[5] |
|---|---|---|---|---|---|---|---|---|---|
| **Surface Soil (from landfill cover)** | 15 | 15 | 15 | 15 | 15 | 15 | 15 | | 15 |
| **Sediment** | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| **QC Samples** | | | | | | | | | |
| Duplicate | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Matrix Spike | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Matrix Spike Duplicate | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **Total Soil and Sediment** | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 22 | 37 |
| **Groundwater** | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 | 46 |
| **Surface water** | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| **QC Samples** | | | | | | | | | |
| Duplicate | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Matrix Spike | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Matrix Spike Duplicate | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Other QC Samples** | | | | | | | | | |
| Trip Blanks | 16 | 16 | | | | | | | |
| Equipment Blank | 5 | 5 | 5 | 5 | 5 | 5 | 5 | | 5 |
| Field Blank | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | 2 |

**See notes at end of table.**

**Table 3-1 (Continued)**
**Analytical Program Summary**
**OU 1, North Grinder Landfill**

Naval Training Center, Orlando
Orlando, Florida

| Sample Identification | Quantity | CLP/TCL VOCs | CLP/TCL SVOCs | CLP/TAL Inorganics | CLP/TCL Pesticides/PCBs[1] | Herbicides | TPH | Radionuclides[4] | Other Secondary Parameters[5] |
|---|---|---|---|---|---|---|---|---|---|
| **Total Water** | 96 | 96 | 80 | 80 | 80 | 80 | 80 | 73 | 80 |

[1] Dioxins will be analyzed only if PCBs are detected.

[2] Radionuclides analysis includes gross alpha, gross beta (USEPA Method 9310), and a Gamma Scan (USEPA Method 101.1). U-234, U-238, Th-227, Th-228, Th-230, Th-232, Ra-226, Ra-228, and radon may also be analyzed, but only if gross alpha and gross beta values are above the referenced gross alpha MCL and gross beta screening level.

[3] Other secondary parameters (depending upon media involved) may include: pH, hardness (USEPA Method 130.2), total dissolved solids (USEPA Method 160.1), total suspended solids (USEPA Method 160.2), phosphate (USEPA Method 300 or SW846 Method 9056), total alkalinity (USEPA Method 310.1), nitrate (USEPA Method 352.1), nitrite (USEPA Method 354.1), sulfate (USEPA Method 375.4), sulfide (USEPA Method 376.1), and total organic carbon (USEPA Method 415.1).

Notes:
CLP = contract laboratory program.
PCBs = polychlorinated biphenyls.
SVOCs = semivolatile organic compounds.
TCL = target compound list.
TSS = total suspended solids.
VOCs = volatile organic compounds.
MCLs = maximum contaminant levels.
QC = quality control.
TAL = target analyte list.
Th = Thorium.
U = Uranium.

laterally along the top of the Hawthorn than vertically downward through the Hawthorn, as discussed in Section 2.3.

Sampling in surface water bodies, if undertaken, will be done with the understanding that the lakes are in an urban environment and subject to uncontrolled releases from local sources via surface water and stormwater runoff. The lakes will not be pristine and it may be difficult to determine whether or not contamination is from the North Grinder Landfill or from other sources.

At the time of this workplan development, the best groundwater flow data available indicates that groundwater flow is northerly, and may have slight northwesterly or northeasterly flow components (Geraghty & Miller, 1986). Therefore, the most likely surface water bodies for offsite surface water and sediment sampling are Lakes Virginia, Berry, and Spier (Figure 2-7).

In accordance with the guidelines presented in the statistical sampling methodology in Section 2.6 (Conover, 1980), if surface water and sediment sampling is required, then five surface water and five sediment sample locations would be selected from each of the lakes listed above.

Surface water sampling would be completed in shallow water along the southern shorelines of the lakes, or in a zone(s) of groundwater discharge if one can be identified. More information on the details of field procedures for surface water sampling is available in the POP (ABB-ES, 1994a).

Parameters analyzed may include TAL metals, TCL organics (excluding PCBs and dioxins), and radionuclides (uranium [U]-234, U-238, thorium [Th]-227, Th-228, Th-230, Th-232, Radium [Ra]-226, and Ra-228). Dioxins will be analyzed only if PCBs are detected. The specific list of contaminants would be tailored to contaminants detected in the groundwater samples collected (Table 3-1). In addition, total organic carbon, pH, hardness, total dissolved solids, total suspended solids, and total alkalinity will be obtained for risk and treatability evaluations. For purposes of this workplan, 15 surface water samples have been budgeted (five from each of the three surface water bodies in a presumed downgradient direction from the North Grinder Landfill).

Sediment sampling would also be completed in shallow water in the same areas as the surface water sampling (along shorelines or in zone(s) of groundwater recharge). Leachability analysis would also be completed on the sediment using surface water to determine the extent of leachability within the existing environment. A location survey for all surface water and sediment sample locations will be completed with a GPS rover and base station system capable of sub-meter accuracy. More information on the details of field procedures for sediment sampling is available in the POP (ABB-ES, 1994a).

Parameters analyzed may include TAL metals, TCL organics and radionuclides (U-234, U-238, Th-227, Th-228, Th-230, Th-232, Ra-226, and Ra-228). Dioxins will be analyzed only if PCBs are detected. As with the surface water analyses, the specific parameters to be analyzed would be tailored to contaminants detected in groundwater samples collected (Table 3-1). In addition, total organic carbon and pH may be obtained for risk and treatability evaluations.

3.5 MONITORING WELL INSTALLATIONS. The objectives of the monitoring well installation program for OU 1, North Grinder Landfill, are

- the characterization of the vertical and horizontal extent of potential groundwater contamination, and
- the development of sufficient information to complete the Risk Assessment and the FS.

In addition to the characterization of potential groundwater contamination, the monitoring well installation program will be designed with the goal of establishing locations suitable for future groundwater monitoring at the landfill, if required.

As discussed in Section 3.3, a direct push screening program will be completed to evaluate the subsurface at the landfill and identify the extent of potential groundwater contamination. This evaluation will be completed by using a combination of TerraProbe℠ and CPT. The TerraProbe℠ will be used for *in situ* groundwater sampling to delineate any contaminant plume that may be present, whereas the CPT program will be used to characterize the lithologies present in the vicinity of the landfill and to characterize the vertical distribution of any contamination throughout the surficial aquifer. This direct push program is included in the investigative approach for the OU 1 landfill because of uncertainties in (1) the presence and location of groundwater contamination and (2) the presence and depths of water-bearing intervals and potential confining units in the site's subsurface. Because of these uncertainties, a detailed discussion of the monitoring well installation program can not be completed with the available information. The following paragraphs will, therefore, outline the approach to be used for the installation of groundwater monitoring wells.

The locations and depths for monitoring well installations at OU 1 will be based on an evaluation of the data provided by the direct push screening program. Data from the screening program will be compiled and evaluated to develop a model of the site's aquifers (there may be more than one in the surficial material above the Hawthorn Group), confining layers, and the extent to which potential contaminants from the landfill have migrated horizontally and vertically in the groundwater. Following this evaluation and model development, a proposed monitoring well installation program will be developed.

The results of the screening program, the model of site conditions, and the proposed monitoring well installation program will be presented to the BRAC Cleanup Team (BCT) in the form of a brief letter report to be followed by a meeting. The meeting will be a working session at which the final monitoring well locations and depths are agreed upon. This approach, a screening program followed by a working session to finalize monitoring well locations, will expedite the completion of the remedial investigation by identifying the probable conditions and reaching consensus on the identification and management of potential uncertainties with the program ultimately agreed upon.

For purposes of this workplan, the following scenario is considered likely. A series of well clusters within the surficial aquifer system (shallow, intermediate, and deep) will be required to characterize groundwater and any contaminant plume emanating from the North Grinder Landfill. The clusters will consist of one upgradient, three lateral (to define both sides of the plume), two downgradient (off the nose of the plume), and three characterization (within the plume) sets of wells (Figure 3-5). Upgradient refers to any point in the direction from which groundwater flows. Downgradient refers to any point in the direction toward which groundwater flows. The term lateral refers to any location downgradient that is also offset laterally from the direction of groundwater flow. Implicit in all three terms is their spatial relationship to a point of interest, in this case, the North Grinder Landfill. Characterization is a term that refers to the placement of monitoring wells within a contaminant plume such that they characterize the plume sufficiently to predict contaminant concentrations and migration pathways. The ultimate goal of the placement of characterization wells and wells outside of a contaminant plume is to enable evaluation of risks and screening of remedial alternatives.

The well clusters would be designed only to support data requirements for the risk assessment and FS. As defined in this workplan, shallow wells will be screened from approximately 5 to 15 feet bls, intermediate wells from 40 to 50 feet bls, and deep wells from 70 to 80 feet bls. The exact placement of well screens will depend on results from the screening survey (TerraProbe℠ and/or CPT). Perched water zones and multiple secondary aquifers within the surficial aquifer may be present, and will need to be assessed.

Each monitoring well location will be scanned with a gamma scintillation detector to determine the presence of gamma emissions. The ground surface will be scanned prior to drilling at each location, and the augers, rods, split spoons, and soil samples will also be scanned after they are brought up. These data will be used not only for personnel protection, but will also be used to qualitatively evaluate the presence and extent of subsurface radioactivity.

For this program, 6¼-inch inner diameter (ID) hollow stem augers will be used to advance the hole to the desired depth. This will permit an ample sand pack around the 2-inch diameter well screen. Split-spoon samples will be taken every 5 feet and may be analyzed for grain size, confirmation of CPT lithology, and other parameters. All wells will be installed with 2-inch polyvinyl chloride (PVC) screen and riser, and well installation details will be in accordance with the POP, Subsection 4.4.6, Exploratory Drilling (ABB-ES, 1994a).

In the event that a contaminant plume is detected at the base of the surficial aquifer, the installation of monitoring wells into the Hawthorn Group would be required as follows: one upgradient, two lateral, one downgradient, and one characterization. For purposes of this workplan, each of these deep wells would be screened 120 to 130 feet bls. A horizontal location survey for all monitoring wells will be completed with a GPS rover and base station system capable of sub-meter accuracy. Vertical surveys will be required for all monitoring wells and will be completed with traditional leveling techniques, as described in the POP, Section 4.9, Elevation Survey (ABB-ES, 1994a).

