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NSWC INDIAN HEAD
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RESOURCE COSERVATION RECOVERY ACT FACILITY INVESTIGATION STUMP NECK
ANNEX NSWC INDIAN HEAD MD
6/26/1991
ENSAFE/ ALLEN AND HOSHALL



RCRA FACILITY INVESTIGATION

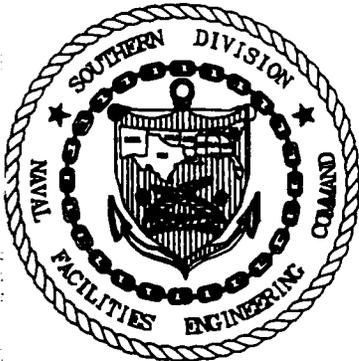
NAVAL EXPLOSIVE ORDNANCE
DISPOSAL TECHNOLOGY CENTER
INDIAN HEAD, MD

STUMP NECK ANNEX

CONTRACT N62467-89-D-0318
CTO - 004

SUBMITTED TO

CHESDIVNAVFACENGCOM



SUBMITTED BY

ENSAFE/ALLEN & HOSHALL

JUNE 26, 1991

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TASK

WEEK

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38

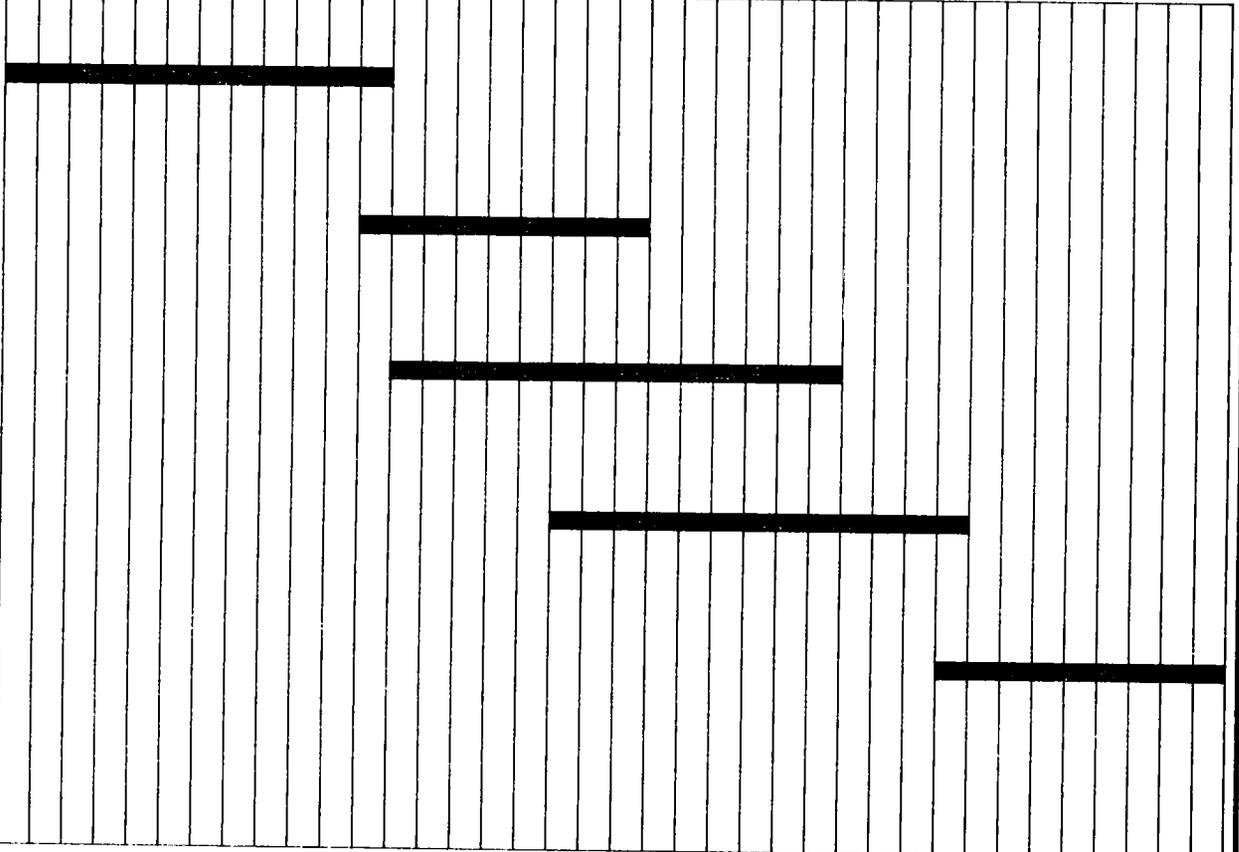
1) COORDINATE FIELD OPERATIONS

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3) LAB ANALYSIS-FIELD DATA

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5) INTERIM REPORT



RCRA FACILITY INV.
STUMP NECK ANNEX
INDIAND HEAD, MD.

RFI
SCHEDULE

DATE: 06/26/91

DWG NAME: CLNSTN2

**RCRA FACILITY INVESTIGATION PLAN
NEODTC
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND**

1.0 INTRODUCTION

The United States Environmental Protection Agency issued permit # MD 417-009-0001, effective January 24, 1991 through January 23, 2001, for Corrective Action and Waste Minimization under the authority of the Solid Waste Disposal Act (SWDA) as amended by the Resource Conservation and Recovery Act (RCRA) of 1976 and as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984, 42 U.S.C. §6901 *et seq.*, and EPA regulations at 40 CFR parts 260-271 and part 124, to the U.S. Navy for the Naval Explosive Ordnance Disposal Technology Center (NEODTC) facility located on Stump Neck Annex, Indian Head, Maryland.

The complete permit for purposes of Section 3005(c) of RCRA 42 U.S.C. §6925(c) consists of two portions: 1) the permit issued by the EPA, as described above; and 2) the permit issued by the Maryland Department of Environment (MDE) on April 14, 1988 in accordance with Provisions of the Code of Maryland Regulations, Title 26, Subtitle 13, for which the state has received authorization under Section 3006(b) of RCRA, 42 U.S.C. 6926(b), to enforce in lieu of the federal hazardous waste management waste program under RCRA.

Pursuant to this permit the EPA has ordered that the U.S. Department of the Navy conduct a RCRA Facility Investigation (RFI) at several sites of the NEODTC's Stump Neck

Annex Site, Indian Head, Maryland. The objectives of this investigation are: (A) to characterize the nature, extent, concentration and rate of migration of releases of hazardous waste or hazardous constituents from each SWMU into groundwater, surface water, soil, and sediments; (B) to identify potential receptors; (C) to provide detailed geologic and hydrogeologic characterization of the area surrounding and underlying each SWMU; (D) to determine the need for and scope of corrective measures; (E) to generate the information described in permit condition II.C.3 of permit # MD 417-009-0001.

The following is a Draft RCRA Facility Investigation Plan for the Naval Explosive Ordnance Disposal Technology Center (NEODTC), Stump Neck Annex, Indian Head, Maryland. The plan is submitted in accordance with the provisions of the Department of Navy Contract N6267-89-D-0318/0004. The investigation will encompass three sites: Range 3 - Burn Point; Chicamuxen Creek's Edge - Dump Site A; and Range 6. The investigation, designed to meet the above objectives, will be conducted in accordance with the RCRA Facility Investigation Plan submitted to the United States Environmental Protection Agency, Region III (EPA), and the State of Maryland Department of the Environment (MDE). The RFI will be conducted for NEODTC, Indian Head, Maryland by EnSafe/Allen & Hoshall.

2.0 SITE BACKGROUND INFORMATION

2.1 Location

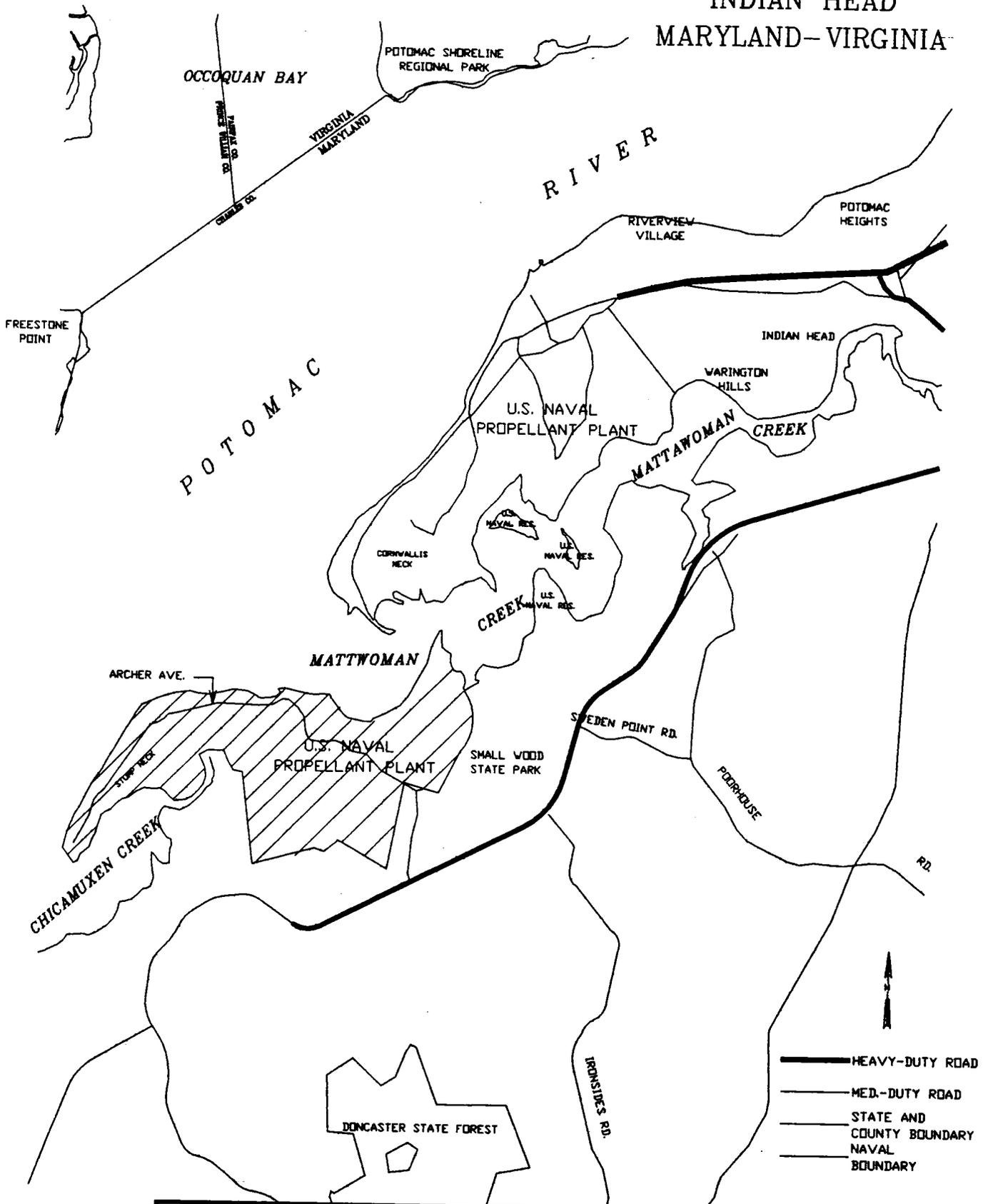
The Naval Ordnance Station (NOS) Indian Head is located on the Stump Neck Peninsula in the Northwestern section of Charles County, Maryland approximately 25 miles southwest of Washington, D.C. It is bounded by the Potomac River, Mattawoman Creek, Chicamuxen Creek, the town of Indian Head, and private property. The Potomac River, along with its tributaries, are considered an estuary. They are subject to tidal action and salt water intrusion from Chesapeake Bay.

Portions of the facility are located within the 100 year floodplain. Also, several SWMUs are located within the 100 year floodplain. The SWMUs being investigated are Range 3 Burn Point, (SWMU 2), Range 6 (SWMU 5), and Chicamuxen Creek's Edge - Site A (SWMU 3) (RFA Report 1989). The Site is located on the Indian Head Quadrangle, USGS Topographic Map, latitude 38° 33' 045" North, and longitude 77° 12' 003" West (figure 1). Figure 2 is a location map showing Stump Neck and the SWMUs.

2.2 Description

The NOS site is located on the Stump Neck peninsula consisting of 1,170 acres. The Naval Ordnance Station has 42 miles of railroad, most of which has been abandoned, and 109 miles of roadway. The NOS has its own water and sewage treatment plants, its own powerplant, and 29 miles of steam distribution lines. The principle facilities of NOS are located on the Indian Head peninsula and occupy 3,400 acres. Additional facilities, including the Naval School, Explosive Ordnance Disposal, are located on Stump Neck.

INDIAN HEAD MARYLAND-VIRGINIA

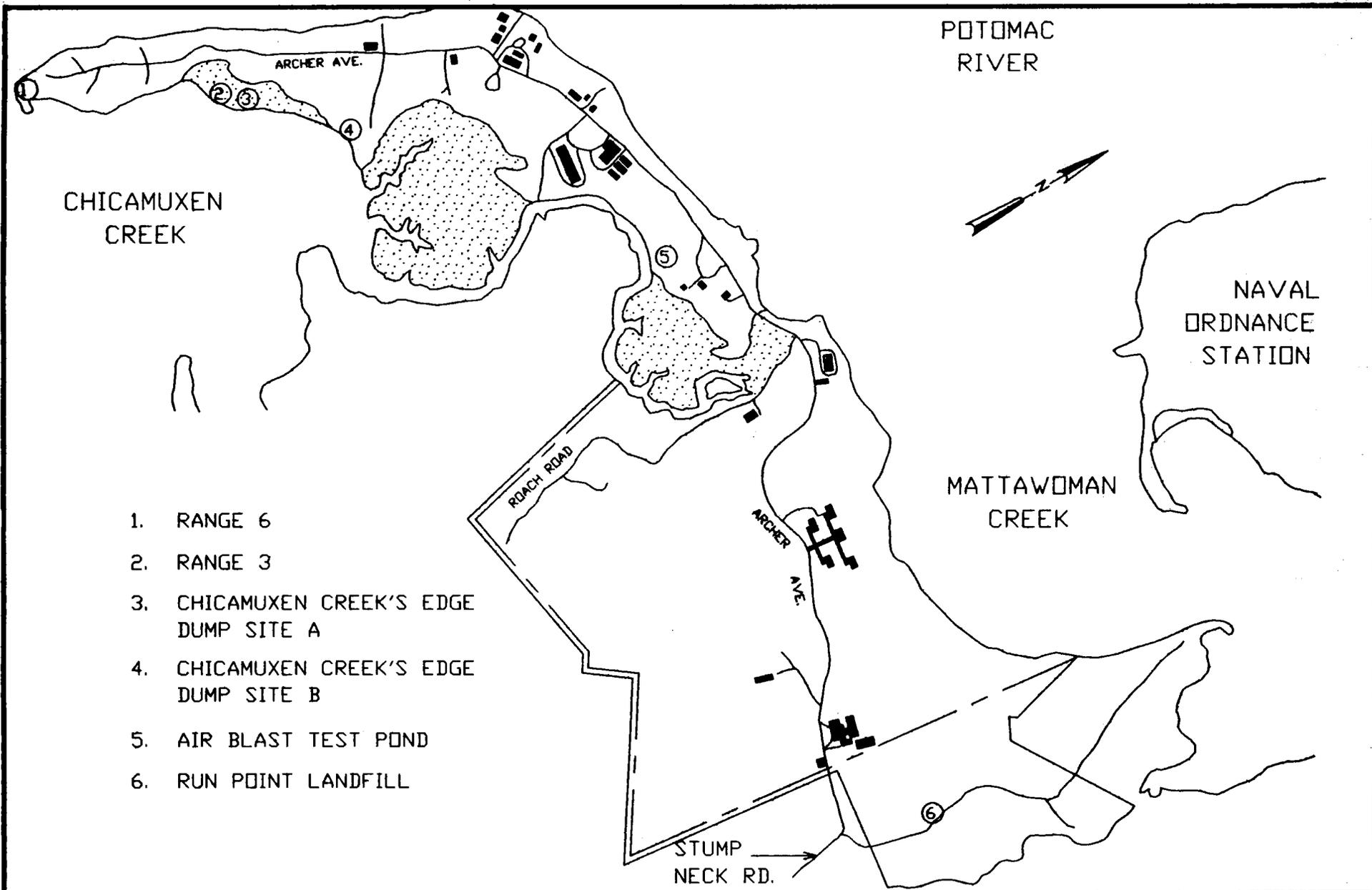


RCRA FACILITY INVESTIGATION
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

VICINITY
MAP
FIGURE 1

DATE: 6/24/91

DWG NAME: MDVICB



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RCRA FACILITY INVESTIGATION
 STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

STUMP NECK SITE MAP
 FIGURE 2

DATE: 6/24/91

DWG NAME: MDNEO2

Stump Neck is separated from Indian Head by Mattawoman Creek. It is bounded by the Chicamuxen Creek on the east and the Potomac on the west. Stump Neck has 4.2 miles of shore line. The shoreline of the Potomac is steep while the shorelines of the Chicamuxen and Mattawoman are buffered by swamps, wetlands, and floodplains. Both Indian Head and Stump Neck are at low elevations and contain many streams and drainage swales.

2.3 Topography

The Stump Neck peninsula has a flat to slightly rolling topography. Most of the land adjacent to Chicamuxen and Mattawoman are wetlands with slopes of 3 percent or less. The inland portion of the peninsula has slopes of 5 percent or more in many places.

Elevations at Stump Neck range from sea level to 143 feet. Elevations along the creeks boundaries are 30 feet or less. There are, however, a few 50 to 60 foot bluffs along the Mattawoman Creek between Stump Neck and Rum Point (RFA report 1989).

2.4 Geology

The geology at the NOS Indian Head site consists of 600 to 700 feet of unconsolidated fluvial and marine deposits overlying dense, hard, crystalline metamorphic and igneous basement rock. The deposits are mainly Cretaceous, Tertiary, and Quaternary age, while the bedrock is Precambrian or Cambrian age. The geologic time scale shown in Table 1 puts these ages in perspective.

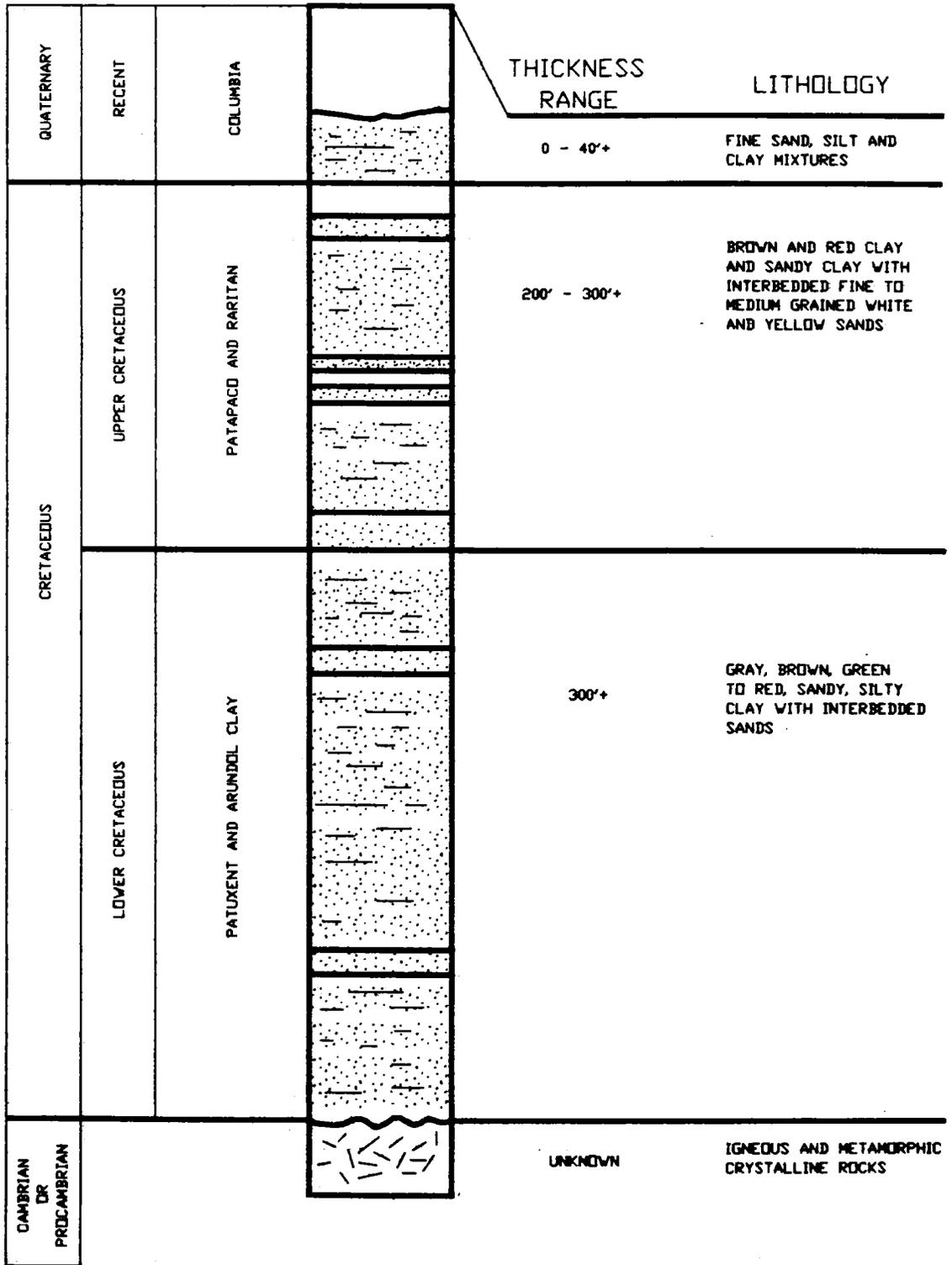
The major stratigraphic units in this area are the Patuxent and Arundel Clay Formations of Lower Cretaceous age, the Patapsco and Raritan Formations of Upper Cretaceous age, and the Columbia Formation of Quaternary age. These units outcrop beneath the Potomac River or to the west of the river in Virginia. The formations strike to the northeast and dip to the southeast at 25 feet per mile. Some figures have been included to aid in the understanding of the geology in this area. Figure 3 is a general lithologic column in the Indian Head area and figure 4 is a cross section of the sub-surface geology from the Virginia outcrop, through the Indian Head area, and into Charles County.

The Stump Neck geology is similar to the geology of the Indian Head peninsula. The exception is that the eastern most boundary of Stump Neck borders the subcrop of the Aquia Greensand, as seen in figure 5. The Aquia Greensand in this area will range in thickness from 0 to 20 feet.

The physical properties of the main formations in the Indian Head and Charles County area are described below. Refer back to figure 4 (Otton, 1955; Slaughter and Otton, 1968).

ERA	PERIOD	EPOCH	AGE RANGE		
Cenozoic	Quaternary	Holocene (Recent)	0-11,000 years		
		Pleistocene	11,000-2 million		
	Tertiary	Pliocene	2-5 million years		
		Miocene	5-25		
		Oligocene	25-35		
		Eocene	35-55		
		Paleocene	55-65		
		Mesozoic	Cretaceous	Upper	65-90
				Lower	90-140
			Jurassic	140-190	
Triassic	190-230				
Paleozoic	Permian		230-280		
	Pennsylvanian	280-320			
	Mississippian	320-350			
	Devonian	350-400			
	Silurian	400-430			
	Ordovician	430-500			
	Cambrian	500-600			
	Precambrian	Proterozoic	600+		
Archeozoic		from 4600?			

GEOLOGIC
AGE UNIT

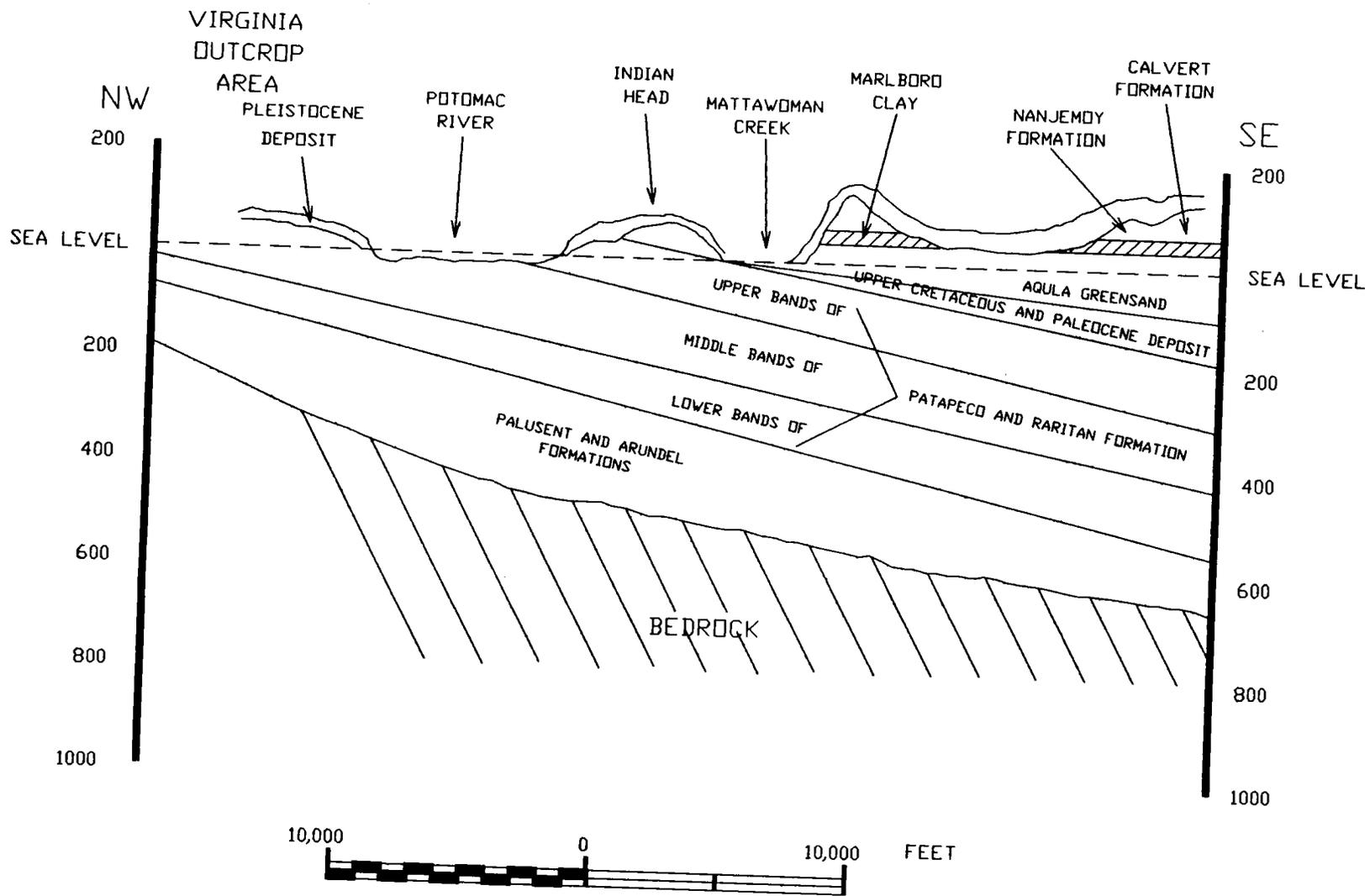


RCRA FACILITY INVESTIGATION
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

LITHOLOGIC COLUMN OF
STUMP NECK AREA
FIGURE 3

DATE: 6/24/91

DWG. NAME: MDH1A1B



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RCRA FACILITY INVESTIGATION
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

CROSS SECTION OF STUMP
NECK VICINITY
FIGURE 4

DATE: 6/24/91 | DWG NAME: MDIHA2B

MAP NUMBER	SYMBOL	SOIL SERIES NAME
1	Cu	Cut-and-Fill Land
2	Bo	Bibb Silt Loam
3	GvE	Gravelly Land, Steep
4	Au	Aura Gravelly Sandy Loam
5	B1	Beltsville Silt Loam
7	Kp	Keyport Silt Loam
9	Ek	Elkton Silt Loam
10	Tm	Tidal Marsh
11	Ms	Matawan Loamy Sand
15	Sh	Sassifias Sandy Loam
17	Ga	Galestorun Loamy Sand
18	Ot	Otbalto Silt Loam
19	Wo	Woodstown Sandy Loam
20	Ex	Exum Silt Loam
21	Mn	Matapeake Silt Loam
22	Mu	Mattapex Silt Loam



▲R BORING LOCATIONS
 (SEE TABLES 5.3-5 AND 5.3-6 FOR
 MORE INFORMATION ON BORINGS)

NOTE: SEE TABLE 5.3-2 FOR SOIL
 SERIES NAMES



RCRA FACILITY INVESTIGATION
 STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

SOIL MAP OF STUMP
 NECK ANNEX
 FIGURE 5

DATE: 6/24/91

DWG NAME: MD SOIL 2

2.4.1 Columbian Formation

The Columbian Formation is Quaternary age and consists of Pleistocene and recent deposits. In Charles County it ranges in thickness from 0 to greater than 60 feet. This formation does not exceed 40 feet in thickness at Indian Head (AWARE, Inc., 1982). These deposits are tan to orange in color and consist of irregularly bedded mixtures of fine sand, silt, and clay. The deposits are broken down into two groups; the lowland deposits, which range from 0 to 40 feet above sea level, and the upland deposits at elevations greater than 40 feet. The upland deposits usually contain coarser grained materials including gravel and cobble beds.