In the same manner, if the contaminant plume extends into the Hawthorn Group, additional monitoring wells would be needed in the Floridan aquifer system. There may be adequate existing downgradient wells that could be sampled for this assessment. However, for purposes of this workplan, three deep wells into the Floridan aquifer system have been budgeted as follows: one upgradient, one downgradient, and one characterization. The wells will be screened approximately 200 feet bls. To prevent any cross contamination between the surficial aquifer,

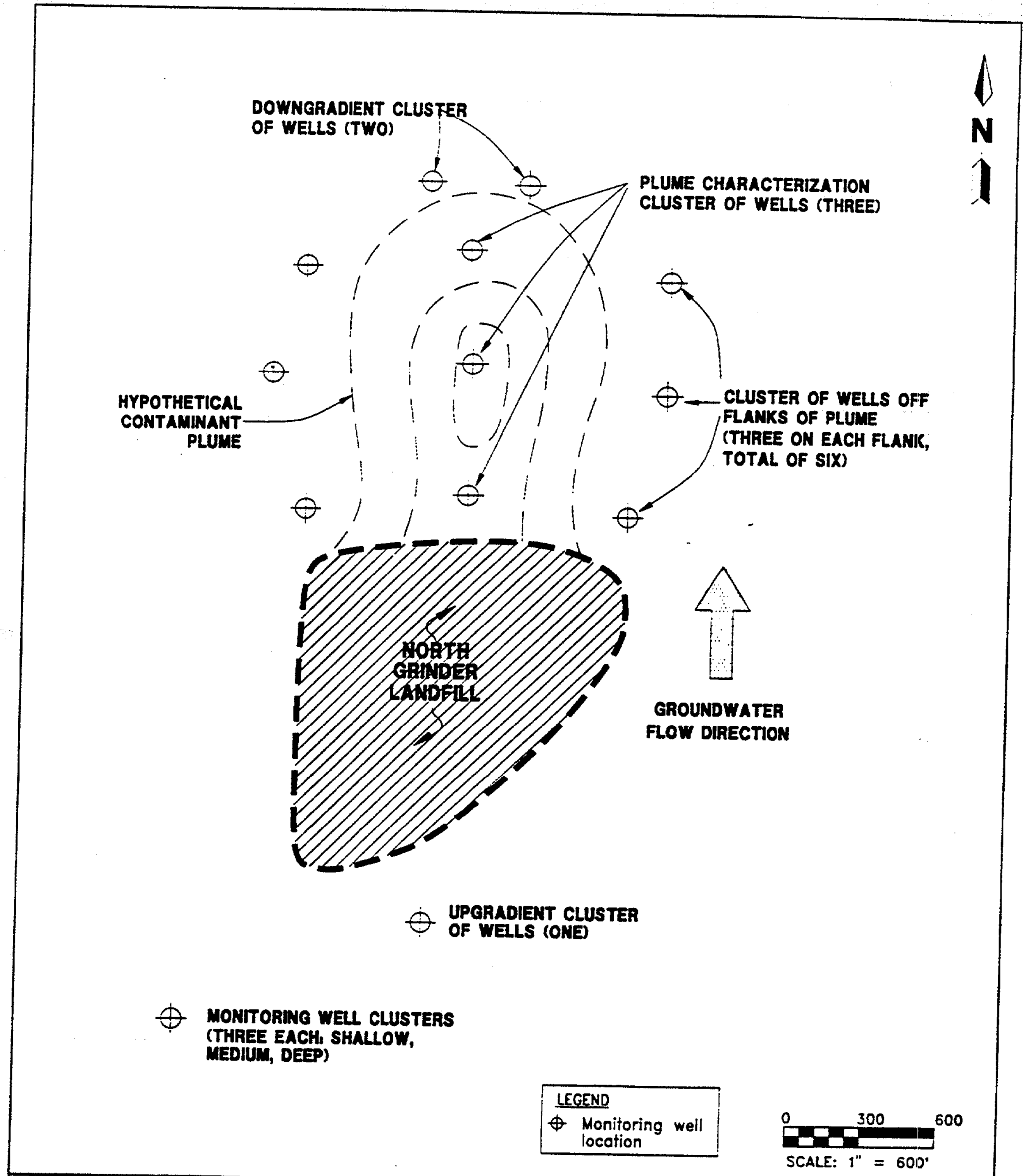


**FIGURE 3-5**

**SCHEMATIC PLACEMENT OF MONITORING WELLS**

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the Hawthorn Group, and the Floridan aquifer system, the deep wells will be double cased.

Groundwater will be analyzed for TAL metals, TCL organics and gross alpha and gross beta (Table 3-1). Radionuclides (U-234, U-238, Th-227, Th-228, Th-230, Th-232, Ra-226, Ra-228, and radon) may also be analyzed, but only if gross alpha and gross beta values are above the referenced gross alpha MCL and gross beta screening level (Table 2-1). Dioxins will be analyzed only if PCBs are detected.

3.6 AQUIFER PERMEABILITY TESTING. The objective of the aquifer permeability testing program for the OU 1 landfill is to develop data on the nature of the aquifer (hydraulic conductivity, transmissivity, etc.) to (1) complete the characterization of groundwater flow, (2) evaluate fate and transport of detected contaminants, and (3) support the evaluation of groundwater remedial alternatives.

Aquifer permeability testing for OU 1 will consist of completing slug tests at 30 percent of the newly installed monitoring wells to characterize the hydraulic conductivity in the vicinity of the screened interval. As there are 36 proposed wells in 12 clusters in the surficial aquifer (12 shallow, 12 intermediate, and 12 deep), 7 proposed wells in the Hawthorn Group, and 3 proposed wells in the Floridan for a total of 46 wells, approximately 14 slug tests will be completed. Locations selected for slug tests will be chosen so that all sides of the site (and groundwater plume if detected) are characterized. It is anticipated that monitoring wells will be installed in more than one horizon (vertically) within the surficial aquifer. Slug tests will be completed at the same frequency (30 percent) for each of the specific intervals where monitoring wells are completed. Slug tests are described in the POP, Subsection 4.8.2, Hydraulic Conductivity Testing (ABB-ES, 1994a).

As discussed in Section 3.5, several uncertainties exist regarding the presence of contamination in the surficial aquifer and groundwater flow at the site. More intensive efforts, such as a pumping test, may be required depending on the conditions encountered. For this reason, it may be necessary to re-evaluate the proposed aquifer testing program when the monitoring well installation program is finalized.

# 4.0 SAMPLE ANALYSES AND VALIDATION

**4.1 DATA VALIDATION.** The approach to providing reliable data that meet the DQOs will include QA/QC requirements for each of the analytical data types generated during the field investigation. The QA/QC efforts for laboratory analyses will include collection and submittal of QC samples and the assessment and validation of data from the subcontract laboratories. Analytical data will be subjected to independent data validation by a subcontractor as described in the POP, Section 8.2, Validation (ABB-ES, 1994a).

Data quality indicators include the precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters. These parameters will be used within the data validation process to evaluate data quality. The achievable limits for these parameters vary with the DQO level of the data. The limits used for laboratory analytical data in this program will be those set by the CLP for Level IV DQOs and as specified in the USEPA methods for Level III DQOs. PARCC parameters are described in the POP, Chapter 12.0, Data Assessment (ABB-ES, 1994a).

**4.2 DATA EVALUATION.** The purpose of this task is to assess usability of validated data results based upon data comparisons to non-site-related conditions. Results that meet the DQO requirements and are considered usable will be compared with background sampling results from a recent investigation (ABB-ES, 1994c). Results of the data evaluation will be documented in the RI report. The following data comparisons and evaluations will be made:

- evaluation of detection limits,
- evaluation of counting errors,
- evaluation of equilibrium data,
- evaluation of qualified data,
- comparison of laboratory and field blanks with sample results, and
- comparison of laboratory and field duplicate results.

Contaminants of concern (COCs) will be identified through evaluation of the following criteria:

- background sampling results,
- frequency of detection, and
- extent of contamination.

COCs will be used throughout the data evaluation, fate and transport assessment, risk assessment, and FS.

Statistical analyses will be used in the data evaluation process and will involve a variety of analytical methods including exploratory analyses and the use of the standard t-test and/or the Mann-Whitney test. The following briefly describes each of the methods along with their application.

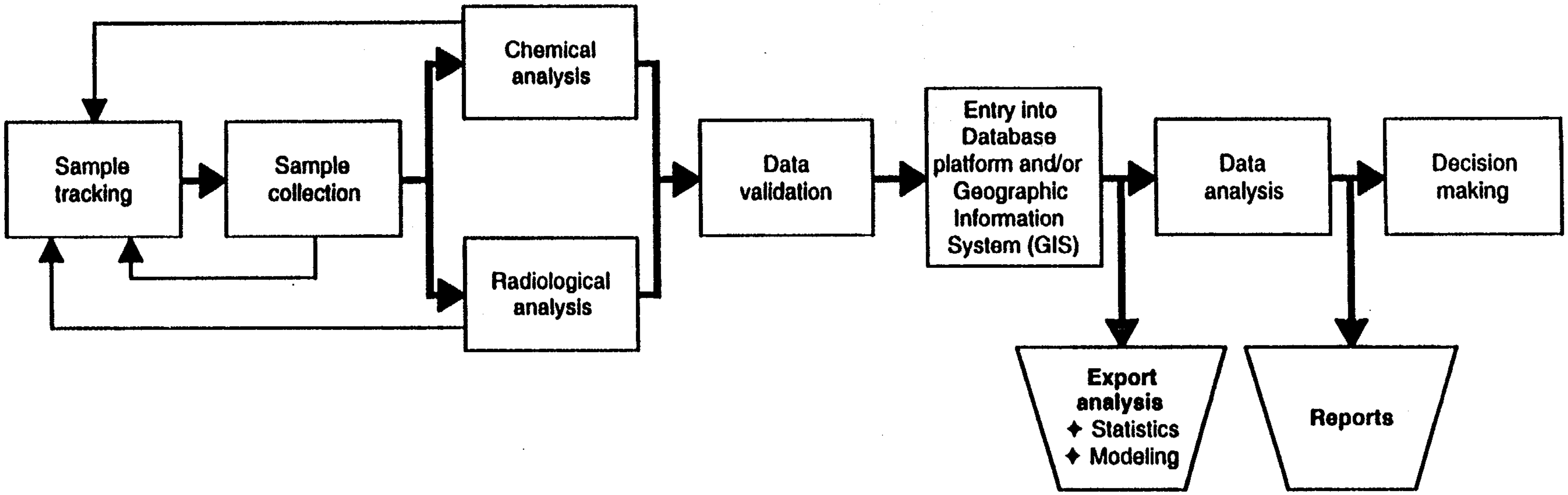
Exploratory analyses consist of graphical methods including probability plots, boxplots, scatter plot matrices, and identity plots. Probability plots are used to identify data distributions. Boxplots graphically compare distributions from different data subsets (e.g., background versus contaminated media). Scatterplots and identity plots graphically display relationships among multiple variables and allow identification of variables that can best provide predicted values. Identification of best-predictor variables will be based upon investigative analyses and corroborated with comparison of goodness of fit statistics after fitting appropriate regression and/or classification and regression trees (CART) models.

Background to onsite comparisons will be made using either a standard t-test or a Mann-Whitney test. Assuming data are normally or lognormally distributed, the standard t-test will be used to evaluate whether differences between background and site-specific samples are statistically significant. If data are not normally distributed and/or cannot be transformed to meet the normality assumptions of the t-test, then comparisons between background and site-specific sampling results will be made using a Mann-Whitney test. The Mann-Whitney test is a nonparametric test analogous to the t-test, which makes no assumptions about the underlying distribution of the data being evaluated and is appropriately applied when data either do not exhibit a normal distribution or are too limited (in number) to evaluate the distribution.

4.3 DATA MANAGEMENT. The purpose of this task is to track and manage environmental and QC data collected from the field investigation from the time the data is obtained through data analysis and report evaluation. Coordination and management of the contracted laboratories is also part of this task. RI activities generate data, including sample locations, measurements of field parameters, and the results of laboratory analyses. Reports regarding the collection and analyses of sample data will also be generated. The RI process entails the flow of data collected in the field and generated by the analytical laboratory work to those involved in project evaluation and decision making. Figure 4-1 illustrates the data management life cycle and project information flow. Management of data collected during RI activities will provide accessibility of data to support environmental data analysis, risk assessments, and the evaluation of remedial action alternatives.

Samples will be tracked from the field collection activities to the analytical laboratories through return of sample residuals from the laboratories (if not disposed by the laboratory) following standard ABB-ES chain-of-custody procedures, which may include bar coding. These procedures are described in the POP, Chapter 5.0, Sample Handling and Custody Procedures (ABB-ES, 1994a). Samples will be labeled and identified following the ABB-ES Standard Operating Procedures, Identification of Environmental Samples for the CLEAN Program. Sample information recorded from bar coding or chain-of-custody forms will be transferred (electronically or manually) into the sample tracking portion of the database management system (Fast Retrieval of Environmental Data [FRED]), thus, enabling the samples to be tracked through final disposition. The sample tracking system will produce reports to inform the project team of potential delays or problems related to sample analysis and validation.