2.4.2 Aquia Greensand

The Tertiary aged Aquia Greensand consists of light to dark olive glauconitic sand interbedded with very fine sand, silt, and clay. The sands are salt and pepper in appearance. The Aquia Greensand averages between 80-150 feet thick in Charles County but, the formation is usually less than 20 feet thick in the eastern most portion of Stump Neck.

2.4.3 Patapsco and Raritan Formation

In Charles County the Upper Cretaceous age Patapsco and Raritan Formations are usually grouped together as one hydrogeologic unit because of the difficulty in separating the two based on lithology. The formation consists mostly of brown and red clay and sandy clay interbedded with yellow and white fine to medium grained sand. Most of the clay is tough and wax-like. Formation thickness ranges from 200 feet in the western part

of the county to 700 feet in the central part. The sands cannot be traced laterally for more than a few miles in this area. However, well logs for the county indicate the existence of a regular sequence of position and thickness of the sands. Because of this, the sands of the Patapsco and Raritan Formation are divided into the lower, middle, and upper sand units. This division is usually based on a hydrologic perspective. The dip of this formation is roughly 25 feet per mile to the southeast.

2.4.4 Patuxent and Arundel Clay Formations

The Patuxent and Arundel Clay Formations are of Lower Cretaceous age. In the Washington D.C. and the Baltimore areas a distinction can be made between the Patuxent and Arundel Clay Formations; however, no distinction can be made in the central and southern portions of the Southern Maryland geographic region. The entire sequence is considered the Patuxent Formation. The formation consists of sandy silty clays, interbedded with sand zones which often contain gravel. In the Indian Head area the formation consists of approximately 77 percent clay and related fine sediment. The rest is sand and coarser material. The color of the clay varies from gray, brown, light green and deep red. The top of the Patuxent has been arbitrarily placed at the bottom of the lowest sand unit of the Patapsco and Raritan Formation. The Patuxent overlies a crystalline bedrock with an irregular erosional surface. The formation is around 300 feet thick in the Indian Head area. The top of the unit lies approximately 250 to 300 feet below sea level. The Patuxent dips 30 to 50 feet per mile.

2.5 Soils

The facility is situated on three different soil associations. These associations are the Evesboro-Keyport-Elkton Association on the peninsula on the western part of the facility, the Bibb-Tidal Marsh-Swamp Association in the central portion of the facility, and the Beltsville-Exum-Wickham Association in the eastern portion with the exception of the northeastern section near Rum Point, which is Evesboro-Keyport-Elkton Association (figure 5) (RFA 1989).

2.5.1 Beltsville-Exum-Wickham Association

Beltsville-Exum-Wickham Association Soils are typically moderately sloping and situated on elevated areas moderately dissected by major rivers and streams. Beltsville soils are highly erodible on moderate slopes. They are very silty with dense fraginans that retard the downward movement of water.

2.5.2 Evesboro-Keyport-Elkton Association

Evesboro-Keyport-Elkton Association soils are level to moderately sloping soils ranging from sandy, excessively drained soils to loamy, poorly drained soils, with underlying clayey subsoils. Elkton soils are nearly level, poorly drained soils with clay or silty clay subsoils while Keyport soils are moderately well drained with clay or silty clay subsoils. Range 3 Burn Point, Chicamuxen Creek's Edge Dump Site A and Range 6 are situated upon Keyport silt loams, with two to five percent slopes that are moderately eroded (RFA 1989). It should be noted that Range 3 Burn Point and Chicamuxen Creek's Edge Dump Site A have undergone cut and fill operations.

(RFA 1989). It should be noted that Range 3 Burn Point and Chicamuxen Creek's Edge Dump Site A have undergone cut and fill operations.

2.5.3 Bibb-Tidal Marsh-Swamp Association

Bibb-Tidal Marsh-Swamp Association soils are miscellaneous unclassified wetlands and poorly drained soils on flood plains. This soil association is locate in areas along major flood plains. Tidal Marsh soils are wet and unstable soils. They are subject to flooding by brackish or saline water. Range 3 Burn Site and Chicamuxen Dump Site A are bounded by Tidal Marsh soils. Range 6 is bound by Tidal Marsh soils and Cut and Fill. Charles County Survey defines Cut and Fill as any area that has been excavated or filled (RFA 1989)

2.6 Climate

The NOS experiences a continental type of climate with well defined seasons, but the Chesapeake Bay and Potomac River have a modifying effect on the temperature.

The climate is typical of the temperate belt in the Eastern U.S.; warm summers and wet cold winters. The average summer high is 89°F and the average winter low is 21°F.

The precipitation is rather evenly distributed throughout the year. Mean annual precipitation for Charles County is 47 inches. The mean annual frozen precipitation is 19 inches.

Wind speeds for this area average 9 miles per hour. Prevailing winds are from the northwest but, become more southerly in the summer months.

3.0 SOLID WASTE MANAGEMENT UNITS (SWMU)

Previous investigations have identified three (3) sites that require testing. The following section will provide a description of these sites (figure 2).

3.1 Range 3 Burn Point (SWMU 2)

The Range 3 Burn Point occupies approximately 2 acres of relatively flat, bare soil on the bank of Chicamuxen Creek (Figure 6). The unit is surrounded on three sides by a man-made rip-rap berm. The Range 3 Burn Site is a RCRA regulated unit used to burn or thermally treat explosive wastes generated at the facility. The explosive waste, explosive-contaminated materials, and spent carbon thermally treated at this unit are burned either on bare soil using diesel and an ignition source or in a Thermal Treatment Tank (SWMU 16) which rests on bare soil approximately 30 feet from the Creek's edge. This area also contains a metal container used in the testing of small blasting caps (squibs). During the VSI, burned scraps were observed in the container and charred debris was observed on the soil in the immediate vicinity of the Thermal Treatment Tank. A faint solvent or paint odor was detected close to the Creek, approximately fifteen feet from the Thermal Treatment tank. This unit is located within the 100 year flood plain.

Past operations included open burning of explosive wastes on bare soil. Release to air which occurs during each burning is regulated under Charles County Air Permit CH71GAP005.

3.2 Chicamuxen Creek's Edge Dump Site A (SWMU 3)

This unit is located directly under the Range 3 Burn Point (Figure 6). It is approximately 2 acres and covered with bare soil. It is surrounded on three sides by a rip-rap berm covered with a wire mesh. Dump Site A is located adjacent to Chicamuxen Creek within the 100 year floodplain. Facility representatives were unclear as to what was dumped in the unit. However, they did indicate that this area and Range 3 Burn Point are man-made fill areas.

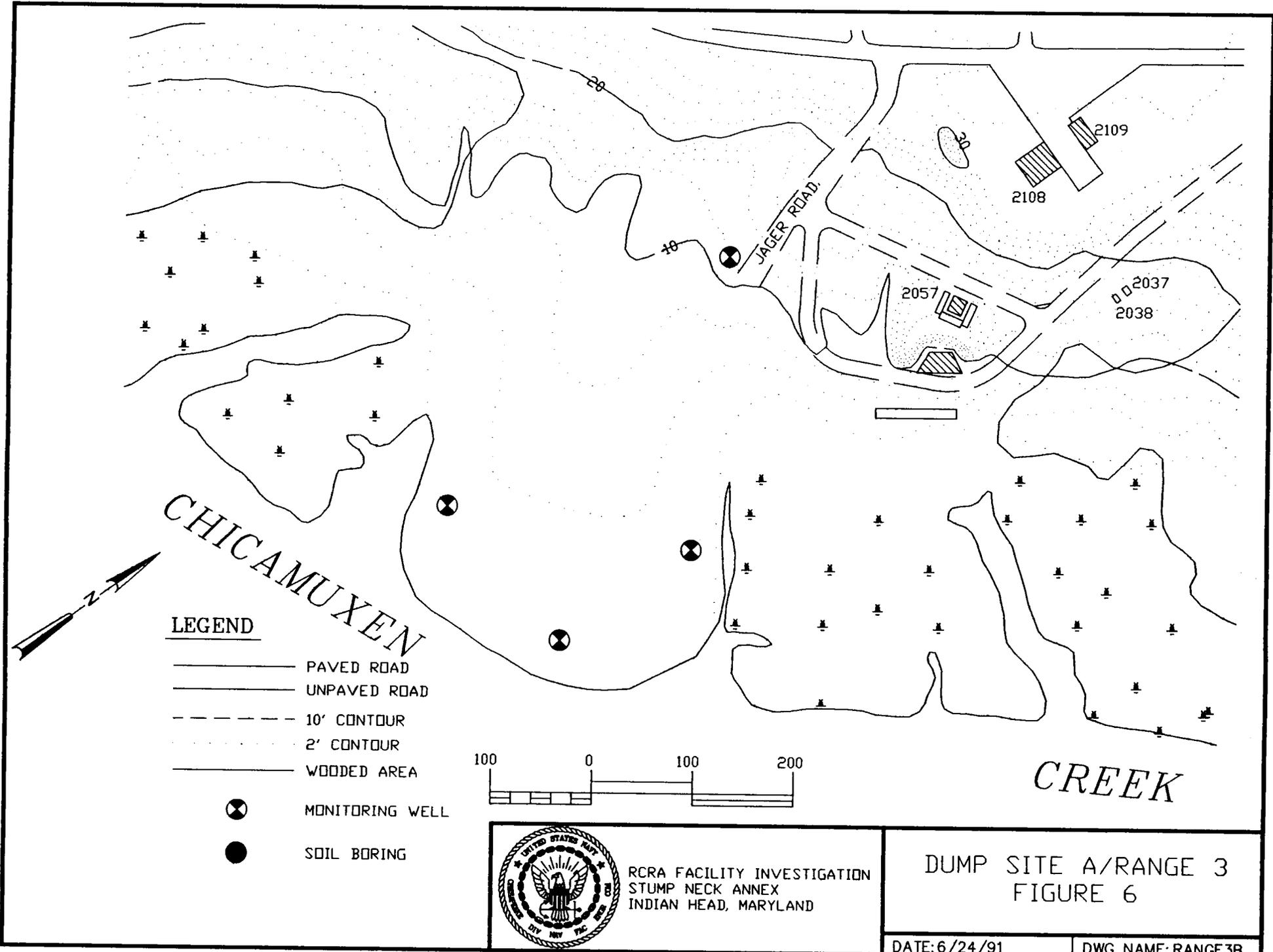
The type of waste in this dump is unknown. There is no history of release noted in the file material and no evidence of release was observed during the VSI. However hazardous materials may have been handled in contact with bare soil.

3.3 Range 6 (SWMU 5)

Range 6 is located at the end of Archer Avenue (Figure 7), on a point of land extending into the Potomac River and Chicamuxen Creek within the 100 year floodplain. This unit consists of five ranges used for open detonation training. Explosive charges of less than two or three pounds are used. During the VSI, the unit consisted of bare soil and was sparsely covered with a low briar ground cover. This unit is divided by an asphalt road that runs near the Potomac. This unit is currently used on a weekly basis but, will soon be phased out since the EOD school is relocating to Florida.

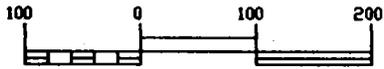
The waste on this site consists of small quantities of shrapnel and casings from detonated explosives. There was no evidence of release in the file material and no release was observed during the VSI.

18.1

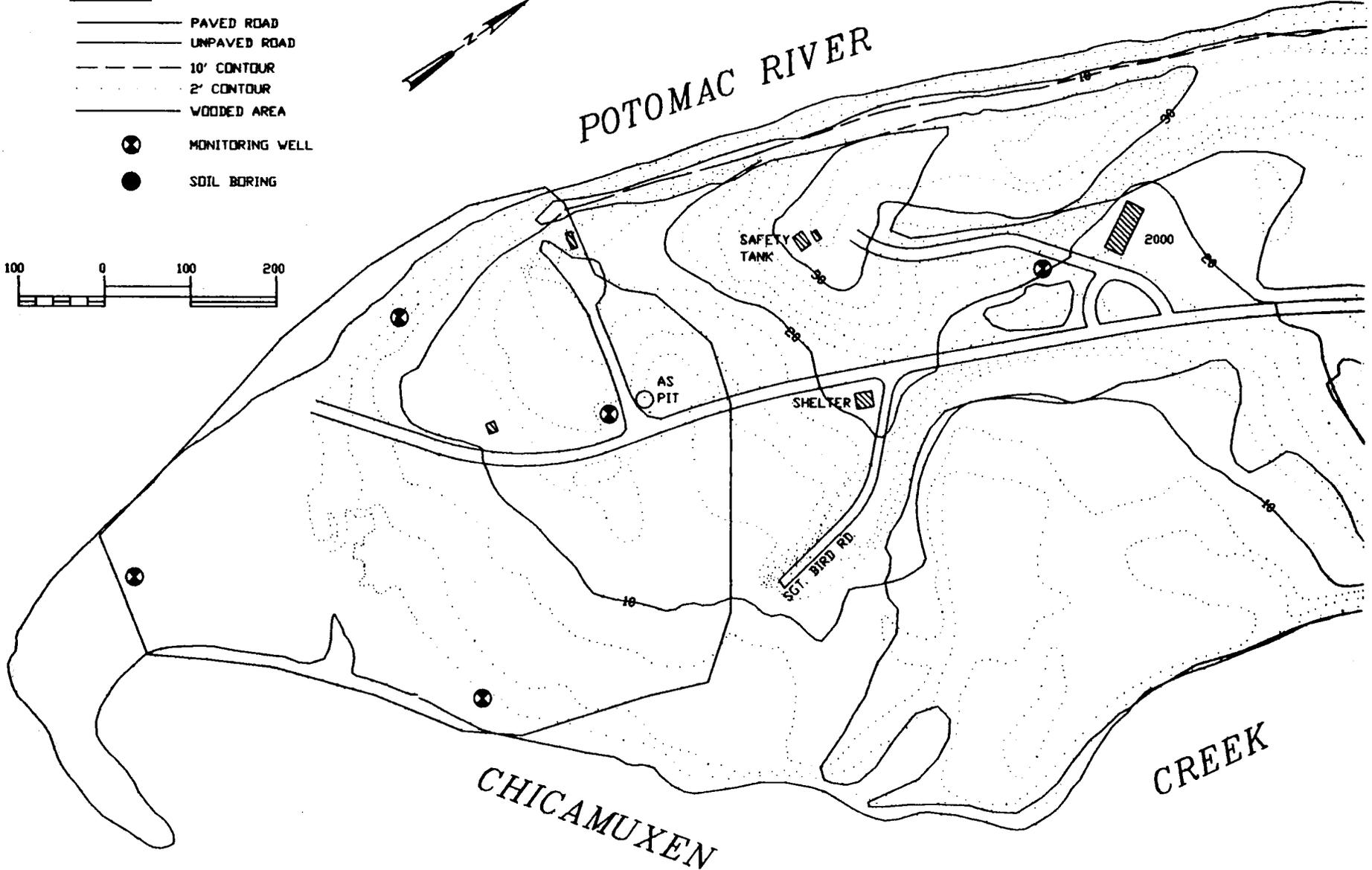


LEGEND

- PAVED ROAD
- UNPAVED ROAD
- - - 10' CONTOUR
- · · 2' CONTOUR
- WOODED AREA
- ⊗ MONITORING WELL
- SOIL BORING



POTOMAC RIVER



18.2



RCRA FACILITY INVESTIGATION
STUMP NECK ANNEX
INDIAN HEAD, MARYLAND

FIGURE 7
RANGE 6

DATE: 6/24/91

DWG NAME: RANGE6B

4.0 SAMPLING AND ANALYSIS PLAN

The following section lists and describes the various aspects of sampling and analysis for the RFI. The Sampling and Analysis Plan was prepared for the Range 3 Burn Point Site, the Chicamuxen Creek's Edge - Dump Site A, and Range 6. The Field Sampling Plan (FSP) discusses sampling locations and sampling procedures.

All soil and water samples from Chicamuxen Creek's Edge - Dump Site A, Range 6, and Range 3 Burn Point will be analyzed for the following constituents:

- 1) 40 CFR 264 Appendix IX metals;
- 2) Volatiles and Semi-Volatiles;
- 3) Trinitrotoluene (TNT);
- 4) Cyclotrimethylenetrinitramine (RDX);
- 5) Cyclotetramethylenetetranitromine (HMX);
- 6) Total Organic Carbon (TOC);
- 7) Total Organic Halogen (TOH);and,
- 8) Ph

4.1 Field Sampling Plan (FSP)

Each of the aforementioned sites identified in Section 3 will be investigated under the RFI to determine the nature and extent of contamination, if present, and assess subsequent routes of migration. A series of shallow soil borings, to be completed as monitoring wells, will be installed at each location. Due to the close physical relationship of Range 3 and Dump Site A, these Solid Waste Management Units

(SWMUs) will be investigated as one. Additional surface soil samples will be collected at each location by means of hand augering techniques.

4.1.1 Soil Borings/Monitoring Wells

4.1.1.1 Types Of Drilling

One of three types of drilling methods will be used depending on the type of soil. These methods may vary with each site. All drilling equipment will be cleaned by the methods outlined in section 4.8.

Hollow Stem Auger

A hollow stem auger is best suited for stable sand, clay, and silt. The hollow stem prevents the bore hole from collapsing before the well casing can be installed.

Samples will be collected during the boring with a 24 inch split spoon sampler. Drilling will be stopped at 5 foot intervals, the sampler will be attached to the drill rod and sampling will begin. The sampling method is described in section 4.1.3.

Mud Rotary Drilling

Mud rotary drilling is well suited for unsaturated or saturated, unstable sand and gravel. The hole is advanced by means of a 12 bit roller, drag, fish tail, or tri-cone bit attached

to a hollow drill rod. The mud, consisting of a potable water and sodium bentonite slurry, is pumped through the drill bit, forcing the cuttings up through the annular space of the bore hole. The head pressure of the slurry prevents the hole from collapsing. The integrity of the hole is also improved as the mud cakes on the walls. At the prescribed depth, the drill bit is removed and the split spoon sampler is attached and sampling, as described in section 4.1.3, will begin. Drilling will continue once the sample is collected and the split spoon sampler is removed.

Casing Rotary

Casing rotary may be used if unconsolidated rip-rap, and or fill rocks are encountered. The hole is advanced through the fill by using a cutting shoe and tri-cone rotary bit attached to a hollow steel casing. The appropriate diameter of the cutting shoe, tri-cone rotary bit and the hollow stem augers will chosen at the site. As the casing rotates the bit cuts through the fill material. Potable water is poured down the hole during the drilling process to provide lubrication. Once the soil below the fill is reached, the tri-cone bit is removed, the casing is left in place, and drilling is continued with a hollow stem auger or by mud rotary drilling. Samples will be collected at the prescribed depths with a split spoon sampler. The sampling method is described in section 4.1.3.

4.1.2 Hand Auger Sampling

A stainless steel hand auger will be used to collect samples at shallow depths. The samples will be collected in the auger bucket and transferred to a sample jar using the same sampling methods described in section 4.1.3 and the same decontamination procedures described in section 4.4. Each hole will be backfilled. Soil borings will be collected only at points where explosions are visibly evident.

4.1.3 Soil Sampling

Soil samples will be collected from each of the proposed boring and well locations. The samples will be collected with a split-spoon sampler. The samples will then be split into representative samples in accordance with the EPA SOP/QA Manual to minimize the possibility of volatilization.

The split spoon sampler will be lowered through the annulus of the auger and samples will be collected by repeatedly dropping a 140 pound hammer 30 inches onto the drill rod to drive the sampler, or by hydraulically pressing the sampler 24 inches into the ground. The split spoon sampler will then be pulled from the bore hole and removed from the drill rod. After the sampler is removed, drilling will continue until the next

sampling interval. A sample will be collected from the core retrieved by the split spoon. The soil will be packed into the VOA's with zero headspace to prevent volatilization. The VOA's will be packed in an ice chest and shipped overnight to the lab for analysis.

The following precautions will be taken for all samples collected in order to prevent cross contamination:

- 1) A clean pair of latex or rubber surgical gloves will be worn each time an individual sample is collected.
- 2) A field sampling team will consist of at least two people. One person will collect the sample while the other person keeps complete notes on all sampling procedures and day to day activities.
- 3) All disposable sampling equipment will be containerized in 55 gallon steel drums and disposed of properly at the end of the investigation. Section 4.4 provides a more detailed description of this procedure.

4.1.4 Groundwater Monitoring Well Installation

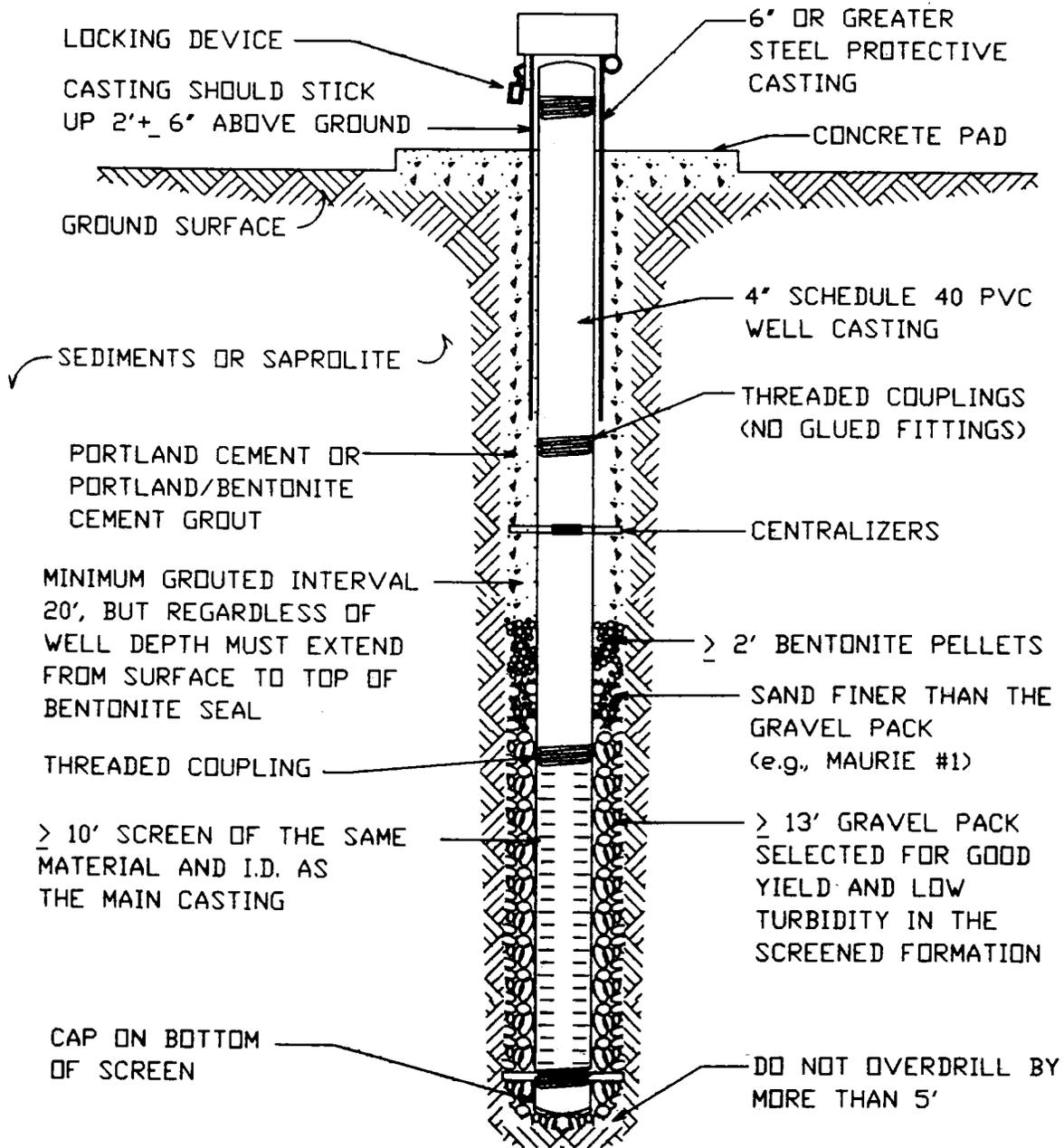
All groundwater monitoring wells will be designed and installed according to the State of Maryland Department of the Environment regulations (Figures 8 and 9). The following is a list of construction procedures:

- 1) A 10 foot section of pre-constructed, commercially manufactured 0.010 inch mesh well casing screen with an inner-diameter of at least 4 inches will be attached to the riser pipe and lowered to the bottom of the bore hole. A minimum of three centralizers will be attached to the well casing, one near the bottom of the screen, one near the center of the casing, and one near the ground surface. There will be approximately 2 feet of casing exposed above the ground surface.

- 2) A gravel pack, consisting of screened sand specifically manufactured for this purpose, will be poured around the screened section of the well starting at the bottom, working toward the surface. This sand will be emplaced with a 1.5 inch diameter PVC tremie pipe. The gravel pack will be a minimum of 13 feet thick.

STATE OF MARYLAND
 DEPARTMENT OF THE ENVIRONMENT
 HAZARDOUS AND SOLID WASTE MANAGEMENT ADMINISTRATION

TYPICAL ILLUSTRATION OF MINIMUM SPECIFICATIONS
 FOR MONITORING WELL CONSTRUCTION



">" MEANS "GREATER THAN OR EQUAL TO"
 WELL REGULATIONS, MINIMUM SPECIFICATIONS, AND SPECIFIC INSTRUCTIONS BY HSWMA SUPERCEDE THESE GENERAL REQUIREMENTS.



RCRA FACILITY INVESTIGATION
 STUMP NECK ANNEX
 INDIAN HEAD, MARYLAND

MONITORING WELL DESIGN
 FIGURE 8

DATE: 6/24/91

DWG NAME: MWELL08

Next, a layer of sand, finer than the gravel pack will be tremmied down the bore hole. A 2 foot layer of 0.25-0.50 inch diameter bentonite pellets will then be added and hydrated with deionized water. The bentonite pellets will be allowed to hydrate for a minimum of 8 hours. The remaining portion of the bore hole will then be pressure grouted with Type I Portland Cement. The mixture ratio will be 8 gallons of water to one 94 pound bag of cement with 4-5% bentonite by weight.

- 3) A concrete pad will then be constructed around the exposed well casing. The pad will be a minimum of 18 inches by 18 inches. The pad will have a steel protective casing surrounding the well casing. This protective casing will be at least 6 inches in diameter and will have a locking cap.
- 4) The diameter of the boring will be exceed the diameter of the casing by at least 4 inches to allow for a 2 inch minimum filter pack around the screen.