Analytical results, applicable QA/QC data, validation flags, chain-of-custody information, and any other attributed information will be incorporated into FRED. All data will be verified after uploading to ensure completeness and accuracy. FRED resides on an ORACLE™ platform that is integrated with other programs to enable efficient data management and to support data evaluation, risk evaluation, remedial alternative selection, and report generation. FRED is capable of




**Legend**

Flow path

Tracking routine

FIGURE 4-1

DATA MANAGEMENT LIFE CYCLE

RI/FS WORKPLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

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generating a variety of reports that were designed to support data evaluation and decision making. Integration of additional software packages to enhance data evaluation and the ability to make informed risk management decisions is in process.

# 5.0 RISK EVALUATION

5.1 HUMAN HEALTH EVALUATION. The purpose of the human health risk evaluation at the North Grinder Landfill is to provide an evaluation of the potential risks to human receptors posed by landfill-derived chemicals. The evaluation will be conducted under the presumed remedy of source containment. The presumptive remedy addresses exposures and risks within the source area, but does not address exposures and risks outside the source area.

The results of the preliminary risk evaluation presented in Paragraph 2.7.2.2 have been used to develop an approach for the human health risk evaluation. In the human health risk evaluation, the adequacy of the various components of the presumptive remedy will be evaluated to determine if they are sufficient to prevent exposure in the landfill source area and in off-landfill areas. The human health risk evaluation will qualitatively evaluate and discuss the adequacy of the presumptive remedy components as they relate to exposure. Provided the presumptive remedy addresses all potential source area exposure pathways, a quantitative risk evaluation for the landfill source area will not be conducted. If contaminants have migrated to offsite locations where human exposure is possible, then a quantitative risk evaluation may be necessary. The focus of the quantitative risk evaluation will be on potential exposure pathways outside the source area.

The quantitative risk evaluation will consist of the following components, which are discussed below: hazard identification, toxicity assessment, exposure assessment, risk characterization, comparison to health standards and guidelines, and uncertainty assessment.

The approach used in the human health risk evaluation will be consistent with the following guidance:

- Risk Assessment Guidance for Superfund (RAGs), Volume I, Human Health Evaluation Manual (Part A), Interim Final (USEPA, 1989a);
- USEPA Region IV Risk Assessment Guidance (USEPA, 1991c); and
- Presumptive Remedy for CERCLA Municipal Landfill Sites (USEPA, 1993a; 1993b)

5.1.1 Hazard Identification This section will present an overview of the type and extent of contamination present at the North Grinder Landfill and will identify CPCs. CPCs will be selected based on factors such as comparison to background concentrations, frequency of detection, data quality objectives, inherent toxicity of the chemical, and physical and chemical properties of the chemical.

5.1.2 Toxicity Assessment If a quantitative risk evaluation is necessary, the most recent toxicity constants or dose-response values will be obtained from the USEPA Integrated Risk Information System (IRIS) database and the Health Effects Assessment Summary Tables (HEAST). If neither IRIS nor HEAST contain a toxicity constant for a particular CPC, then the USEPA Environmental Criteria and Assessment Office (ECAO) will be contacted to determine if an ECAO-derived value is available.

5.1.3 Exposure Assessment The exposure assessment will evaluate the potential for human exposure to landfill-derived contaminants. It will consist of the identification of potential human receptors, potential pathways of exposure, and estimation of exposure intakes.

Following the USEPA's directive on presumptive remedies for CERCLA municipal landfill sites (USEPA, 1993a; 1993b), the following exposure pathways associated with the source (i.e., the landfill) are assumed to be addressed by a particular component of the remedy:

- direct contact with soil and/or debris is prevented by the landfill cap,
- exposure to contaminated groundwater within the landfill area is prevented by groundwater control,
- exposure to contaminated leachate is prevented by leachate collection and treatment, and
- exposure to landfill gas is addressed by gas collection and treatment, as appropriate.

In the human health risk evaluation, the adequacy of the various components of the presumptive remedy will be evaluated to determine if they are sufficient to prevent exposure. The human health risk evaluation will qualitatively evaluate and discuss the adequacy of the presumptive remedy components as they relate to exposure.

If contaminants have migrated to offsite locations where human exposure is possible, then a quantitative risk evaluation may be necessary. The results of field investigations and chemical analyses will be used to determine if potential exposure pathways need to be evaluated quantitatively. As discussed in the Human Health Preliminary Risk Evaluation (Paragraph 2.7.2.2), under what are considered to be the most probable site conditions, no human exposure pathways have been identified. Other potential pathways, although less likely to be complete pathways and, therefore, referred to in the conceptual site model as potential deviations, include the following.

- Another potential pathway is dermal contact with and incidental ingestion of landfill-derived contaminants that have migrated to surface water and/or sediment beyond the landfill boundaries by an area (off-landfill) resident;
- Another potential pathway is ingestion of and direct contact with groundwater by a future area (off-landfill) resident. The groundwater is assumed to be extracted from the surficial aquifer at a location beyond the boundaries of the landfill at some point in the future. If volatile compounds are present, the inhalation exposure route will be included.
- The last potential pathway identified is inhalation of landfill gas by a site maintenance worker or recreational user of the site in the future.

Exposure point concentrations will be represented as the 95 percent upper confidence limit (UCL) of the arithmetic average (with those contaminants not detected set equal to one-half their sample quantitation limit). If, however, the UCL exceeds the maximum detected concentration, then the exposure point concentration will be set at the maximum.

To minimize revisions to the draft human health risk evaluation, a preliminary exposure memorandum will be prepared and circulated to the regulatory risk assessors prior to completion of the draft risk evaluation. The purpose of the memorandum will be to inform the regulators of the exposure pathways and parameter values being evaluated and to provide them with the opportunity to comment on the proposed approach to the risk evaluation.

5.1.4 Risk Characterization The purpose of the risk characterization will be to combine the findings of the toxicity and exposure assessments to characterize the human health risks associated with off-landfill contamination (i.e., contaminants that have migrated beyond the source area).

Both cancer and noncancer risks will be estimated following the procedures established in RAGs. Excess lifetime cancer risks and hazard indices will be calculated for the CPCs. These risk estimates will be compared to the Superfund target risk range for carcinogens of $10^{-4}$ to $10^{-6}$ and noncancer hazard index of one.

5.1.5 Comparison to Health Standards and Guidelines Exposure point concentrations will be compared to available Federal and State health standards and guidelines. These may include but not be limited to drinking water, surface water, and/or air standards and guidelines such as Federal and State MCLs, ambient water quality criteria (AWQCs), and Occupational Safety and Health Administration (OSHA) permissible exposure levels (PELs).

5.1.6 Uncertainty Analysis The prediction of human health risks involves a number of assumptions and uncertainties. In this section, the uncertainties in the risk evaluation will be identified and their potential effects upon the results of the risk evaluation will be discussed. Both site-specific and general risk assessment uncertainties and limitations will be included.

5.2 ECOLOGICAL EVALUATION. The purpose of the ecological evaluation at the North Grinder Landfill is to provide an evaluation of the potential risks to ecological receptors posed by chemicals in environmental media under the presumed remedy of source containment. This presumptive remedy addresses exposures and risks within the source area, but does not address exposure pathways outside the source area.

The results of the preliminary risk evaluation presented in Paragraph 2.7.2.3 have been used in the development of the approach for the ecological evaluation. The ecological evaluation will be based on data obtained during RI field activities and its objectives will be twofold: (1) to determine if the existing soil cover on the North Grinder Landfill is sufficient to prevent exposures and risks to ecological receptors on the landfill, and (2) to determine if contaminants within the landfill have migrated to offsite locations where other ecological exposures could occur.

The ecological evaluation will consist of the following elements, which are discussed below in greater detail: hazard assessment, ecological characterization, ecological exposure assessment, ecological effects assessment, ecological risk characterization, and an uncertainty analysis.

The approach used in this ecological evaluation will be consistent with the following guidance:

- Risk Assessment Guidance for Superfund - Environmental Evaluation (USEPA, 1989b),
- Framework for Ecological Risk Assessment (USEPA, 1992f),
- USEPA Region IV Risk Assessment Guidance (USEPA, 1991c),
- USEPA "ECO Update" bulletins (USEPA, 1991a; 1991b; 1992c; 1992d; 1992e),
- Conducting Remedial Investigations and Feasibility Studies for CERCLA Municipal Landfill Sites (USEPA, 1991d), and
- Presumptive Remedy for CERCLA Municipal Landfill Sites (USEPA, 1993a; 1993b).

5.2.1 Hazard Assessment This section will present an overview of the type and extent of contamination present at the North Grinder Landfill and will identify ecological CPCs. CPCs will be selected from available site data based on factors such as the applicability of the data for ecological assessment, the data quality objectives, the classification of chemicals (e.g., inorganic, volatile organic, semivolatiles, and pesticides), comparison of chemical concentrations with naturally occurring background concentrations, the physical and chemical properties of chemicals, the frequency of detection, and the inherent toxicity of the chemicals and their potential to bioaccumulate.

5.2.2 Ecological Characterization The ecological characterization will serve as the basis for identifying potential ecological receptors at the North Grinder Landfill. Flora and fauna located at or potentially affected by the site will be qualitatively characterized.

The characterization will be based on a limited site reconnaissance. In addition, background information on the North Grinder Landfill and surrounding area will be reviewed, including literature on the range and distribution of wildlife species, and interviews with local, State, and Federal wildlife officials. Emphasis will be placed on assessing habitat suitability for aquatic and terrestrial organisms; assessing the potential occurrence of rare, threatened, or endangered species; and identifying wetland or other aquatic habitats that may potentially be affected by site-related contaminants. The U.S. Fish and Wildlife Service, Florida Natural Heritage Program, and Florida Game and Fresh Water Fish Commission will be contacted regarding the presence of potential receptors. Additional information will be obtained, if available, from other subcontractors conducting the basewide Environmental Impact Statement. The results of the receptor analyses will be used to further develop exposure scenarios for the ecological exposure assessment.

5.2.3 Ecological Exposure Assessment The Ecological Exposure Assessment will evaluate the potential for receptor exposure to CPCs at the North Grinder Landfill. This evaluation involves the identification of potential exposure routes and an evaluation of the magnitude of exposure of identified ecological receptors. Exposure concentrations and/or doses will be estimated for each exposure pathway. If appropriate, indicator species will be selected for ecological exposure modeling.

Exposure pathways describe how ecological receptors can come into contact with contaminated media and are based on identifying (1) the contaminant source, (2) the environmental transport medium, (3) the point of receptor contact, and (4) the exposure route (e.g., incidental soil ingestion, drinking of contaminated surface water, or ingestion of contaminated prey items).

A conceptual site model, which identified exposure pathways under probable conditions as well as possible deviations from those site conditions, was presented in the preliminary risk evaluation section (Paragraph 2.7.2.3) of this workplan. As discussed in that section, the ecological exposure pathways most likely to be completed at the North Grinder Landfill are:

- food chain exposure and
- dermal contact and incidental ingestion of soil or landfill material.

Additional exposure pathways for ecological receptors, which are possible deviations in the conceptual site model include:

- direct contact with and ingestion of surface water and sediment by aquatic life,
- dermal contact with and incidental ingestion of sediment by terrestrial and semi-aquatic wildlife,
- dermal contact and ingestion of surface water by terrestrial wildlife, and
- inhalation of landfill gas.