Prior to implementation of field activities, an Explosive Ordnance Disposal (EOD) survey will be conducted to determine if there are any unexploded ordnance buried beneath the drilling site.

The man-made fill areas and the rip-rap berms that exist in some of the sites may impede drilling activities. If these berms or fill areas are encountered, the final location of the well may have to be modified.

4.1.5 Well Development

Before any samples can be collected, the well must first be developed. Bailing, surge block, or pumping/overpumping/backwash will be used to develop the wells.

Bailing

The bailer is allowed to fall to the bottom of the well until it strikes the surface of the water. This forces the water in the well back into the formation, breaking up bridging that has formed in the formation. Once the bailer has filled with water, it is rapidly withdrawn. The drawdown created by the removal of the water filled bailer causes water to flow back into the well. This washes any particulate matter in the filter pack and surrounding formation into the well. This particulate matter will be removed as suspended sediment in the water as bailing continues. Bailing will continue in this manner until the water is free of suspended particulate matter.

Surge Block

The surge block will be operated as a part of the drill rod or on the end of a 1 inch diameter PVC riser pipe. It will be heavy enough to free-fall through the water standing in the bottom of the well. This fall through the water causes an outward surge that breaks up any bridging. The surge block has a bypass valve that allows the water to slowly flow through the block. Once the water has flowed through, the surge block is rapidly withdrawn. This withdrawal creates a vacuum which draws water and sediment into the well. After this process is repeated several times, the water and suspended particulate matter is bailed or pumped from the well. This will continue until the water is clear.

Pumping/Overpumping/Backwashing

Pumping causes water to flow from the formation to the well. This water washes any particulates from the formation and filter pack into the well. These particulates are then carried out by the pump.

When overpumping, the water is drawn out of the well faster than the well can be recharged. This increases the velocity of the water flowing into the well. The higher velocity washes more particulate matter into the well to be removed by the pump.

When there is no backflow prevention valve installed, the pump is turned on and off repeatedly. When turned on, the pump draws water up into the pipe, when turned off, the water flows down the pipe and into the well causing a surge which forces water back into the formation. This breaks up any bridging and washes the particulate matter into the well where it is removed by the pump.

4.1.6 Soil Gas Survey

A soil gas survey will be conducted at each of the sites to aid in determining the nature and extent of the contamination, if any. A series of soil gas borings will be completed to a maximum depth of 10 feet to meet these objectives. This soil gas survey will assist in the decision for the location of the proposed monitoring wells.

The technique used to collect these samples will utilize soil borings drilled with solid flight augers. The auger will be advanced to a depth of 4 feet and removed allowing the vapor detection measurements with a photo ionization detector (PID) that is lowered

down the hole. Once the sample has been collected and the PID removed, boring will resume for another 5 feet where the next sample will be collected. The boring will be terminated if groundwater is reached before the 10 foot depth.

4.1.7 Groundwater Sampling

Groundwater sampling will begin after the installation and development and purging of the proposed monitoring wells. Clean plastic will be spread over the ground during purging and sampling. Water samples will be collected to identify contaminant, identify the migration pathways and to delineate the contaminant plume.

The groundwater level will be measured and recorded prior to each sampling. A precleaned electronic water level indicator will be used. These measurements will be converted to elevations relative to mean sea level (msl) and used to construct a potentiometric surface map. The height of the water standing in the well will also be measured and recorded. This will be used for the calculation of the volume of water in the well. All wells will be purged prior to each sampling of standing water within the well casing. The evacuation of three well casing volumes, with a teflonTM bailer or a nitrogen filled bladder pump, will be sufficient to ensure a representative sample of groundwater. Volatiles will be measured with a PID which will be lowered down the

hole. The pH, temperature, and conductivity of the water will be measured prior to sampling.

Groundwater samples will be collected from each monitoring well by a bailer or by bladder pumps. The samples will be collected in pre-cleaned 40 ml septum vials (VOAs) and 1000 ml glass jars, both equipped with TeflonTM lined lids. The samples will be preserved at 4 C° centigrade.

4.2 Sample Identification

All samples will be identified and fully documented in the field records, on the chain-of-custody records, and on the sample labels and sample tags. Any samples that are thought to be potentially hazardous (i.e. corrosive, flammable, etc.) will be identified as such in the field records, on the chain-of-custody records, and on the sample tags.

4.3 Chain of Custody

A strict chain-of-custody procedure will be followed to assure that the samples are maintained in a safe and reliable manner. This will be implemented in the field and carried out during the entire sampling process. An example of the chain-of-custody form is illustrated in figure 5.8.1-1.

4.4 Sampling Decontamination Procedures

To prevent cross-contamination during well boring and sampling, all equipment (sampling, drilling, mobilization, etc.) that is used during the investigation will be decontaminated in accordance with Attachment A of USEPA permit number MD 417-009-0001. All decontamination procedures will take place in a contained area which will be constructed before the investigation begins. All waste water collected in the containment basin will be pumped into 55 gallon steel drums and maintained on site for proper disposal with other wastes from the investigation.

All sampling spoils will also be containerized in 55 gallon steel drums and maintained on site for proper disposal. These wastes include auger spoils from drilling, and all disposable sampling equipment, etc. All wastes will be properly disposed of following

the investigation in accordance with all applicable federal and state provisions and regulations.

Sampling equipment such as the split spoon sampler, hollow stem augers, and any other reusable equipment that may be utilized during the sampling events will be decontaminated between bore holes as follows:

- (1) The equipment will be rinsed with hot, high pressure potable water and washed with Alquinox and hot potable water using a brush to remove particulate matter or surface films.
- (2) The equipment will be rinsed with 10% isopropanol rinse.
- (3) The equipment will be rinsed with deionized water.
- (4) The equipment will be wrapped with aluminum foil, or covered with plastic for transport to activities.

Each rinsing solution will be kept in a plastic bucket designated specifically for that solution. When each solution is changed, each waste material will be poured into a 55 gallon steel drum marked specifically for that waste. When each drum has been filled, a sample will be collected and sent to a NEESA approved Lab for analysis to determine if the water is contaminated or not. If the water is contaminated, it will be maintained

on site and disposed of properly with the other waste from the investigation. If the water is not contaminated, it will be poured onto the ground at the site, or into the sewer system, if permitted.

4.5 Data Quality Objectives

Data Quality Objectives (DQOs) for this project are consistent with Attachment A of the United States Environmental Protection Agency Permit # MD 417-009-0001. Attachment A procedures will be followed for all analyses performed. The following is an outline of the Attachment A sample collection requirements.

Sample Collection Methods and Procedures - The Permittee Shall:

- 1) Describe the samplers of sampling equipment for each environmental media and/or waste matrix to be sampled at each SWMU
- 2) Describe the sampling procedure for each environmental media and/or waste matrix in explicit detail. Include, but not be limited to, procedures and methods for work such as bailing, drilling holes, etc.;
 - A) Describe the sequence to be followed in conducting the field activities.
 - B) Include quality assurance samples for analysis at the rate specified:

- (1) Equipment Blank - One with each sampling event for each matrix type;
 - (2) Trip Blank - One with each analytical volatile batch for each matrix type;
 - (3) Field Blank - One with each analytical batch or every 20 samples, whichever is greater;
 - (4) Replicates - One with each analytical batch or every 20 samples, whichever is greater.
- C) Identify the type and source of the sample containers to be used for each analytical parameter;
- D) Detail the sample preservation methods to be utilized and state the maximum permissible holding times to be allowed for each analytical parameter prior to analysis;
- E) Describe the sample custody procedures starting with the cleaning of sample containers to be used, and provide an example "chain-of-custody" form;
- F) Detail the sampling equipment decontamination procedures to be utilized;
and

- G) Describe what will be done with disposable equipment contaminated on site and how contaminated materials will be disposed of, including contaminated environmental media.

A detailed description of Attachment A QA/QC procedures and laboratory deliverable requirements is provided in the section 5.0.

4.6 Sampling Rationale

As previously outlined, the sampling objective is to determine the lateral and vertical extent of contamination, if any, in the soil and groundwater at the Chicamuxen Creek's Edge - Dump Site A, Range 3 Burn Point, and Range 6. Since Range 3 rests on Dump Site A, they will be investigated as one site.

4.6.1 Chicamuxen Creek Dump Site A / Range 3 Burn Point

Four (4) monitoring wells will be installed. One (1) up gradient of the site and three (3) down gradient of the site (Figure 8). It is possible that the holes will be bored through refuse or fill material. If this is the case, a twelve (12) inch diameter boring will be drilled to at least five (5) feet below the lowest occurrence of waste. Then an ten (10)

inch diameter casing will be grouted in and the drilling can be continued with an eight (8) inch bore hole. Split Spoon soil samples will be taken continuously as previously outlined. Samples for analytical testing will be collected at 5 foot intervals. A minimum of 3 Shelby Tube samples will be taken, at alternating depths, from each soil boring.

A maximum of ten (10) soil samples will be collected at 0-1 foot depth intervals. These samples will be taken with hand augers at visible burn points.

4.6.2 Range 6

Testing at Range 6 will consist of five (5) monitoring wells, one (1) up gradient, three (3) down gradient, and an additional well will be installed down gradient from a suspected arsenic dump (Figure 9). In 1956/57, 1500-2000 pounds of arsenic powder were buried in plastic bags at this site. The dump was forty (40) feet deep and six (6) feet in diameter (Outbrief,NEODTC,10/5/90). Split Spoon soil samples will be collected continuously during well boring. Samples for testing will be taken at 5 foot intervals beginning at a depth of 5 feet. A minimum of three (3) Shelby Tube samples will be collected in the same way as previously mentioned. Additional soil samples will be collected with a hand auger.

4.7 Quality Assurance Project Plan

The Quality Assurance Project Plan is designed to ensure the Quality Assurance and Quality Control QA/QC for sampling and record keeping at the previously mentioned sites. The QAPP discusses the Data Quality Objectives sampling decontamination procedures and techniques and chain-of-custody.

5.0 QUALITY ASSURANCE PLAN

5.1 INTRODUCTION

This document presents policies, project organization and objectives, functional activities, quality assurance and quality control measures intended to achieve data quality goals of the Verification Investigation to be performed by EnSafe/Allen & Hoshall at the U.S. Naval Explosive Ordnance Disposal Technology Center, Stump Neck Annex, Indian Head, Maryland as part of the Hazardous Waste Management Facility Permit issued, through RCRA, by USEPA Region III. The project contract number is N62467-89-D-0318/0004.

This document is intended to fulfill requirements for ensuring that all work will be conducted in accordance with quality assurance/quality control protocols, and field procedural protocols for environmental monitoring and measurement data as established in:

- "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program, NEESA 20.2-047B", Naval Energy and Environmental Support Activity, Port Hueneme, California, June 1988 (NEESA 20.2-047B)
- "Ground-Water Monitoring Guide, NEESA 20.2-031A", Naval Energy and Environmental Support Activity, Port Hueneme, California, February 1985 (NEESA 20.2-031A)

Where specific NEESA guidelines do not exist, applicable EPA and/or Maryland Department of Environment guidelines and methods will be applied. These regulations are referenced in specific sections of this document (where applicable).

5.2 PROJECT DESCRIPTION

The RCRA Facility Investigation will focus on three areas of Stump Neck Annex. These include: 1) Range 3 Burn Point; 2) Chicamuxen Creek's Edge-Dump Site A; and 3) Range 6. Activities to be performed during the investigation will provide data required to determine the nature and extent of contamination in the soils, subsoils, and/or ground water systems associated with these sites and to determine what follow-up action, if any, is required to maintain compliance with environmental regulations.

Installation of, soil borings, to be completed as groundwater monitoring wells, and associated well purging, development, and sampling as required will be undertaken. All boring/well installations and associated field work descriptions are provided in this document.

Previous investigations conducted indicate that Range 3 Burn Point is an relatively flat area consisting of approximately 2.0 acres. This site is used to periodically burn or thermally treat explosive wastes. On-site inspection (1983) revealed the presence of burned scraps and a faint solvent or paint odor was detected.

Chicamuxen Creek's Edge - Dump Site A directly underlies range 3 Burn Point. There has been no evidence discovered in the records or from facility representatives to indicate the nature of the disposed materials.

Range 6 is located at the end of Archer Avenue, on a point of land extending into the Potomac River and Chicamuxen Creek. This unit, located on the 100 year flood plain, is used as a demolition traing area. Wastes associated with this unit include small quantities of shrapnel and casings from detonation of explosives.

The soils and ground water will be investigated for the presence of Appendix IX metals (using EPA methods 6010), Volatiles (using EPA methods 8240/624), and Semi-volatiles (using EPA methods 8270/627) at all three sites. USATHAMA Method 3S "Identification and Determination of Explosives Related Material in water using High Perfomance Liquid Chromatography (HPLC)" will be adapted for soil analysis and incorporated at all three sites to test for the presence of HMX, RDX, and TNT.

5.3 PROJECT QUALITY ASSURANCE OBJECTIVES

In general, quality assurance objectives of EnSafe/Allen & Hoshall projects conducted as part of the Navy Technical Services contract are to assess and document the precision, accuracy, representativeness, completeness, and comparability of all sampling and analysis performed. Quality criteria are set herein to assure suitability for intended use of data obtained during projects, and to meet goals established by NEESA. The following discusses the project specific level of effort for Quality Assurance (QA), and data quality criteria.

5.3.1 Field Measurements

QA objectives for parameters to be measured in the field by EnSafe/Allen & Hoshall personnel are presented in Table 5.3-1. Field measurements will include pH, temperature, specific conductance, soil gas screening, and static groundwater level.

5.3.2 Sampling and Analysis for Contamination Level

Project QA objectives of analytical parameters for soil and groundwater will be as stipulated in EPA Method 8270/627, 8240/6240, 6010, USATHAMA 3S, and as determined by the analytical laboratories historical data quality evaluation for these methods. The NEESA laboratory approval process will ensure that laboratory method QA/QC standards are appropriate to meet goals for intended data uses. Anticipated QA goals for these methods are presented in Table 5.3-2.