In selecting ecological exposure pathways for the ecological evaluation, these and other potential exposure pathways will be considered in light of the additional information obtained during the field investigative efforts.

Based on CPC concentration data, exposure point concentrations will be estimated for the selected ecological exposure pathways and receptors. These concentrations will be assumed to be equivalent to the lower of the 95 percent upper confidence limit on the arithmetic mean or the maximum detected concentration.

The process of assessing exposure for terrestrial receptors will involve estimating the likely dosage for each relevant exposure route, and summing these estimates to derive an expected total body dosage for each receptor type. The extent of exposure will depend upon various factors such as the type of food consumed, feeding rates, habitat preference, and home range.

<u>5.2.4 Ecological Effects Assessment</u> The Ecological Effects Assessment will contain a description of the ecotoxicological effects associated with the CPCs, and a discussion of the relationship between the exposure concentration and the potential for adverse effects in ecological populations. Toxicological effects will be evaluated using concentration- or dose-response data regarding acute and

chronic toxicity to the identified potential ecological receptors. Benchmark concentrations or doses will be identified for use in the ecological risk characterization section. Sources that will be considered in identifying benchmark values for aquatic receptors include USEPA ambient water quality criteria, State water quality standards, and sediment quality guidelines. Criteria or standards for protection of terrestrial receptors have not yet been established; therefore, terrestrial benchmark values will be obtained from published toxicological studies.

5.2.5 Ecological Risk Characterization The purpose of the Ecological Risk Characterization will be to combine the results of the exposure and effects assessments to characterize the ecological risks at the North Grinder Landfill. This section will identify ecological receptors that might be at risk from site-related contamination. Potential risks will be described using the following hazard index approach.

The estimated doses or exposure concentrations will be compared to benchmark values identified in the toxicity assessment. Hazard Quotients (HQs) will be calculated for each chemical by dividing the exposure concentration by the benchmark value. These HQs will be summed into a cumulative hazard index (HI). As the HI increases in magnitude, the likelihood for adverse ecological effects increases. The ecological risk characterization will include a discussion of the chemicals and pathways that may pose a risk to ecological receptors under the presumed remedy. It will also contain a discussion of visual observations of any ecosystem degradation or other symptoms of environmental stress observed during the site visit.

The findings of the ecological risk characterization will be used in evaluating the need (if any) for addressing specific ecological concerns in the presumed remedy of source containment for the North Grinder landfill.

5.2.6 Uncertainty Analyses The prediction of ecological risks involves a number of assumptions. In this section, the uncertainties associated with these risk assessment assumptions will be identified and their potential effects upon the results of the risk assessment will be discussed.

# 6.0 INVESTIGATIVE-DERIVED WASTE MANAGEMENT

The purpose of this task is for the management of IDW that is generated during studies conducted in the North Grinder Landfill. Also considered will be the management of sample residuals of any radiologically contaminated samples returned from the laboratories.

This section contains definitions and identifies waste categories and classification methods, packaging requirements, and preferred management options. The approach outlined in this section emphasizes the following objectives:

- management of IDW in a manner that is protective of human health and the environment;
- minimization of IDW generation, thereby reducing costs and the use of limited storage facility capacity; and
- compliance, to the extent practical, with Federal and State requirements that are legally ARARs.

## 6.1 DEFINITIONS.

An Area of Concern (AOC) is the area delineated by the areal extent of potential contamination on the project site. This boundary may contain varying concentrations and types of hazardous substances and may contain uncontaminated areas. For the purpose of this workplan, the AOC will be considered represented at the site boundary surrounding the landfill.

USEPA "Contained-In" Policy requires any mixture of a non-solid waste (environmental media) and a Resource Conservation and Recovery Act (RCRA)-listed hazardous waste to be managed as a hazardous waste, as long as the material contains the listed hazardous waste above health-based standards.

A Field Staging Area (FSA) is an area within the project site where drums and other containers or IDW are stored until the site investigative activities are completed or a final disposal option is selected in an ROD. This area will be posted as the FSA and will be checked for leaking containers weekly during field activities. This area will remain active until all containers have been disposed appropriately. Additional empty drums, overpack, and absorbent materials will be kept at the FSA in the event of a leak or spill. The FSA is not considered an RCRA 90-day storage area.

Hazardous Constituents are those constituents listed in 40 CFR Part 261, Appendix VIII.

Hazardous Substances, for the purposes of this plan, shall have the meaning set forth by Section 101(14) of CERCLA, 42 U.S. Code (USC) 9601(14).

IDW is discarded materials resulting from site investigation activities, such as decontamination, which in present form possess no inherent value or additional usefulness without treatment. Such waste may be: solid, semi-solid, liquid, or gaseous material that may or may not be hazardous as defined in 40 CFR Part 261;

radioactive due to the presence of radionuclides regulated by the Atomic Energy Act (AEA) of 1954, as amended; or mixed, which is a waste that contains both radioactive and hazardous components. IDW may include materials such as used personal protective equipment (PPE), decontamination fluids (wash and rinse), drilling muds and cuttings, pumped monitoring well fluids, purge water, soil, and other materials from collection of samples and spill contaminated materials.

IDW will be classified as RCRA hazardous waste if it meets one of the following criteria:

- contains a USEPA-listed hazardous waste identified in 40 CFR 261, or
- exhibits characteristics of hazardous waste, including ignitability, corrosivity, reactivity, or toxicity, as described in 40 CFR 261.

Land Disposal means placement in or on the land and includes, but is not limited to, placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, underground mine or cave, or concrete vault or bunker intended for disposal.

Land Disposal Restrictions (LDRs) are restrictions that prohibit the land disposal of certain RCRA hazardous wastes unless specific treatment standards are met. The USEPA has established standards for specific hazardous wastes that are protective of human health and the environment when the wastes are land disposed. LDRs apply to waste management activities under RCRA and the Safe Drinking Water Act (SDWA), which controls underground injection of hazardous waste in deep wells.

Radioactive Waste is waste that contains radioactivity above background or referenced levels.

Mixed Waste is materials that have been classified as hazardous and/or PCB waste, and are also classified as radioactive.

Movement (Non-Placement) is an activity that consists of moving soil within the site, whether excavated or surface soil, along with RCRA hazardous wastes and CERCLA hazardous constituents contained in soil to consolidate the material within the AOC. Note that movement of soil with CERCLA constituents or radioactive constituents that do not contain RCRA hazardous waste would not trigger RCRA LDRs, even if moved outside the AOC.

Placement is an activity that consists of moving soil contaminated with RCRA hazardous wastes offsite or outside the AOC.

Wastewater is liquid waste consisting primarily of water without other liquid phases present that may result from groundwater well installation, development, and sampling activities, or from the cleaning of well installation or sampling equipment.

**6.2 GENERAL MANAGEMENT APPROACH**. The intent of this plan is to return as much as possible of the IDW (excluding PPE and decontamination liquids) generated from sampling activities back to the original source, thereby reducing the volume of waste to be containerized, stored, and managed. This approach minimizes IDW and does not add a greater threat to human health and the environment than existed prior to the investigation. Returning the IDW to the original source will also allow the IDW to be addressed in a manner consistent with the final remedy for the site.

Residuals from hand augers and borings will be returned to the borehole from which they originated. Additional clean fill material will be used to fill any remaining parts of the borehole resulting from the borehole residuals being tamped down.

Wastewater and PPE generated during decontamination operations and sampling activities will be containerized, centralized, and managed in accordance with this plan.

6.3 AREA OF CONCERN. Prior to development of this plan, the concept of returning the residual soil back to the original borehole was evaluated regarding compliance with applicable regulations. The most significant ARAR considered included the LDRs under RCRA. For LDRs to be applicable, the action must constitute "placement" of a restricted RCRA hazardous waste in a land disposal unit. To clarify whether "placement" occurs, the concept of AOC has been adopted.

IDW that is generated, moved, consolidated, stored, or redeposited within the boundaries of the AOC will not constitute "placement" or trigger LDRs (USEPA, 1992b). However, "placement" will occur as a result of either of the two following activities: (1) IDW is consolidated from different AOCs into a single AOC and redeposited, and (2) IDW is moved outside of an AOC (for example, for treatment or storage) and returned to the same or a different AOC.

6.4 WASTE HANDLING, SEGREGATION, AND PACKAGING. IDW will be containerized for characterization and classification. PPE will be composited into open-top, 55-gallon steel 17C U.S. Department of Transportation (DOT)-approved drums with a plastic liner. Wastewater generated will be collected in either 55-gallon drums or a bulk polypropylene-type container mounted to a transportable trailer or vehicle.

Waste containers that are filled will be securely closed, cleaned, and labeled. All labeling will include the date, the specific location (boring or well), waste type, and any field observations that may be appropriate. Labels will be completed with permanent markers and will be attached to the container when it is full or sampling activities are complete.

6.5 WASTE TRANSPORTATION AND STORAGE. IDW generated during field activities will be composited into drums or containers at the FSA within the AOC. Wastewater from the decontamination activities will be sampled for CLP TAL metals and TCL organics (excluding PCBs, dioxins, and pesticides). Radionuclides (U-234, U-238, Th-227, Th-228, Th-230, Th-232, Ra-226, Ra-228, and radon) may also be analyzed, but only if gross alpha and gross beta values are above the referenced gross alpha MCL and gross beta screening level (Table 2-1).

Once the drums and/or containers are securely sealed and labeled they will be moved to the FSA. Waste to be transported during sampling activities will be scanned for direct (total) radioactive contamination prior to transport to the

FSA. Waste materials will be containerized at the job site after the radiological survey is conducted. If the results of the radiological survey indicate radioactivity less than 2,000 picocuries per gram (pCi/g), then the material will be considered non-radioactive for purposes of DOT shipping requirements for shipment of radioactive materials (limited quantity radioactive shipping requirements presented in 49 CFR 173). At the FSA, the drums will be unloaded onto pallets not to exceed four drums per pallet. Drums will be positioned on the pallets such that the container labels are visible and readable.

IDW will be temporarily stored at the FSA pending analytical results of samples collected. Following receipt of the environmental and IDW sample results and comparison of these data to regulatory levels, disposal options and/or additional classification criteria will be determined with the Navy. Additional information on the handling and temporary storage of IDW is contained in the POP, Section 4.10, Control and Disposal of IDW (ABB-ES, 1994a).

6.6 WASTE CLASSIFICATION CRITERIA. If needed for final disposal, the Navy will classify the IDW into four categories:

(1) non-hazardous,
(2) radiological waste,
(3) mixed waste, and
(4) RCRA hazardous waste.

These categories are as defined in the definition section. IDW will be classified on the basis of environmental sample results for determining disposal options for PPE and using IDW sample results for decontamination fluids and drilling residuals. All IDW will be disposed in a manner consistent with the final remedy.

To determine whether a waste is a listed waste under RCRA, the source must be identified. Site information, such as disposal records, investigation analyses, etc., will be used to determine source identity. When such documentation is unavailable, it will be assumed that the wastes are not RCRA-listed hazardous wastes. However, if documentation does confirm that IDW waste contains RCRA-listed waste resulting from disposal activities that occurred after the effective date of RCRA regulations (November 19, 1980), the IDW will be managed as a hazardous waste per USEPA's "Contained-In" Policy. Prior to development of this plan, information reviewed indicated that no activities or disposals of RCRA-listed wastes had occurred after 1980.

IDW classification (non-PPE) will be evaluated on the basis of comparison of analytical results obtained during the RI to promulgated and guidance regulatory values for water, soil, and sediment. Soil and sediment results will be evaluated for hazardous characteristics, as determined by RCRA, by comparing sample analytical results to total extraction limits as described in 40 CFR 261, Appendix II, Method 1311, Toxicity Characteristic Leaching Procedure (TCLP), item 1.2, which states, "If a total analysis of the waste demonstrates that the individual contaminants are not present in the waste, or that they are present but at such low concentrations that the appropriate regulatory thresholds could not possibly be exceeded, the TCLP need not be run."

Thus, the IDW could not be considered an RCRA hazardous waste. If, however, the sample analytical results meet or exceed the total extraction limit for a constituent, then the IDW may need to be sampled and analyzed for TCLP parameters.

6.7 SAMPLE MANAGEMENT. Radioactive laboratory residuals may be returned to the site only if accompanied with proper chain-of-custody paperwork for temporary storage in the FSA until final disposal. Samples will be shipped in accordance with the "limited quantity" radioactive shipping regulations presented in 49 CFR 173. Samples will be required to be shipped under the limited quantity rule unless the laboratory can document that levels contained in the cooler will not exceed 2,000 pCi/g.

6.8 DISPOSAL OPTIONS. Wastewater, PPE, soil cuttings, and drilling muds and fluids are the types of IDW that are anticipated to be generated during the site investigation. The approach recommended in this plan is intended to minimize IDW generation and pursue management options consistent with the final remedy selected for the site.

Wastewater. Wastewater generated from decontamination activities and well installations will be temporarily stored at the FSA. Samples collected for characterization of this IDW will be evaluated for acceptability for disposal at the NTC, Orlando POTW. If the IDW wastewater contamination is at a level that cannot be disposed at the POTW, then the IDW wastewater will be stored at the FSA until discharge limits can be achieved through treatment.

Soils and Drilling Fluids. Analyses of samples collected that are representative of the applicable IDW will be evaluated regarding onsite disposal of soil IDW as discussed under Section 6.2, General Management Approach. If constituent levels detected are at concentrations that would not affect human health or the environment, then the IDW would be used as clean fill material in areas identified by the Navy. If concentrations are such that onsite disposal is not permitted, then the IDW will be stored at the FSA and disposed consistent with the final remedy.

PPE. The incidental contact with waste or contaminated media by personal protective equipment (PPE) typical of CERCLA sit investigations does not warrant management of PPE as hazardous, solid waste. However, if exposure to radioactive materials occurs, PPE will only be regarded as hazardous if radiological levels indicate radioactivity in excess of 2,000 pCi/g.

# 7.0 REMEDIAL INVESTIGATION REPORT

The draft RI report will be prepared in accordance with the guidance contained in *Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1991d). The report will include appropriate sections on site background, investigation activities, physical characteristics, nature and extent of contamination, fate and transport, and risk evaluations (both human health and ecological assessments). Numerical modeling may be used to evaluate the nature and extent and fate and transport of contaminants detected within OU 1. If so, the USGS in Altamonte Springs, Florida, will provide this capability. Probable conditions and reasonable deviations, as depicted in the current site conceptual model, will be verified and/or revised and presented in the report.

After internal review, the document will be prepared for submission to the NTC, Orlando BCT members for review. A final RI document will include a responsiveness summary based on comments received.

## 8.0 FEASIBILITY STUDY

The purpose of the FS is to identify and evaluate remedial action alternatives to minimize or eliminate exposure to contaminants from the landfill (USEPA, 1991d). The FS report for the North Grinder Landfill will include a summary of RI results for each medium, summary of site risks, identification of ARARs, identification of remedial action objectives and general response actions, and identification, screening, and analysis of remedial technologies and alternatives. ARARs, preliminary remedial action objectives, and several potentially applicable technologies have been identified in Subsection 2.7.3 based on what is currently known about the landfill. These will be refined in the FS report based on the findings of the RI.

The approach for screening remedial technologies, developing and screening remedial alternatives, and evaluating alternatives in the FS report is presented in the following subsections.

8.1 ALTERNATIVE TECHNOLOGY SCREENING. The USEPA has reviewed a number of FS reports and RODs for CERCLA municipal landfill sites and has evaluated the types of technologies that are typically selected for implementation (USEPA, 1991d). Generally, these landfills, like the North Grinder Landfill, contain a large volume of heterogeneous waste. This often makes technologies such as excavation and treatment of landfilled materials impractical and costly. Therefore, the presumptive remedy for CERCLA landfill sites is containment, with other components (e.g., leachate or groundwater collection and treatment, hot spot remediation, or landfill gas control) to supplement the containment technologies, depending on site-specific conditions (USEPA, 1993).

Preliminary remedial technologies within the general response action categories of institutional controls, capping, containment, and collection and treatment of surface water, sediment, leachate, groundwater, and landfill gas have been identified in this workplan to assist in focusing the scope of the RI/FS. These technologies have been identified for probable and potential contaminated media and exposure pathways (Table 8-1). The physical and chemical characteristics of the site may require consideration of certain technologies and make others infeasible. The purpose of the technology screening step in the FS process is to eliminate technologies that are infeasible or ineffective for the site conditions and contaminants found at the landfill, as identified in the RI.

Technologies will be screened on the basis of effectiveness, implementability, and cost, as described below. The technology screening step will be conducted in tabular form.

Effectiveness considers the effect that physical and chemical properties of the medium, individual compounds, and compound mixtures would have on a given technology or process. It also considers the technology's reliability over time, its ability to meet chemical-specific ARARs or guidance values, and impacts to the community or environment during implementation.

Implementability focuses on the construction, operation, and performance of a technology. The evaluation of technologies against this criterion considers site-specific features such as topography, buildings, utilities, and available space

**Table 8-1**
**Preliminary Remedial Actions**

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Environmental Media | General Response Actions | Remedial Technologies | Process Options | Description | Evaluation Comments |
|---|---|---|---|---|---|
| Soil and Landfill Contents | Limited action | Access restrictions | Deed restriction | All deeds for property within potentially contaminated areas would include restrictions on use of property. | Potentially viable. |
| | | | Fencing | Security fences installed around potentially contaminated areas to limit access. | Potentially viable. |
| | | | Zoning restrictions | Municipal zoning regulations would be revised to limit access, development, and use of the land. | Potentially viable. |
| | | | Groundwater restrictions. | All deeds for property within potentially contaminated areas would include restrictions on development and use of groundwater. | Potentially viable. |
| | | | Reclassification and/or restricted access of surface water bodies. | State re-classification of surface water bodies limiting use and access. | Potentially viable. |
| | Containment | Surface controls | Vegetation | Seeding, fertilizing, and watering until a stand of vegetation has established itself. | Potentially viable. |
| | | | Grading | Reshaping of topography to manage infiltration and run-off to control erosion. | Potentially viable. |
| | | Cap | Native soil | Uncontaminated native soil placed over landfill. | Viable in cases where direct contact is prime threat. Also may be viable in cases where majority of source is below water table and leaching is not a significant release mechanism. Unless engineered to do so, will not result in reduction in infiltration. |

See notes at end of table.

## Table 8-1 (Continued)
## Preliminary Remedial Actions

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Environmental Media | General Response Actions | Remedial Technologies | Process Options | Description | Evaluation Comments |
|---|---|---|---|---|---|
| Soils and Landfill Contents (continued) | Containment (continued) | Cap (continued) | Single barrier | Cap of compacted clay over site. Usually protected with additional fill above, and topsoil. Clay cap is normally 2 feet thick. | Potentially viable in situations where it is not necessary to comply with RCRA Subtitle C. |
| | | | Composite barrier | Compacted clay covered with a synthetic membrane (20 to 30 millimeter minimum) followed by 1 foot of sand and 1.5 feet of fill and 6 inches of topsoil to provide erosion and moisture control, and freeze-thaw protection. | Potentially viable. Provides maximum protection from exposure due to direct contact. Also, this is the most effective capping option for reducing infiltration in compliance with RCRA guidance. |
| Groundwater and Leachate | No action | | | No action. | Required by NCP to be carried through detailed analyses of alternatives for groundwater usage outside landfill when applying presumptive remedy. |
| | Containment | Vertical barriers | Slurry wall | Trench around site or hot spot is excavated and filled with a bentonite slurry. Trench is backfilled with a soil- (or cement-) bentonite mixture. | Potentially viable. Effectiveness depends on site characteristics. Slurry wall should be keyed into aquitard or bedrock. |
| | Collection | Extraction | Extraction wells | Series of wells to extract contaminated groundwater. | Potentially viable. May include perimeter wells to collect leachate as well as downgradient wells to capture migration of contaminated groundwater. |
| | Treatment | Leachate collection | Subsurface drains | System of perforated pipe laid in trenches to collect contaminated groundwater and lower the water table. | Potentially viable. |
| | | Biological treatment | Aerobic | The use of aerobic microbes to biodegrade organic wastes. | Potentially viable for organics. Sludge produced. |
| | | | Anaerobic | The use of anaerobic microbes to biodegrade organic wastes. | Potentially viable for organics. Sludge produced. |

See notes at end of table.

# Table 8-1 (Continued)
## Preliminary Remedial Actions

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Environmental Media | General Response Actions | Remedial Technologies | Process Options | Description | Evaluation Comments |
|---|---|---|---|---|---|
| Groundwater and Leachate (continued) | Treatment (continued) | Chemical treatment | Chemical oxidation | Oxidizing agents added to waste for oxidation of heavy metals, unsaturated organics, sulfides, phenolics, and aromatic hydrocarbons to less toxic oxidation states. | Potentially viable. |
| | | | UV/oxidation | Destruction of organic contaminants using oxidizing agents and ultraviolet light. | Potentially viable. |
| | | Chemical treatment | Metals precipitation | Inorganic constituents altered to reduce the solubility of heavy metals through the addition of a substance that reacts with the metals or changes the pH. | Potentially viable. |
| | | | pH adjustment | Neutralizing agents (such as lime) added to adjust the pH. This may be done to neutralize a waste stream or to reduce the solubility of inorganic constituents as part of the metals precipitation process. | Potentially viable. |
| | | Physical treatment | Granular activated carbon (GAC) adsorption | Passage of contaminated water through a bed of adsorbent so contaminants adsorb on the surface. | Potentially viable. |
| | | | Air stripping | Mixing of large volumes of air with water in a packed column or through diffused aeration to promote transfer of VOCs from liquid to air. | Potentially viable. |
| | | | Sedimentation | Suspended particles are settled out as a pretreatment or primary treatment step. | Potentially viable. |
| | | | Filtration | Used to filter out suspended particles. May be preceded be a coagulation and flocculation step to increase the effectiveness of sand filtration. | Potentially viable. |
| | Disposal | Offsite discharge | POTW | Extracted groundwater discharged to local POTW for further treatment. | Potentially viable. Requires extensive negotiations with POTW. |

See notes at end of table.