5.3.3 Precision and Accuracy

Methods of assessing precision and accuracy of investigations are discussed in Section 13.2 of this document. The precision and accuracy parameters for this investigation are included in table 5.3-3.

TABLE 5.3-1
Field Measurements

Measurements Parameter	Reference	Matrix	Precision (%)	Accuracy ± Recovery	Completeness
pH	EPA 150.1 ¹	Water	± 0.05 pH	± 0.2 pH	100
Temperature	EPA 170.1 ¹	Water	± 0.1° C	± 0.2° C	100
Static Water Level	SOP ²	Water	± 0.01 in.	± 0.005 in.	100
Photoionization Detector	SOP ³	Air	± 10 ppm	± 20 ppm	100
Well Survey Points	SOP ⁴	Spatial	± 5%	± 0.1 feet	100
	SOP ⁴	Vertical	± 0.05 feet	± 0.01 feet	100

¹ - Methods for Chemical Analysis of Water and Wastes, EPA-600/4/79-020, Revised March 1983.

² - Manufacturer's SOP for static water level measurement.

³ - Manufacturer's SOP for operation of Photovac TIP II or HNu.

⁴ - Standard Land Surveying Methods as employed by Registered Land Surveyors.

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TABLE 5.3-2 CLP TCL QUALITY OBJECTIVES
Matrix Spikes/Matrix Spike Duplicates/Surrogate Spikes

Fraction	Compound	Soil Precision (%RPD)	Soil Accuracy (%Recovery)	Water Precision (%RPD)	Water Accuracy (%Recovery)
VOA(8240/624)	Matrix Spikes				
	1,1-Dichloroethene	22	59-172	14	61-145
	Trichloroethene	24	62-137	14	71-120
	Chlorobenzene	21	60-133	13	75-130
	Toluene	21	59-139	13	76-125
	Benzene	21	66-142	11	76-127
VOA	Surrogate Spikes				
	Toluene-d ₈	---	81-117	---	88-110
	4-Bromofluorobenzene	---	74-121	---	86-115
	1,2-Dichloroethane-d ₄	---	70-121	---	76-114

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TABLE 5.3-2 CLP TCL QUALITY OBJECTIVES
Matrix Spikes/Matrix Spike Duplicates/Surrogate Spikes

Fraction	Compound	Soil Precision (%RPD)	Soil Accuracy (%Recovery)	Water Precision (%RPD)	Water Accuracy (%Recovery)
BNA (8270 /627)	Matrix Spikes				
BN	1,2,4-Trichlorobenzene	23	38-107	28	39-98
	Acenaphthene	19	31-137	31	46-118
	2,4-Dinitrotoluene	47	28-89	38	24-96
	Di-n-butyl Phthalate	47	29-135	40	11-117
	Pyrene	36	35-142	31	26-127
	N-Nitroso-Di-n-Propylamine	36	41-126	38	41-116
	1,4-Dichlorobenzene	27	26-104	26	36-97
A	Pentachlorophenol	47	17-109	50	9-103
	Phenol	35	26-90	42	12-89

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TABLE 5.3-2 CLP TCL QUALITY OBJECTIVES
Matrix Spikes/Matrix Spike Duplicates/Surrogate Spikes

Fraction	Compound	Soil Precision (%RPD)	Soil Accuracy (%Recovery)	Water Precision (%RPD)	Water Accuracy (%Recovery)
	2-Chlorophenol	50	25-102	40	27-123
	4-Chloro-3-Methylphenol	33	26-103	42	23-97
	4-Nitrophenol	50	11-114	50	10-80
BNA	Surrogate Spikes				
	Nitrobenzene-d ₅	---	23-120	---	35-114
	2-Fluorobiphenyl	---	30-115	---	43-116
	p-Terphenyl-d ₁₄	---	18-137	---	33-141
	Phenol-d ₅	---	24-113	---	10-94
	2-Fluorophenol	---	25-121	---	21-100
	2,4,6-Tribromophenol	---	19-122	---	10-123

VOA= Volatile Organics BN= Base/Neutral Extractable A= Acid Extractable -Advisory Limits

TABLE 5.3-3 USATHAMA Method 3S Precision and Accuracy

Measurement Parameter	Reference	Matrix	Precision (%)	Accuracy (% recovery)	Completeness
Explosives and related materials	USATHAMA 3S with EPA3040 Extraction	Soil	25%	±25%	100%
Explosives and related materials	USATHAMA 3S	Water	25%	±25%	100%

TABLE 5.3-4 CLP TAL QA OBJECTIVES
Matrix Spikes/Duplicate Analyses

Compound (Metal)	Medium/High Sample Precision ^A (%RPD)	Low Sample Precision ^B (%RPD)	Accuracy (% Spike Recovery)
Antimony	± 20	± CRDL	75-125
Arsenic	± 20	± CRDL	75-125
Barium	± 20	± CRDL	75-125
Beryllium	± 20	± CRDL	75-125
Cadmium	± 20	± CRDL	75-125
Chromium	± 20	± CRDL	75-125
Cobalt	± 20	± CRDL	75-125
Copper	± 20	± CRDL	75-125
Lead	± 20	± CRDL	75-125
Mercury	± 20	± CRDL	75-125
Nickel	± 20	± CRDL	75-125
Selenium	± 20	± CRDL	75-125
Silver	± 20	± CRDL	75-125
Thallium	± 20	± CRDL	75-125
Tin	± 20	± CRDL	75-125
Vanadium	± 20	± CRDL	75-125
Zinc	± 20	± CRDL	75-125
Cyanide	± 20	± CRDL	75-125

^A- Medium/High Samples= compound or metal present at 5 times (or more) the Contract Required Detection Limit (CRDL)^C

^B- Low Samples= compound or metal present at less than 5 times the CRDL

NOTE: QA/QC Requirements excerpted from 2/88 CLP SOW

5.3.4 Representativeness

The goal of this investigation is to assess the nature and extent of possible soil and groundwater contamination caused by ordinance disposal at the site. By properly measuring soil gas vapors, collecting soil and groundwater monitoring well samples, and measuring well parameters in accordance with NEESA (and others by reference) protocol and EPA SOP/QAM; samples collected during investigations will be representative of areas of concern.

5.3.5 Completeness

Completeness goals of field measurements reflect the ability to resample all existing and planned wells, and subsequent sample collection for groundwater quality criteria defined in the QA Plan (QAP).

5.3.6 Comparability

Comparability is assured through the use (by field technicians and the laboratory) of established methods of sampling and analysis as specified in NEESA 20.2-031A and NEESA 20.2-047B, as well as other accepted methods.

5.4.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Overall responsibility for projects conducted in accordance with NEESA regulations will be vested in NEESA (or its approved representatives). Therefore, project coordination responsibilities lie with the NEESA, Engineering Field Division (EFD). The following

describes the components of the project chain-of-command as established in NEESA 20.2-047B.

5.4.1 Oversight

5.4.1.1 Navy Energy and Environmental Support Activity

NEESA is responsible for ensuring that the quality of laboratory analyses performed during the various phases CLEAN is acceptable. NEESA is also responsible for managing the NEESA Contract Representative (NCR).

5.4.1.2 Engineering Field Division

The Engineer in Charge (EIC) at the EFD provides the site information and history, provides logistical assistance, specifies the sites requiring investigation and reviews results and recommendations. Ms. Donna Woodhouse Jordon, CHESDIV, Naval Facilities Engineering Command, Washington Navy Yard, Washington, D.C. serves as the EIC for this project.

5.4.1.3 Engineer in Charge

The EIC is responsible for coordinating procurement, finance, and reporting; for ensuring that all documents are reviewed by the NCR; for communicating comments from the NCR and other technical reviewers to the subcontractors; and for ensuring that the subcontractors address all the comments submitted and take appropriate corrective actions.

5.4.1.4 NEESA Contract Representative

The NCR for this project is Dwight Cargile. The NCR is responsible for ensuring that each project has appropriate overall QA. The NCR reviews laboratory QA plans, work plans, submits performance sample data, provides field and laboratory audits, and reviews data from the site. The questions from subcontractors and the EIC regarding specific field and laboratory QC practices are directed to the NCR. The NCR also provides evaluation of referee samples. The NCR contact for this project is Dwight Cargile.

5.4.1.5 State or Local Oversight

The MDE will also serve in an oversight capacity for this investigation. The results of the soil gas screening, and soil and groundwater sampling program will be forwarded to the MDE to comply with Division requirements (for environmental assessments). The investigation results will be presented in the form of a Contamination Assessment Report (CAR). The Verification Investigation has been requested in accordance with requirements set forth in USEPA Permit for Corrective Action and Waste Minimization (Permit # MD 417-009-0001), Part II, A, paragraph 3, under RCRA as amended by HSWA 1984.

5.4.2 Investigation Performance

5.4.2.1 Engineering Subcontractor

EnSafe/Allen & Hoshall will serve as the Engineering Subcontractor for this project. As such, EnSafe/Allen & Hoshall is responsible for designing and implementing the field investigation activities.

5.4.2.2 Analytical Laboratory

The analytical laboratory will be employed by EnSafe/Allen & Hoshall and must adhere to the laboratory requirements in NEESA 20.2-047B (or other QA and method requirements as specified). The laboratory is required to prepare and submit a laboratory QA plan, to analyze and submit the results of proficiency testing, to submit to an on-site inspection, and to correct any deficiencies cited during the inspection by the NCR. The laboratories are required to identify a Laboratory QA Coordinator (LQAC) responsible for overall QA. The LQAC must not be responsible for schedule, costs, or personnel other than QA assistants. It is preferred that the LQAC report to the laboratory director. The LQAC must have the authority to stop work on projects if QC problems arise which affect the quality of the data produced.

In addition to conforming to all NEESA regulations, all work shall be performed in a manner consistent with: the Resource Conservation and Recovery Act (RCRA), as amended; the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Title 40 Code of Federal Regulations (CFR), Part 300, as amended; and other appropriate federal, state, and local guidelines, rules, regulations, and criteria (where applicable).

5.5 SOIL BORINGS AND SAMPLING

5.5.1 Soil Sampling Procedures

All soil samples will be collected in accordance with NEESA 20.2-031A, Chapter 4- Monitor Well Drilling. The specific sampling method is discussed in Section 4.2.3.3 - Split Spoon Samples.

Soil borings will be installed using 6.25 inch internal diameter (I.D.) hollow stem auger flights. Borings will be advanced to a depth of seven (7) feet below groundwater. Soil samples will be collected using a 24 inch split spoon sampler, through the annulus of the augers at five (5) foot intervals to the depth the well will be installed. The last soil sample to be collected for analysis will be at the top of the saturated zone. Any samples collected in the saturated zone will be used for purposes of determining lithology only. Soil boring logs will be prepared for each boring advanced on-site.

Split spoon samples will be collected at five (5) foot intervals throughout the profile. The water table is anticipated to be approximately 6 to 10 feet below ground surface. The split spoon sampler will be a standard two (2) inch outside diameter split-spoon sampling tool. The sampler will be driven into the soil through the use of a 140 pound hammer dropped through a 30 inch fall per NEESA 20.2-031A, Chapter 4- Monitor Well Drilling specifications.

Each soil sample (from each interval) will be split into three (3) samples. The first subsample will be placed in the appropriate containers for subsequent laboratory analysis. The second subsample will be placed in the appropriate containers for

subsequent laboratory analysis of biologic activity. The third subsample will be placed in a precleaned mason jar with sufficient headspace to allow for contaminant volatilization. After allowing a sufficient time for volatilization of headspace samples, readings will be made with a PID. The sample collected at the top of the saturated zone will be selected for analysis. The selected samples will then be preserved in a cool ice chest and shipped under strict chain-of-custody via overnight courier to the selected laboratory for analysis, (as discussed below).

5.5.2 Soil Sample Analyses

All soil samples analyses will be performed in accordance with NEESA 20.2-047B, Chapter 7 - Analytical Methods. The NCR has established that all soil samples will be analyzed by EPA Methods 8240 and 8270- Volatiles and Semi-Volatiles, and EPA Method 6010 (Metals) and USATHAMA Method 3S (Explosives).

5.5.3 Soil Sample Documentation

All soil samples will be documented in accordance with NEESA 202.- 031A, Chapter 6 - Monitoring Well Data Record Requirements, and as discussed in Section 9.0. EnSafe/Allen & Hoshall personnel will use bound logbooks for the maintenance of all field records pertaining to the investigation. These records will document all visual observations, calculations, and equipment calibrations. Every entry will be dated and the time for each entry noted. The logbooks are accountable documents that will be properly maintained and retained as part of the project files. In addition, soil boring logs will be produced for all soil borings advance on-site. Information to be included

on boring logs includes (but is not limited to): total depth of boring, lithologic descriptions of each geologic formation encountered, blow counts for split spoon sampler penetration, water bearing zones, and any subsurface obstructions encountered during boring advancement (with explanations if available).

5.5.4 Soil Sampling Equipment Decontamination

All equipment used in collection of soil samples (i.e. split spoon samplers, sampling rods, hollow stem auger flights, etc.) will be high pressure, steam cleaned prior to initiation of on-site activities. Decontamination of all augers and downhole equipment (i.e. auger flights, sampling rods, etc.) will be performed between each boring through steam cleaning detergent wash and potable water rinse. Split spoon samplers will be decontaminated between samples using a detergent wash, potable water rinse, and final deionized water rinse. This procedure will be followed in order to minimize the potential for cross-contamination of soil samples. Disposable gloves will be worn during all sampling phases which require handling of samples. A new pair of gloves will be donned prior to handling of each sample.

5.6.0 MONITORING WELL INSTALLATION

Each of the wells will be logged by a field geologist during soil sampling. Each well will be constructed using a 10 foot section of four (4) inch diameter, 0.01 inch slot size, schedule 40 PVC screen attached to four (4) inch diameter, schedule 40 PVC riser. The 10 foot screen positioned three (3) feet above and seven (7) feet below the water table will ensure adequate collection of "floaters" contaminants that may be present, while allowing for temporal fluctuations in the water table. Should an underlying aquitard be

encountered prior to a depth of seven (7) feet below the water table, drilling will be terminated so as to maintain the integrity of the aquifer. Should such an aquitard be encountered at a depth of two (2) feet or less below the water table, a five (5) foot screen will be used. This will allow for monitoring of the entire water bearing unit, and an additional three (3) feet of screen above the water table.