**Table 8-1 (Continued)**
**Preliminary Remedial Actions**

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Environmental Media | General Response Actions | Remedial Technologies | Process Options | Description | Evaluation Comments |
|---|---|---|---|---|---|
| Groundwater and Leachate (continued) | Disposal (continued) | Onsite discharge | Surface water discharge | Discharge of treated effluent to an adjacent surface water body. A Federal and State NPDES permit would likely be required. | Potentially viable. |
| Sediments | Removal | Excavation | Mechanical excavation | Use of mechanical excavation equipment to remove and load contaminated sediment for disposal. | Potentially viable. Potential for secondary migration of contaminants via surface water during excavation. |
| | Disposal | Offsite disposal or discharge | RCRA landfill | Transport of excavated sediment to an RCRA permitted landfill. | Potentially viable. Treatment may be based on land disposal restrictions. |
| | Treatment | Physical | Stabilization | Soil mixed with stabilizing reagents (e.g., lime or fly ash) that can stabilize contaminants. | Potentially viable for sediment contaminated with inorganics and low concentrations of organics. |
| | | | Thermal treatment | Contaminated sediment is thermally destroyed in a controlled oxygen-sufficient environment. | Potentially viable. Ash may require additional treatment for inorganics. |
| Landfill Gas (LFG) | Collection | Passive systems | Pipe vents | Atmospheric vents are used for venting LFG at points where it is collecting and building up pressure. Vents are often used in conjunction with flares. | Potentially viable. |
| | | | Trench vents | Constructed by excavating a deep narrow trench surrounding the waste site or spanning a section of the area perimeter. The trench is backfilled with gravel, forming a path of least resistance through which gases migrate upward to the atmosphere. Trenches are most successfully used where the depth of LFG migration is limited by groundwater or an impervious formation. | Potentially viable. |

See notes at end of table.

## Table 8-1 (Continued)
## Preliminary Remedial Actions

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Environmental Media | General Response Actions | Remedial Technologies | Process Options | Description | Evaluation Comments |
|---|---|---|---|---|---|
| Landfill Gas (LFG) (continued) | Collection (continued) | Active systems | Extraction wells | Applied vacuum extraction will serve to withdraw LFG in both the horizontal and vertical directions. Wells are connected by a collection header that leads to a blower and burner facility. Vacuum blowers serve to extract the LFG from the wells and push the collected gas through a free vent or waste gas burner. | Potentially viable. |
| | Treatment | Thermal destruction | Flaring | Enclosed ground flare systems consist of a refractory-lined flame enclosure. Waste is sometimes mixed with a supplemental fuel and fed through a vertical, open-ended pipe. Pilot burners next to the end of the pipe ignite the waste. | Potentially viable; however, could produce secondary air pollutants from the process. |
| | | | Catalytic oxidation | Organic compounds are destroyed by combustion, facilitated by catalyst media, thereby decreasing the operating temperature from traditional incineration. | Potentially viable. Not effective for treatment of VOCs. |
| | | Physical treatment | GAC adsorption | Passage of LFG through a bed of adsorbent so contaminants absorb to the GAC surface. | Potentially viable. |

Source: U.S. Environmental Protection Agency (USEPA), 1991.

Notes: RI/FS = Remedial Investigation and Feasibility Study.
RCRA = Resource Conservation and Recovery Act.
NCP = National Oil and Hazardous Substances Contingency Plan.
UV/oxidation = ultraviolet light and oxidation.
VOCs = volatile organic compounds.
POTW = publicly owned treatment works.
NPDES = National Pollution Discharge Elimination System.

in determining feasibility. A technology that has not been demonstrated or is not widely available may also be eliminated under this criterion.

Cost affects the practicality of certain technologies at a site. A technology can be eliminated on the basis of cost if it can be shown that the higher cost technology provides little or no advantage in effectiveness or implementability over another, lower cost technology. At this stage, costs will be presented on an order-of-magnitude, unit cost basis (e.g., per acre or per gallon).

**8.2 ALTERNATIVE DEVELOPMENT AND SCREENING**. The technologies remaining following technology screening will be assembled into remedial alternatives that address each response objective established for the site. In addition to the no action alternative (only for off-landfill exposure), which is required under CERCLA to establish a baseline for comparison of alternatives, a number of other alternatives may be developed that focus on containment of the landfilled material, and address other media of concern (e.g., groundwater migrating from the site or landfill gas emissions). For each alternative developed, a brief description of the components will be provided in the FS report.

Because of the nature of the site, few options may be available to adequately address the remedial action objectives. If few alternatives (i.e., less than six) are developed, it may not be necessary to conduct further screening to limit the number of alternatives to be evaluated. However, if the complexity of the site indicates that several options are potentially feasible, a second screening step may be required. The alternative screening would be conducted employing the same criteria used for technology screening, but would consider how the alternative components function together to meet the remedial action objectives.

**8.3 ALTERNATIVE EVALUATION**. Remedial alternatives will be evaluated in the FS report to provide information that will help decision-makers select an appropriate remedial action for the North Grinder Landfill. The evaluation process will consist of (1) a detailed description of the alternative components, sufficient to support a conceptual design and a cost estimate accurate to +50/-30 percent; (2) an evaluation of each alternative against seven of the USEPA's nine evaluation criteria (State and community acceptance will be addressed in the Proposed Plan and ROD); and (3) a comparison of the alternatives relative to one another, with respect to the evaluation criteria.

Where appropriate, the description of alternatives may present preliminary design calculations, process flow diagrams, sizing of key components, and preliminary layouts and cross sections. The description may also include a discussion of limitations, assumptions, and uncertainties associated with each alternative.

The seven criteria that will be used to evaluate each alternative are described below.

Overall protection of human health and the environment considers how risks identified in the conceptual site model are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Compliance with ARARs identifies how the alternative meets the Federal and State requirements regulating the chemical constituents, location of the site, and the type of action to be implemented.

Long-term effectiveness and permanence considers the integrity of the system or component over time, long-term management of waste, and magnitude of risk associated with waste remaining in place.

Reduction of toxicity, mobility, or volume through treatment does not apply to the containment or other non-treatment components, but applies to treatment components for hot spot, groundwater, leachate, sediment, or landfill gas. This criterion considers the amount of material destroyed or treated, and the degree of expected contaminant reduction. It also includes an evaluation of the irreversibility of the treatment technology.

Short-term effectiveness considers the impacts on the surrounding community during construction and operation of the alternative. It also evaluates the amount of time required to achieve the response objectives.

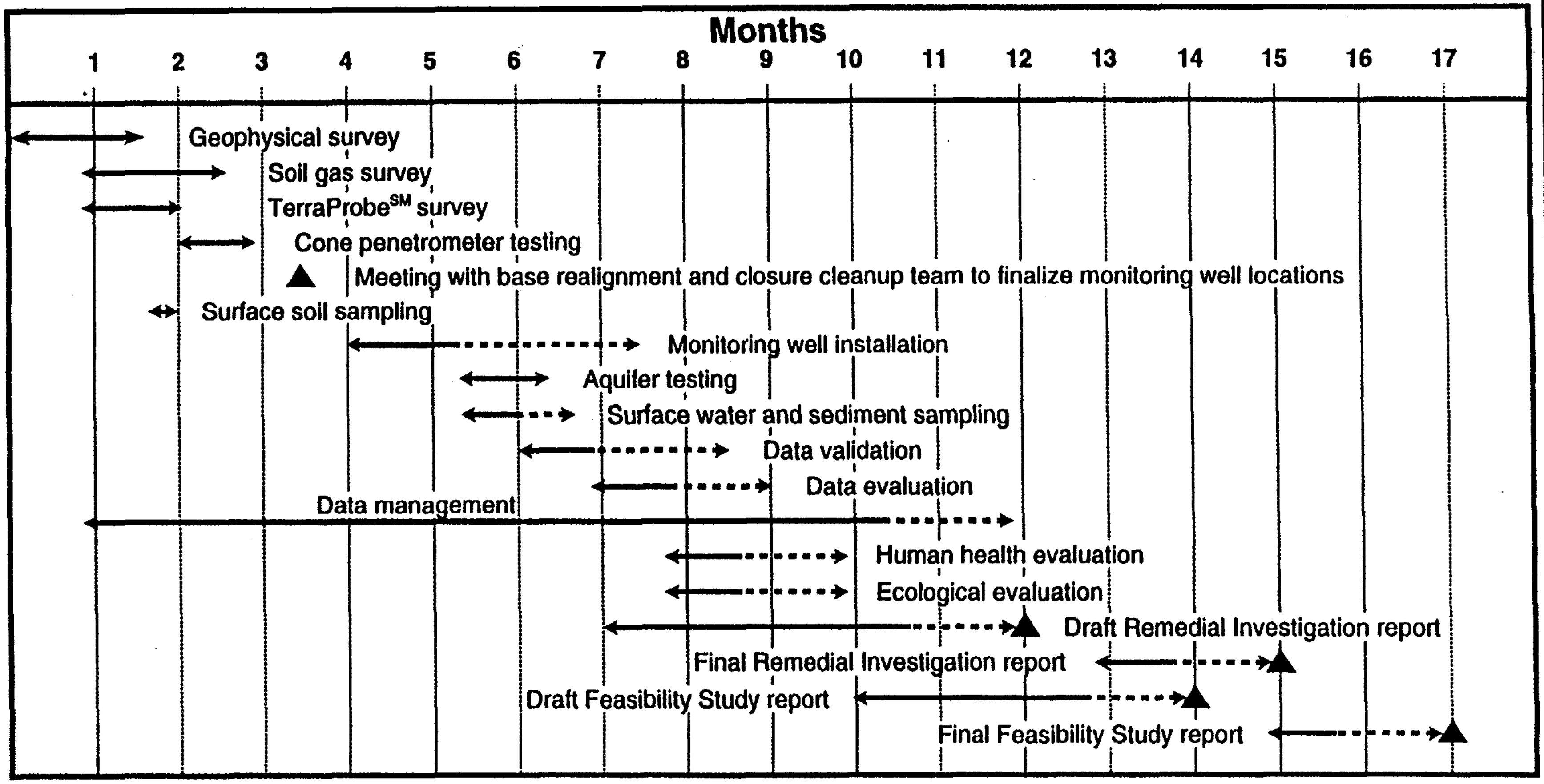
Implementability includes several factors, such as technical feasibility (i.e, the ability to construct and operate the alternative, the reliability of the technology, and the ability to monitor the effectiveness of the remedy), availability of materials and services, and administrative feasibility (i.e., the ease or difficulty of coordinating with or obtaining approvals from other agencies, and enforceability of deed restrictions).

Cost includes a line item cost estimate for construction and operation and maintenance costs, and a total present worth cost for the purpose of comparison with other alternatives. These cost estimates may be presented as a range of values with an accuracy of +50/-30 percent. The cost estimates will include a reasonable contingency factor to cover details and unforeseen circumstances. The estimates may be suitable for budgeting, but should not be considered the final construction cost estimates for the remedial action.

The comparative analysis of alternatives highlights the relative advantages and disadvantages of the alternatives for each of the seven evaluation criteria. This analysis will be presented as a written discussion for each alternative and will be summarized in tabular format for ease of comparison.

# 9.0 PROJECT SCHEDULE

The anticipated schedule for all tasks related to the OU 1 RI/FS Workplan is presented in Figure 9-1. The probable duration and potential duration of each task are treated in a manner consistent with the conceptual site model (Figure 2-7). The dashed lines represent uncertainty regarding the duration of certain field tasks due to variables during the field investigation that may be implemented such as, for example, multiple aquifer evaluations.




**Legend**

- ——— Probable Duration
- - - - - Potential Duration
- ▲ Milestone

**FIGURE 9-1**

**PROJECT SCHEDULE**

**RI/FS WORK PLAN, OPERABLE UNIT 1, NORTH GRINDER LANDFILL**

**NAVAL TRAINING CENTER ORLANDO, FLORIDA**

8519-08 941128WEM

REFERENCES


ABB Environmental Services, Inc., 1994a, Project Operations Plan for Site Investigations and Remedial Investigations, Naval Training Center, Orlando: Unit Identification Code N65928, Navy CLEAN District 1, Contract No. N62467-89-D-0317, March.

ABB Environmental Services, Inc., 1994b, Base Realignment and Closure (BRAC) Cleanup Plan, Naval Training Center, Orlando, Florida: October.

ABB Environmental Services, Inc., 1994c, Background Sampling Plan (draft), Naval Training Center, Orlando, Florida: October.