During construction, clean 20/40 silica sand will be tremied through the annulus of the HSA to a depth of not more than two (2) feet above the top of the screen. The sand is intended to prevent clogging of the screen slots. A bentonite seal (bentonite pellets hydrated with deionized water) with a minimum thickness of two (2) feet, will be tremied on top of the sand pack to prevent infiltration of surface water down the outside of the well casing. An additional sand pack of approximately one (1) foot will be placed on top of the bentonite seal to ensure that grout does not penetrate the bentonite.

During introduction of the sand pack and the bentonite seal, accurate measurements (\pm 0.2 feet) will be made to the top of the pack and the seal with a weighted steel measuring tape or the tremie pipe itself. After allowing the bentonite seal to cure for a minimum of 12 hours, the remaining annulus of the borehole will be grouted with a Portland cement/bentonite mixture.

With the exception of one (1) background well, all wells will be completed with approximately two (2) feet of PVC riser above ground surface, capped with a locking cap, and covered with a protective steel cover. The background well, located in the parking lot will be finished at ground level, capped with a locking cap, and secured by a flush-mount (manhole-style) protective covering. Figure ??? is a suggested schematic for monitoring wells to be installed.

After completion of well construction, all monitoring wells will be surveyed by a State of Maryland registered land surveyor to the nearest 0.01 foot incorporating USGS NAD '27. A permanent mark will be located at the top of each well casing to aid in generating accurate and consistent groundwater elevation data. Once the wells are properly developed and surveyed, water level measurements will be recorded in order to determine groundwater flow direction, and to construct an accurate potentiometric surface diagram for the area of investigation (see Section 5.7.1 below).

All monitoring well installation notes, calculations, descriptions, and observations will be recorded in the project field logbook. In addition, well construction logs will be produced accurately depicting all components of the finished monitoring wells (i.e. total depth, depth to water, depth of filter pack, thickness of bentonite seal, etc.).

5.7.0 GROUNDWATER SAMPLING

5.7.1 Static Water Level Measurement

Static water level measurements will be performed on all monitoring wells in accordance with NEESA 20.2-031A, Chapter 6.1.5.6. Static water level measurements will be used to determine groundwater flow direction, and to construct potentiometric surface diagram of the area of investigation for inclusion in the CAR.

5.7.2 Groundwater Sampling Procedures

All groundwater samples will be collected in accordance with NEESA 20.2-031A, Chapter 7- Ground-Water Sampling. Groundwater samples will be collected using a Teflon-coated single check valve bailer and nylon coated bailing rope. The bailer will be slowly lowered into the water column to minimize water column disturbance and possible loss of volatile parameters. The bailer will be manually retrieved and the samples will be immediately transferred to appropriate sample containers.

5.7.3 Groundwater Sample Analyses

All groundwater samples analyses will be performed in accordance with NEESA 20.2-047B, Chapter 7- Analytical Methods. The NCR has established that all groundwater samples will be analyzed by EPA Method 602- Gasoline Hydrocarbons, and EPA Method 6010 (Metals) and USATHAMA Method 35 (Explosives). In addition, pH and temperature will be measured in the field for each sample collected.

5.7.4 Groundwater Sample Documentation

All groundwater samples will be documented in accordance with NEESA 20.2-047B, Chapter 3- Site-Specific QC Requirements, and NEESA 20.2-031A, Chapter 6- Monitoring Well Data Record Requirements, and as discussed in Section 5.0. EnSafe/Allen & Hoshall personnel will use bound logbooks for the maintenance of all field records pertaining to the investigation. These records will document all visual observations, calculations, and equipment calibrations. Every entry will be dated and the

time for each entry noted. The logbooks are accountable documents that will be properly maintained and retained as part of the project files.

5.7.5 Monitoring Well Purging

Prior to sample collection, each well will be purged of standing water. A minimum of three (3) casing volumes (as calculated from static water level) will be purged from each well. In the event that a well bails to dryness before three (3) casing volumes are removed, the purged volume will be noted and an explanation will be given. All well purging will be performed using a Teflon-coated single check valve bailer which is manually lowered and removed from the well. In the event that the well is bailed dry, a minimum of 24 hours will be allowed to pass between well purging and well sampling. The well purging process will be used to ensure that groundwater samples representative of the aquifer under investigation are obtained.

5.7.6 Groundwater Sampling Equipment Decontamination

All equipment used in measuring and sampling groundwater monitoring wells will be decontaminated in accordance with NEESA 20.2-031A, Chapter 3.3- Aquifer Protection requirements. Prior to initiation of site activities, it will be necessary for all bailers, and the water level indicator to be decontaminated using a potable water/detergent wash, followed by a potable water rinse, and a final deionized water rinse. Sampling equipment will be decontaminated in the same manner between samples. This procedure will be followed in order to minimize the potential for cross-contamination of samples between sampling locations. Disposable gloves will be worn during all

measurement and sampling activities. A new pair of disposable gloves will be donned for each water sample and/or measurement.

5.8.0 Sample Identification, Containers, Preservation and Labelling

Pre-cleaned sample containers will be provided by the laboratory. EnSafe/Allen & Hoshall will receive the containers from an approved laboratory that has followed NEESA 20.2-047B, Chapter 3.5- Sample Container Cleaning Procedures (and/or other applicable protocol), and the containers will remain in the custody of EnSafe/Allen & Hoshall personnel. All soil samples to be analyzed by EPA Methods 8240/8270/6010 will be collected in 125 ml. glass vials with Teflon-lined septum lids. All EPA Method 624/627/6010 water samples will be collected in 40 ml. glass vials with Teflon-lined septa (in duplicate). While in the field and during transport to the laboratory, all samples will be retained in a field cooler with ice packs to maintain sample temperature at approximately 4 degrees C (\pm 2 degrees C). All water samples will be acidified with HCL to reduce pH levels below 2.0. Proper acidification will be verified using litmus paper. Holding times for all samples (soil and water) shall not exceed 14 days prior to analysis.

Sample containers, preservation and holding times are summarized in Table 5.9-1.

5.8.1 Sample Chain-of-Custody

EnSafe/Allen & Hoshall will follow strict chain-of-custody procedures in accordance with NEESA 20.2-047B, Chapter 3.8, and corporate Standard Operating Procedures for chain-of-custody. EnSafe/Allen & Hoshall will generally use chain-of-custody forms, such as

illustrated in Figure 5.8.1-1 for transferring sample shipments to the laboratory. Documentation of all samples will also be kept in a project field logbook.

Upon transfer of custody, the chain-of-custody form will be signed by the EnSafe/Allen & Hoshall field sampling team leader, including the date and time the samples were relinquished. As common carriers will not sign chain-of-custody forms, the chain-of-custody records will be sealed within each shipping container. All chain-of-custody forms received by the laboratory must be signed and dated by the laboratory sample custodian and returned to EnSafe/Allen & Hoshall following receipt, or as part of the data reporting package.

5.9.0 CALIBRATION PROCEDURES AND FREQUENCY

The analytical laboratory will perform analytical instrument calibration in accordance with NEESA 20.2-47B (and specific

TABLE 5.9-1 Sample Containers, Preservation, and Holding Time

Analytical Method	Sample Matrix	Container Size/Material	Sample Preservation	Holding Time
EPA Method 8270	Soil	8oz. Clear Glass, wide-mouth Jar w/teflon lined lid	4°C, Store in Dark	14 Days to Extraction, 40 days to Analysis
EPA Method 625	Water	2.5 Liter Amber Glass Jar w/teflon lined lid	4°C, Store in .008% Na ₂ S ₂ O ₃	7 Days to Extraction, 40 days to Analysis
EPA Method 6010 (7000 Series)	Soil	16oz. Boston round Glass Jar w/teflon lined lid	4°C	up to 6mos. until analysis
EPA Method 6010 (200 Series)	Water	500 ml. HDPE Bottle	4°C, pH<2 with HNO ₃	up to 6mos. until analysis
EPA Method 7196 (Chromium VI)	Soil	8oz. Clear Glass, wide-mouth Jar w/teflon lined lid	4°C	24 hours to analysis
EPA Method 218.4 (Chromium VI)	Water	250 ml. HDPE Bottle	4°C	24 hours to analysis
EPA Method 7470 (Mercury)	Soil	8oz. Clear Glass, wide-mouth Jar w/teflon lined lid	4°C	28 days to analysis
EPA Method 245.1 (Mercury)	Water	250 ml. HDPE Bottle	4°C, pH<2 with HNO ₃	28 days to analysis
EPA Method 8240	Soil	4oz Clear Glass, wide-mouth Jar w/teflon lined lid	4°C	14 days to analysis
EPA Method 624	Water	2x40ml vials w/teflon lined septum	4°C	14 days to analysis
USATHAMA Method 3S (Explosives) with EPA Method 3040A Extraction	Soil	8oz. Clear Glass, wide-mouth Jar w/teflon lined lid	4°C, Store in Dark	14 days to extraction, 40 days to analysis
USATHAMA Method 3S (Explosives)	Water	1 liter Amber Glass Jar w/teflon lined lid	4°C, Store in Dark	14 days to extraction, 40 days to analysis

instrument methods by reference). Adherence to proper calibration procedures will be determined by the NCR during the on-site laboratory inspection.

EnSafe/Allen & Hoshall plans to calibrate field equipment such as pH, temperature and HNu PID according to manufacturer's standard operating procedures. Field equipment for which SOPs are not in force will be calibrated and operated in accordance with the manufacturer's recommendations.

All field instruments will be calibrated at the beginning and end of each work day.

5.10.0 ANALYTICAL PROCEDURES

This investigation will utilize the following analytical procedures.

5.10.1 Field Analyses

Soil gas screening and soil sample screening will be performed as outlined in Sections 5 and 6 of this document. Static water level measurements will also be performed on all monitoring wells subsequent to well development with adequate time allowed for well recharge.

Monitoring well casing (tops) will be surveyed (spatial and horizontal orientation) by a State of Maryland registered land surveyor. The survey measurements will be recorded relative to the USGS NAD '27.

All field measurements will be recorded in a dedicated field logbook and/or appropriate EnSafe/Allen & Hoshall field activity log (i.e. boring log, well construction log, etc.).

5.10.2 Laboratory Analyses

Selected soil samples collected during the course of this investigation will be analyzed by EPA Methods 8240 and 8270- for Volatiles and Semi-Volatiles , EPA Method 6010 for Metals, EPA Method 7196 for Chromium VI, and EPA Method 7470 for Mercury and USATHAMA 3S for Explosives. USATHAMA 3S does not specifically include an extraction method for dealing with soil/ sediment extraction. As a result, a modified Soxhlet method extraction procedure will be used. All water samples collected during this investigation will be analyzed for EPA Methods 624, 627, 6010 and USATHAMA 3S analysis.

5.11.0 DATA REDUCTION, VALIDATION, AND REPORTING

Laboratory procedures for data reduction, validation, and reporting will be conducted according to standard operating procedures as dictated by the requirements of NEESA 20.2-047B, Chapters 7- Analytical Methods and 8- Maintaining Laboratory Approval. The specific procedures for data reduction, validation and reporting will be those outlined for Level C QC data in NEESA 20.2-047B, and the NCR approved laboratory QA Plan. For USATHAMA Method 3S, QC procedures specific to his method (as outlined in the method) will be applied.

Required internal QC checks and data validation procedures are described in Section 5.13.0.

EnSafe/Allen & Hoshall's use of the laboratory will be accomplished by a services agreement (contract). The contract will specify the scope of services to be performed by the laboratory, the specific analytical quality assurance requirements to be met, and the information to be developed and reported.

5.12.0 FIELD AND LABORATORY QUALITY CONTROL CHECKS

Internal laboratory control checks used by the laboratory will be conducted in the laboratory by the laboratory staff. EnSafe/Allen & Hoshall will conduct internal quality control checks of sampling procedures and laboratory analyses. These checks will consist of preparation and submittal of sampler rinseate blanks, trip blanks, field blanks, and field duplicates for analysis, and an evaluation of the laboratory analytical package. The data validation checklists, included as Appendix B of this QA Plan, will be used as guides in evaluating data collection, field records, and analytical performance; these checklists will aid in identifying valid data and in classifying the data into one of three use categories: unusable data, Class A (qualitative) data, or Class B (qualitative and quantitative) data.

The types and frequency of blank and other control check samples will be dictated by the level of QC selected for each project by the NCR. The required control check samples frequencies are outlined in NEESA 20.2-047B, Chapter 3- Site-Specific QC Requirements and Chapter 7- Analytical Methods. For Level C QC, quality control measures can be discussed for sampling and analysis as follows:

5.12.1 Field Data Quality

All field work will be conducted and/or supervised by EnSafe/Allen & Hoshall personnel in order to ensure that proper procedures are followed. Field records will be kept of all activities that take place during the investigation and these records will be maintained at the EnSafe/Allen & Hoshall office in Memphis, Tennessee. These records will include any obstacles that may be encountered during the investigation.

Field samples will be collected per the procedures outlined in Section 5.5, 5.6, and 5.7 of this document. Precision will be assessed by evaluating the results of duplicate samples, and accuracy will be assessed by evaluating the analyses of field blanks, trip blanks, and laboratory matrix and surrogate spikes.

A duplicate is an identical sample collected from the same location (i.e. well) at the same time under identical conditions. Duplicate samples are analyzed along with the original sample to obtain sample procedure precision and inherent sample source variability. For this project the field duplicate will be used for preparation of the laboratory matrix spike and matrix spike duplicate samples. Due to the heterogeneity of soils, duplicate soil samples are of limited value in assessing the precision of sampling and analytical methods, and as a result, will not be collected during this investigation.

A field blank is a sample container filled with organic-free water in the field and is prepared, preserved and stored in the same manner as the other field samples. The field blanks are analyzed along with the field samples for the constituents of interest to check for contamination imparted to the samples by the sample containers or other exogenous

sources. One field blank per sampling event (or every 10 water samples) will be prepared.