ABB Environmental Services, Inc., 1994d, Base Realignment and Closure Environmental Baseline Survey Report, Naval Training Center, Orlando, Florida: June.

Conover, W.J., 1980, Practical Nonparametrics Statistics: John Wiley and Sons.

Florida Game and Freshwater Fish Commission (FGFWFC), 1991, Official Lists of Endangered and Potentially Endangered Fauna and Flora in Florida: compiled by D.A. Wood, Endangered Species Coordinator.

Geraghty & Miller, 1986, Verification Study, Assessment of Potential Soil and Ground Water Contamination at Naval Training Center, Orlando, Florida: Prepared for Naval Facilities Engineering Command, Southern Division, Charleston, South Carolina, Contract No. N62467-85-C-0667.

Johnson, C.C., & Associates, 1985, Initial Assessment Study, Naval Training Center, Orlando, Florida: prepared for Navy Assessment and Control of Installation Pollutants Program, Naval Energy and Environmental Support Activity, Port Hueneme, California: September.

Lichtler, W.F., Anderson, Warren, and Joyner, B.F., 1968, Water Resources of Orange County, Florida: Florida Bureau of Geology Report of Investigation 50.

Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), 1985, Master Plan Update.

U.S. Air Force, 1962, Sewer Main System, (no drawing Number available).

U.S. Environmental Protection Agency, 1989a, Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part A), EPA/540/1-89/002, Interim Final, December.

U.S. Environmental Protection Agency, 1989b, Risk Assessment Guidance for Superfund, Volume 2: Environmental Evaluation Manual, EPA/540/1-89/002; December.

U.S. Environmental Protection Agency, 1990, Streamlining the RI/FS for CERCLA Municipal Landfill Sites: Directive No. 9355-11FS, September.

U.S. Environmental Protection Agency, 1991a, ECO Update bulletins, Volume 1: Number 1, September, 1991, Publication 9345.0-051.

U.S. Environmental Protection Agency, 1991b, ECO Update bulletins, Volume 1: Number 2, December, 1991, Publication 9345.0-051.

U.S. Environmental Protection Agency, 1991c, Baseline Risk Assessment Guidance Based on the National Contingency Plan and Directed to Federal Facilities: USEPA Region IV, Waste Management Division, Atlanta Georgia, April.

U.S. Environmental Protection Agency, 1991d, Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites: Office of Solid Waste and Emergency Response, OSWER Directive 9355.3-11, February.

U.S. Environmental Protection Agency, 1992a, Office of Emergency and Remedial Response, Superfund Accelerated Cleanup Model (SACM): PB92-963263, Publication 9203.1-01, March.

U.S. Environmental Protection Agency, 1992b, Guide to Management of Investigation-Derived Waste: Publication 9345.3-03FS, April.

U.S. Environmental Protection Agency, 1992c, ECO Update bulletins: Volume 1: Number 3, March, 1992, Publication 9345.0-051.

U.S. Environmental Protection Agency, 1992d, ECO Update bulletins: Volume 1: Number 4, May, 1992, Publication 9345.0-051.

U.S. Environmental Protection Agency, 1992e, ECO Update bulletins: Volume 1: Number 5, August, 1992, Publication 9345.0-051.

U.S. Environmental Protection Agency, 1992f, Framework for Ecological Risk Assessment: EPA/630/R-92/001, February.

U.S. Environmental Protection Agency, 1993a, Presumptive Remedy for CERCLA Municipal Landfill Sites: Directive No. 9355-0-49FS, September.

U.S. Environmental Protection Agency, 1993b, Presumptive Remedy for CERCLA Municipal Landfill Sites: Quick Reference Fact Sheet, Office of Solid Waste and Emergency Response, September.

U.S. Geological Survey, 1980, Orlando East, Florida: 7.5 minute topographic quadrangle, 1956, photorevised 1980.

# APPENDIX A

## SYNOPSIS OF POTENTIAL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

# Appendix A
## Synopsis of Potential Federal and State ARARs

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Federal Standards and Requirements | Requirements Synopsis | ARAR Type | Consideration in the Remedial Response Process |
|---|---|---|---|
| Atomic Energy Act (AEA), Protection of Individuals in Unrestricted Areas for Radiation Exposure [10 CFR Part 20.105] | Establishes radiation exposure limits for members of the public. | Action specific | This is potentially applicable for all categories of Nuclear Regulatory Commission (NRC) licensees. Also applicable to exposure for source, byproduct, and special nuclear material, as well as to naturally occurring and accelerator-produced radioactive material (NARM) released from facilities licensed to possess source, byproduct, and special nuclear material. |
| Atomic Energy Act (AEA), Discharge of Radionuclides to Unrestricted Areas (Air and Water) [10 CFR Part 20.106] | Establishes maximum concentration limits for radionuclide discharges to air and water. | Chemical specific | This is potentially relevant and appropriate for all categories of NRC licensees. Also applicable to exposure for source, byproduct, and special nuclear material, as well as to NARM released from facilities licensed to possess source, byproduct, and special nuclear material. |
| Atomic Energy Act (AEA), Protection of Individuals in Restricted Areas for Radiation Exposure [10 CFR Part 20.106] | Establishes radiation exposure limits for individuals in restricted areas. | Action specific | This regulation is applicable or relevant and appropriate for worker exposure during remedial activities. Exposure to source, byproduct, and special nuclear material, as well as to NARM released from facilities licensed to possess source, by product, and special nuclear material would be included. |
| CAA, National Ambient Air Quality Standards (NAAQS) [40 CFR Part 50] | Establishes primary (health based) and secondary (welfare based) air quality standards for carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur oxides emitted from a major source of air emissions. | Action specific | Site remediation activities must comply with NAAQS. The principal application of these standards is during remedial activities resulting in exposures through dust and vapors. In general, emissions from remedial activities are not expected to qualify as a major source, and are, therefore, not expected to be applicable requirements. However, the requirements may be determined to be relevant and appropriate for non-major sources with significantly similar emissions. |

See notes at end of table.

## Appendix A (Continued)
## Synopsis of Potential Federal and State ARARs

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Federal Standards and Requirements | Requirements Synopsis | ARAR Type | Consideration in the Remedial Response Process |
|---|---|---|---|
| Clean Water Act (CWA), Ambient Water Quality Criteria [40 CFR Part 131] | Federal Ambient Water Quality Criteria (AWQC) are non-enforceable, health-based criteria for surface water. AWQC provide levels of exposure from drinking the water and consuming aquatic life which are protective of public health. AWQC also provide acute and chronic concentrations for protection of freshwater and marine organisms. | Chemical specific | In the absence of any Florida Surface Water Quality Standard (FWQS) specific to the pollutant and water body of concern, AWQC may be ARARs for surface-water bodies when protection of aquatic life is a concern or if human exposure from consumption of contaminated fish is a concern. |
| CWA, National Pollutant Discharge Elimination System (NPDES) [40 CFR Parts 122 and 125] | Requires permits specifying the permissible concentration or level of contaminants in the effluent for the discharge of pollutants from any point source into waters of the United States. | Action specific | Off-site discharge from a site to surface waters may require that a NPDES permit be obtained and that both the substantive and administrative NPDES requirements be met. |
| CWA, National Pretreatment Standards [40 CFR Part 403] | Sets pretreatment standards through the National Categorical Standards or the General Pretreatment Regulations, for the introduction of pollutants from non-domestic sources into publicly owned treatment works (POTWs). In order to control pollutants which pass through, cause interference, or are otherwise incompatible with treatment processes at a POTW. | Action specific | If groundwater is discharged to a POTW, the discharge must meet local limits imposed by the POTW. A discharge from a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site must meet the POTW's pretreatment standards in the effluent to the POTW. Discharge to a POTW is considered an off-site activity and is therefore subject to both the substantive and administrative requirements of this rule. |
| CWA, Discharge of Radioactive Pollutants to Surface Waters [40 CFR Part 440] | Requires that the concentration of pollutants discharged in drainage from mines that produce uranium not exceed specified standards. | Chemical specific | This regulation should be used for guidance in the evaluation of radium and uranium in drainage and surface water runoff into surface waters. |
| CWA, Toxic Pollutant Effluent Standards [40 CFR Part 129] | This rule regulates the concentration of a toxic pollutant in navigable waters that shall not result in adverse impacts to aquatic life or to consumers of aquatic life. | Chemical specific | This rule is a potential ARAR for sites which may potentially discharge regulated pollutants to surface water. These standards may be incorporated into NPDES permits where applicable for off-site discharge of surface water. |

See notes at end of table.

## Appendix A (Continued)
## Synopsis of Potential Federal and State ARARs

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Federal Standards and Requirements | Requirements Synopsis | ARAR Type | Consideration in the Remedial Response Process |
|---|---|---|---|
| Fish and Wildlife Coordination Act [40 CFR Part 302] | Requires that the Fish and Wildlife Services (USFWS), National Marine Fisheries Service (NMFS), and other related State agencies be consulted when a Federal department or agency proposes or authorizes any control or structural modification of any stream or other water body. Also requires adequate provision for protection of fish and wildlife resources. | Location specific | Should a remedial alternative involve the alteration of a stream or other body of water, the USFWS, NMFS, and other related agencies must be consulted before that body of water is altered. |
| National Environmental Policy Act [40 CFR Part 6] | Requires an EIS or a "functional equivalent" for Federal actions which may impact the human environment. Also requires that Federal agencies minimize the degradation, loss, or destruction of wetlands, and preserve and enhance natural and beneficial values of wetlands and floodplains under Executive Orders 11990 and 11988. | Location specific<br>Action specific | A Federal action may be exempted from an EIS if a functionally equivalent study, such as an ecological risk assessment as performed under CERCLA, is completed. For remedies which may impact wetlands, the intent of NEPA (i.e., that degradation, loss, or destruction of wetlands should be minimized) is a potential ARAR. |
| Occupational Health and Safety Act (OSHA), General Industry Standards [29 CFR Part 1910] | Requires establishment of programs to assure worker health and safety at hazardous waste sites, including employee training requirements. | Action specific | Under 40 CFR 300.38, requirements apply to all response activities under the National Contingency Plan. |
| Occupational Health and Safety Act, Occupational Health and Safety Regulations [29 CFR Part 1910, Subpart Z] | Establishes permissible exposure limits for workplace exposure to a specific listing of chemicals. | Chemical specific | Standards applicable for worker exposure to OSHA hazardous chemicals during remediation activities. |
| Occupational Health and Safety Act (OSHA), Recordkeeping, Reporting, and Related Regulations [29 CFR Part 1904] | Provides recordkeeping and reporting requirements applicable to remediation activities. | Action specific | These requirements apply to all site contractors and subcontractors and must be followed during all site work. |
| Occupational Health and Safety Act (OSHA), Health and Safety Standards [29 CFR Part 1926] | Specifies the type of safety training, equipment, and procedures to be used during site investigation and remediation. | Action specific | All phases of the remedial response project should be executed in compliance with this regulation. |

See notes at end of table.

## Appendix A (Continued)
## Synopsis of Potential Federal and State ARARs

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Federal Standards and Requirements | Requirements Synopsis | ARAR Type | Consideration in the Remedial Response Process |
|---|---|---|---|
| Resource Conservation and Recovery Act (RCRA), Identification and Listing of Hazardous Waste [40 CFR Part 261] | Defines those solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265. | Action specific | These requirements define RCRA-regulated wastes, thereby delineating acceptable management approaches for listed and characteristically hazardous wastes which should be incorporated into the characterization and remediation elements of remedial response projects. |
| RCRA, Contingency Plan and Emergency Procedures [40 CFR Part 264, Subpart D] | Outlines requirements for emergency procedures to be used following explosions, fires, etc. | Action specific | These requirements are relevant and appropriate for remedial actions involving the management of hazardous waste. |
| RCRA, Closure and Post-Closure [40 CFR Part 264, Subpart G] | Details general requirements for closure and post-closure of hazardous waste facilities, including installation of a groundwater monitoring program. | Action specific | This requirement is a potential ARAR for remedial alternatives that involve the closure of a hazardous waste site. |
| RCRA, Use and Management of Containers [40 CFR Part 264, Subpart I] | Sets standards for the storage of containers of hazardous waste. | Action specific | This requirement would apply if a remedial alternative involves the storage of containers of RCRA hazardous waste. Additionally, the staging of study-generated RCRA-wastes should meet the intent of the regulation. |
| RCRA, Landfills [40 CFR Part 264, Subpart N] | Provides requirements for design, operation, monitoring, inspection, recordkeeping, closure, and permit requirements for RCRA regulated landfills. As part of a RCRA closure, a final cover must be designed and constructed that prevents migration of liquids, requires minimum maintenance, promotes drainage, minimizes erosion, accommodates settling, and has a permeability less than or equal to that of any bottom liner or natural subsoils present. | Action specific | These requirements should be considered during the development and implementation of remedial alternatives for landfills which contain hazardous waste. |
| RCRA, Land Disposal Restrictions [40 CFR Part 268] | Establishes restrictions on land disposal of untreated hazardous wastes, and provides treatment standards for hazardous wastes. | Action specific | Under the LDRs, treatment standards have been established for all listed wastes. If it is determined that hazardous wastes are considered subject to LDRs, the material must be handled and treated in compliance with these regulations. No excavation (as treatment), however, could apply to IDW disposal. |

See notes at end of table.

## Appendix A (Continued)
## Synopsis of Potential Federal and State ARARs

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
Orlando, Florida

| Federal Standards and Requirements | Requirements Synopsis | ARAR Type | Consideration in the Remedial Response Process |
|---|---|---|---|
| Safe Drinking Water Act (SDWA), Maximum Contaminant Level Goals (MCLGs) [40 CFR Part 141] | Establishes drinking water quality goals at levels of no known or anticipated adverse health effects with an adequate margin of safety. These criteria do not consider treatment feasibility or cost elements. | Chemical specific | MCLGs greater than zero are relevant and appropriate standards for ground or surface waters that are current or potential sources of drinking water. |
| Safe Water Drinking Act (SDWA), National Primary Drinking Water Standards, Maximum Contaminant Levels (MCLs) [40 CFR Part 141] | Establishes enforceable standards for specific contaminants which have been determined to adversely effect human health. These standards, MCLs, are protective of human health for individual chemicals and are developed using MCLGs, available treatment technologies, and cost data. | Chemical specific | MCLs established by the SDWA are relevant and appropriate standards where the MCLGs are not determined to be ARARs. MCLs apply to ground or surface waters that are current or potential drinking water sources. |
| SDWA, National Secondary Drinking Water Standards (SMLCs) [40 CFR Part 143] | Establishes welfare-based standards for public water systems for specific contaminants or water characteristics that may affect the aesthetic qualities of drinking water. | Chemical specific | SMCLs are non-enforceable limits intended as guidelines for use by States in regulating water supplies. |
| Solid Waste Disposal Act Regulations Criteria for Municipal Solid Waste Landfills (40 CFR Part 258). | Establishes minimum standards for municipal solid waste landfills | Action specific | Requirements of this regulation are implemented by the State of Florida under Chapter 62-701, Florida Administrative Code. Florida received full final determination to implement requirements in July 1994. |
| Uranium Mill Tailings Radiation Control Act (UMTRCA), Control of Uranium or Thorium Mill Tailings [40 CFR Part 192] | Establishes health and environmental protection standards for uranium and thorium mill tailings. | Chemical specific | May be relevant and appropriate for CERCLA sites that contain materials other than, but sufficiently similar to, uranium and thorium mill tailings (i.e., contaminated soil or any other waste containing more than 5 pCi/g). |

See notes at end of table.

## Appendix A (Continued)
## Synopsis of Potential Federal and State ARARs

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
Naval Training Center
*Orlando, Florida*

| State Citations[1] | Requirements Synopsis | ARAR Type | Consideration in the Remedial Response Process |
|---|---|---|---|
| Chapter 62-2, FAC Florida Air Pollution Rules - October 1992 | Establishes permitting requirements for owners or operators of any source which emits any air pollutant. This rules also establishes ambient air quality standards for sulfur dioxide, $PM_{10}$, carbon monoxide, and ozone. | Action specific | Where remedial action could result in release of regulated contaminants to the atmosphere, such as may occur during air stripping, this regulation would be a potential ARAR. |
| Chapter 62-4, FAC<br>Florida Rules on Permits - February 1994 | Establishes procedures for obtaining permits for sources of pollution. | Action specific | The substantive permitting requirements must be met during a CERCLA remediation. Both substantive and administrative requirements must be met for non-CERCLA activities. |
| Chapter 62-301, FAC<br>Florida Surface Water Standards - May 1990 | Provides criteria for determination of the line demarcating the landward extent of surface waters. | Location specific | This rule would be considered to differentiate soils from sediments during the determination of preliminary remediation goals. |
| Chapter 62-302, FAC<br>Florida Surface Water Standards - August 1994 | Defines classifications of surface waters, and establishes water quality standards (WQS) for surface water within the classifications. The State's antidegradation policy is also established in this rule. | Chemical specific<br>Location specific | Remedial actions which potentially impact surface waters of the State will consider surface water quality standards (WQS). WQC may also be relevant and appropriate ARARs for groundwater if no MCL exists, groundwater discharges to surface water and contaminants are affecting aquatic organisms, or other health-based standards are not available. |
| Chapter 62-520, FAC<br>Florida Water Quality Standards - April 1994 | Establishes the groundwater classification system for the State and provides qualitative minimum criteria for groundwater based on the classification. | Chemical specific<br>Location specific | Drinking water standards are established in Rule 62-550 for current or potential sources of potable water. The classification system established in this rule defines potable water sources (F-I, G-I and G-II waters). |

See notes at end of table.

## Appendix A (Continued)
## Synopsis of Potential Federal and State ARARs

RI/FS Workplan, Operable Unit 1
North Grinder Landfill
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| State Citations[1] | Requirements Synopsis | ARAR Type | Consideration in the Remedial Response Process |
|---|---|---|---|
| Chapter 62-522, FAC Groundwater Permitting and Monitoring Requirements - April 1994 | Establishes permitting and monitoring requirements for installations discharging to groundwater. | Action specific | This rule should be considered when discharge to groundwater is a possible remedial action. |
| Chapter 62-532, FAC Florida Water Well Permitting and Construction Requirements - March 1992 | Establishes the minimum standards for the location, construction, repair, and abandonment of water wells. Permitting requirements and procedures are established. | Action specific | The substantive requirements for permitting may be potential ARARs for remedial actions involving the construction, repair, or abandonment of monitoring, extraction, or injection wells. |
| Chapter 62-550, FAC Florida Drinking Water Standards - September 1994 | Established to implement the Federal Safe Drinking Water Act by adopting the national primary and secondary drinking water standards and by creating additional rules to fulfill State and Federal requirements. | Chemical specific<br>Location specific | MCLs are commonly considered applicable regulations for aquifers and related groundwater classified as a current or potential potable water supply source. MCLs should be considered ARARs during a cleanup of ground or surface waters that are current or potential sources of drinking water. |
| Chapter 62-650, FAC Florida Water Quality Based Effluent Limitations - November 1989 | States that all activities and discharges, except dredge and fill, must meet effluent limitations based on technology or water quality. | Chemical specific<br>Action specific | All activities and discharges, other than dredge and fill activities, are required to meet effluent limitations based on technology (technology based effluent limit (TBEL)) and/or water quality (water quality based effluent limit (WQBEL)), as defined in this rule. The substantive permitting requirement established in this rule may be potential relevant and appropriate ARARs for remedial actions where treated water is discharged to a surface water body. |

See notes at end of table.

# Appendix A (Continued)
## Synopsis of Potential Federal and State ARARs

RI/FS Workplan, Operable Unit 1
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| State Citations[1] | Requirements Synopsis | ARAR Type | Consideration in the Remedial Response Process |
|---|---|---|---|
| **Chapter 62-660, FAC**<br>**Florida Industrial Wastewater Facilities Regulations - May 1994** | Sets minimum treatment standards for effluent based on water quality considerations and technology. Also establishes general permit requirements for four specific operations. | Action specific | This rule may be a potential relevant and appropriate ARAR for remedial actions which involve discharge of treated water to surface waters of the State if surface water standards are either not available or are not sufficiently protective. |
| **Chapter 62-701, FAC**<br>**Florida Solid Waste Disposal Facilities Regulations - May 1994** | Implements the provisions of the Florida Resource Recovery and Management Act concerning the storage, collection, transportation, separation, processing, recycling, and disposal of solid waste. | Action specific | This rule may be a potential ARAR for remedial actions which involve closure of solid waste disposal facilities. Meeting regulatory requirements for closure should be considered during the RI/FS and remedial design of a solid waste site. |
| **Chapter 62-730, FAC**<br>**Florida Hazardous Waste Rules - October 1993** | Adopts by reference appropriate sections of 40 CFR and establishes minor additions to these regulations concerning the generation, storage, treatment, transportation, and disposal of hazardous wastes. | Action specific | The substantive permitting requirements for hazardous waste must be met where applicable for remedial actions. |
| **Chapter 62-736, FAC**<br>**Florida Rules on Hazardous Waste Warning Signs - July 1991** | Requires warning signs at NPL and Florida Department of Environmental Protection (FDEP) identified hazardous waste sites to inform the public of the presence of potentially harmful conditions. | Action specific | This requirement is applicable for sites which are on the NPL or which have been identified by the FDEP as potentially harmful. |
| **Chapter 62-775, FAC**<br>**Florida Soil Thermal Treatment Facilities Regulations - November 1992** | Establishes criteria for the thermal treatment of petroleum or petroleum product contaminated soils. The rule further outlines procedures for excavating, receiving, handling, and stockpiling contaminated soils prior to thermal treatment in both stationary and mobile facilities. | Chemical specific<br>Action specific | The soil cleanup values established in this rule for TRPH, VOH, metals, and BTEX may be potential relevant and appropriate ARARs for contaminated soils. This requirement does not apply to soils classified as hazardous. Procedures for excavating, receiving, handling, and stockpiling contaminated soils prior to thermal treatment are ARARs for remedial alternatives involving thermal treatment of soils. |

**See notes at end of table.**

## Appendix A (Continued)
## Synopsis of Potential Federal and State ARARs

RI/FS Workplan, Operable Unit 1
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| State Citations[1] | Requirements Synopsis | ARAR Type | Consideration in the Remedial Response Process |
|---|---|---|---|

[1] Date following the State Citation is either the date originally promulgated or the date of the most recent amendment.

Notes:
RI/FS = Remedial Investigation and Feasibility Study.
ARAR = applicable or relevant and appropriate requirements.
CWA = Clean Water Act.
EIS = Environmental Impact Statement.
LDRs = land disposal regulations.
IDW = investigation derived wastes.
MCLGs = maximum contaminant limit goal.
pCi/g = picoCuries per gram.
FAC = Florida Administrative Code.
VOH = volatile organic halocarbons.
TRPH = total recoverable petroleum hydrocarbons.
BTEX = benzene, toluene, ethylbenzene, and xylenes.