Rinseate (or equipment) blanks are collected by retaining rinseate from sampling equipment. The equipment is rinsed with organic and analyte free deionized water after full decontamination procedures have been performed. Rinseate samples are collected in containers of the same type and treatment as the sample containers. One (1) rinseate sample will be collected for each analytical method during each week of the field investigation. The rinseate blank is analyzed along with the field samples for the constituents of interest to check for contamination imparted to the samples by the sampling equipment, containers, or other exogenous source.

A trip blank is a sample container filled with organic-free water that is transported unopened with the sample bottles. It is opened in the laboratory and analyzed along with the field samples for volatile constituents of interest. Trip blanks for all volatile parameters will be prepared and submitted to the laboratory with sample shipping containers at a frequency of one (1) per sample shipping cooler.

The collection frequencies for quality control sample collection are summarized in Table 5.12-1.

TABLE 5.12-1

Quality Control Sample Collection Frequencies

Quality Control Sample	Frequency of Collection
Trip Blank (volatiles only)	One per sample shipping cooler
Rinseate Blank	One per week (for duration of field investigation)
Field Blank	One per groundwater sampling event
Duplicates	One per 10 water samples
Matrix Spike/Matrix Spike Duplicate	One per 10 Water samples (Collect 2 additional containers of sample from the well chosen for matrix spike/matrix spike duplicate analysis for each analytical method)

5.12.2 Analytical Data Quality

Analytical data quality is assured through the use of NEESA guidelines for QA/QC as set forth in NEESA 20.2-047B. The guidelines include analysis and evaluation of matrix spikes.

Matrix spike samples that are prepared by the laboratory are useful in assessing the accuracy of the analytical method, and can detect matrix effects, in which other sample components interfere with the analysis of the contaminant of concern. The method of measuring analytical accuracy is percent recovery. Analysis of matrix spike duplicates will provide a basis for determining method precision specific to the matrix under investigation. Precision is measured as relative percent difference (%) between duplicate analyses.

Analytical matrix spikes and matrix spike duplicates will be performed at a rate of one (1) per sample batch (20 samples maximum) per matrix in accordance with NEESA 20.2-047B.

5.12.3 Field Data Package

The field data package will include all field records and measurements obtained at a site by EnSafe/Allen & Hoshall personnel in accordance with NEESA 20.2-047B, Chapter 7.2- Deliverables and NEESA 20.2-031A, Chapter 6- Monitoring Well Data Record Requirements. The package, including all field records and measurements obtained at the Site by EnSafe/Allen & Hoshall sampling personnel, is validated by conducting the following:

- A review of field data contained on water and soil sampling logs for completeness. Failure in this area may result in the data being invalidated for litigation or regulatory purposes.
- A verification that field blanks, sampler rinsate blanks, and trip blanks were properly prepared, identified, and analyzed. Failure in this area may compromise the analytical data package and result in some data being considered qualitative or invalid.
- A check on field analyses for equipment calibration and condition. Failure in this area may result in the field measurements being invalidated.
- A review of chain-of-custody forms for proper completion, signatures of field personnel and the laboratory sample custodian, and dates. Failure in this area may result in the data being invalidated for litigation or regulatory purposes.

The field data package will be reviewed by the project QA Officer for completeness and accuracy using the checklist in Appendix B.

5.12.4 Analytical Data Package

Validation of the analytical data package will be performed by the project QA Officer (not before completion of field data validation) prior to submittal to the NCR. The validation steps will be performed by applying where applicable the EPA Laboratory Data Validation Functional Guidelines for Evaluating Organics and Inorganics Analyses, Technical Directive Document No. HQ-8410-01, and EPA Precision and Accuracy state-

ments for the analytical methods employed. NEESA 20.2-047B, Chapter 7.3 guidelines will be applied to all Level C data validation procedures. An Analytical Data Validation Checklist (Appendix B) will be used for this purpose.

The analytical data package validation procedure includes, but is not limited to, review of the following:

- Comparison of the data package to the reporting level requirements designated for the project, to confirm completeness.
- Comparison of sampling dates, sample extraction dates, and analysis dates to check that samples were extracted and/or analyzed within the proper holding times. Failure in this area may render the data unusable.
- Review of analytical methods and required detection limits to verify that they agree with the QAPP and the laboratory contract. Failure in this area may render the data unusable.
- Review of field and laboratory blanks will be done to evaluate possible contamination sources. The preparation techniques and frequencies, and the analytical results (if appropriate) will be considered.
- Evaluation of all blanks (rinseate blanks, field blanks, trip blanks, reagent blanks, method blanks, and extraction blanks) must confirm freedom from contamination at the specified detection limit. All blank contaminants must be

explained or the data applicable to those blanks labelled suspect and sufficient only for qualitative purposes.

5.12.5 Data Classification

The data will be classified by the Project Quality Assurance Officer based upon the level of reportables and the result of evaluating the field and analytical data packages. The three possible data classes are:

Unusable data: Data that may not be used for any purpose;

Class A data: Data that meets only the Class A screening criteria contained in Appendix B but not the Level B criteria. This class of data may be used for qualitative purposes only, i.e., to help develop or refine study plans, evaluate different sampling or analytical techniques, or identify gaps in the data base. For this investigation, data will be classified Class A if all documentation identified by checklists in Appendix B and the QAPP have been properly prepared and are available.

Class B data: Data that meets both the Class A and Class B screening criteria. In addition to qualitative uses, the data submitted also may be used for quantitative purposes such as evaluating conditions such as risks or potential remedial solutions. For this investigation, data will be classified Class B if all analytical and field QC samples (rinsates, blanks, and spikes) are within acceptable control limits.

As with the laboratory data validation, the classification of data is based on specifically defined criteria. Samples are evaluated by matrix against the specific class criteria and judged as acceptable, provisional, or unacceptable. The explanation of the judging criteria is as follows:

A - Acceptable: All criteria have been successfully met for all samples.

P-Provisional: Some samples have not fully met the criteria but the information is obtainable.

U-Unacceptable: Criteria has not been met with any samples and is not obtainable. This data may not be classified for use unless sufficient other data criteria have been met and scientific judgement indicate the data may be useful if classified.

N - Not Applicable.

Data will be classified using the Data Classification Summary Checklist (Appendix B). A report of the results of the Data Validation for both previously collected and planned data will be submitted to the Project Manager (see Section 18.1).

5.13.0 PERFORMANCE AND SYSTEM AUDITS

Audits will be performed before and during the work to evaluate the capability and performance of the entire system of measurement and reporting, i.e. experimental design, sampling (or data collection), analysis, and attendant quality control activities.

5.13.1 Field System Audits

The Site Project Manager is responsible for evaluating the performance of field personnel and general field operations and progress. The Site Project Manager will observe the performance of the field operations personnel during each kind of activity such as water-level readings and sampling rounds. A formal systems audit of an field operations personnel by the corporate QA officer will be performed on a biannual basis (for all projects) and a field audit report of each sampling team members will be maintained on file by EnSafe/Allen & Hoshall. Where applicable, these audits will ensure that field operations are being conducted in accordance with NEESA 20.2-031A guidelines.

5.13.2 Laboratory Systems Audit

A laboratory systems audit is routinely conducted (at least annually) by EnSafe/Allen & Hoshall. These audits test methodology and assure that systems and operational capability is maintained. They also verify that quality control measures are being followed as specified in the laboratory written standard operating procedures (SOP) and Quality Assurance Plans (QAP). The Systems Audit Checklist used by the EPA CLP forms the procedural basis for conducting these audits.

Laboratory initiated audits will be conducted in accordance with guidelines set forth in NEESA 20.2-047B, and the laboratory QA Plan as approved by the NCR. Under NEESA 20.2-047B guidelines, the project NCR is also responsible for laboratory inspections to ensure compliance with NEESA laboratory requirements.

5.13.3 Performance Evaluation Audits

A performance evaluation (PE) audit is an audit performed to evaluate a laboratory's ability to obtain an accurate and precise answer in the analysis of known check samples by a specific analytical method. Following the analytical data validation described in Section 12.0, a performance evaluation audit of the laboratory may be conducted by EnSafe/Allen & Hoshall. This audit may be conducted if it is determined that the quality assurance data provided are outside acceptance criteria control limits. PE audits may include a review of all raw data developed by the laboratory and not reported (laboratory non-reportables) and the submission of blind spiked check samples for the analysis of the parameters in question. These check samples may be submitted disguised as field samples, in which case, the laboratory will not know the purpose of the samples; or the samples may be obvious (known) check samples (EPA or National Bureau of Standards (NBS) traceable).

PE audits also may be conducted by reviewing the laboratory's results from "round-robin" certification testing and/or EPA Contract Laboratory Program (CLP) evaluation samples. An additional component of PE audits includes the review and evaluation of raw data generated from the analysis of PE samples and actual field samples that may be in question.

5.13.4 Regulatory Audits

It is understood that EnSafe/Allen & Hoshall field personnel and subcontract laboratories also are subject to quality assurance audits by the EPA, MDE, and the NCR. The NCR (under NEESA guidelines) will conduct laboratory inspections prior

to approval for participation in any NEESA project, and will provide performance samples to the laboratory for approval purposes.

5.14.0 PREVENTIVE MAINTENANCE

The sampling equipment employed by EnSafe/Allen & Hoshall during an investigation that may require preventive maintenance will be checked for proper operation before and after each use on a daily basis. These checks will be conducted at the beginning and end of each day. Any replacements or repairs will be made as needed in accordance with manufacturer's instructions. Equipment or instruments potentially requiring preventive maintenance are listed in Table 5.14-1 along with the preventive maintenance requirements for each. Table 14-2 provides daily preventive maintenance procedures for field groundwater screening equipment to be used during the monitoring project.

TABLE 5.14-1
Field Testing Equipment

Item	Manufacturer	Model Number	Serial Number	Preventive Maintenance
pH Meter	Fisher	Accumet 956	3218	" "
Thermometer	---	Platinum RTD	---	" "
Conductivity/ pH/Temperature Meter	YSI	3500	---	Manufacturer's Operating Manual
Photoionization Detector	ENu Photovac	HW-101 TIP-II	--- ---	" " " "

Records of calibration and maintenance activities for each piece of equipment are contained in logbooks assigned to the equipment.

Preventive maintenance to be performed by the analytical laboratory will be performed in accordance with laboratory SOPs as established in an NCR approved QA Plan.

Table 5.14-2

Preventive Maintenance for Field Equipment

Conductivity Meters

a. Each use: Meter probes are cleaned before and after each use with distilled/deionized water.

Before and after each use (daily) the instruments are checked with a commercial conductivity standard for proper calibration.

The battery is checked for proper charge.

b. Quarterly: The instrument is inspected on a quarterly basis, whether used during the quarter or not.

The inspection consists of a general examination of the electrical system (including batteries) and a calibration check.

Instruments not functioning properly are shipped to the manufacturer for repair and calibration.

pH Meters

a. Each use: Before each use (daily), the probe should be checked for cracks in the electrode bulb and complete filling with electrolyte solution.

At the beginning and end of any sampling day, the pH meter must be calibrated using two standard pH buffers.

The battery is checked for proper charge.

Following each use, the probe is rinsed with deionized water. The probe cap is filled with electrolyte solution and placed on the probe tip. Excess electrolyte is rinsed off and the probe dried with a paper towel. The instrument is then placed in its carrying case.

- b. Quarterly: The instrument is inspected on a quarterly basis whether or not it has been used.

The inspection consists of a general examination of the probe, wire, electrical system (battery check) and a calibration check. Any malfunctioning equipment is returned to the manufacturer for repair and recalibration.

Thermometers

- a. Each use: Before each use, thermometers are visually checked for cracks and mercury separation.

After use, thermometers are rinsed with deionized or distilled water and placed in their protective case to prevent breakage.

- b. Monthly: Thermometers are visually inspected as described above, whether used or not. They are checked against an NBS certified thermometer for accuracy.

5.15.0 Specific Routine Procedures Used To Assess Data Precision, Accuracy, and Completeness

Precision is an estimate of the reproducibility of a method, and it is estimated by several statistical tests; the standard deviation of the error distribution, the coefficient of variation and the relative percent difference between replicate (duplicate) samples. EnSafe/Allen & Hoshall will determine the precision of a method by analyzing replicate data.

Precision is then defined by the coefficient of variation (CV), which expresses the standard deviation as a percentage of the mean. An indicator of CV, relative percent

difference will serve as quality criterion for classification of data resulting from this investigation.

Specific statistical comparison of duplicate samples (field and laboratory), as a measure of precision evaluating both sample collection procedures and laboratory instrument performance, may be accomplished by first comparing the obtained duplicate results with the published EPA criteria for method precision (relative percent difference).

The accuracy of a method is an estimate of the difference between the true value and the determined mean value. Specific statistical comparison of percent recovery values reported by the laboratory as a measure of method accuracy will be compared with the published EPA (or other appropriate regulatory entity) criteria for the accuracy of an individual method. Another technique for evaluating the accuracy of a method is to use the Students t-test. This test identifies whether or not a significant bias is present.

Data completeness will be expressed both as the percentage of total tests conducted and required in the scope of work that are deemed valid. Methods for assessing data precision, accuracy, and completeness by the laboratory will be outlined in the approved laboratory QA Plan.

5.16.0 CORRECTIVE ACTION

During the course of any investigation, field personnel are responsible for seeing that field instruments and equipment are functioning properly and that work progresses satisfactorily. The field personnel are also responsible for ensuring performance of routine preventive maintenance and quality control procedures, thereby ensuring

collection of valid field data. If a problem is detected by the field personnel, the project manager shall be notified immediately, at which time problem correction will begin. Similarly, if a problem is identified during a routine audit by the project QA officer or the regulatory QA officer (or NCR), an immediate investigation will be undertaken and corrective action deemed necessary will be taken as early as possible.

In the event that corrective action is required by the analytical laboratory, it should be conducted in accordance with their NCR approved QA Plan following guidelines provided in NEESA 20.2 -047B, Chapter 4.5 - Out-of-Control Events.

5.17.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

5.17.1 Internal Reports

The EnSafe/Allen & Hoshall QA Officer will provide status reports to the Project Manager. The reports address the following, as applicable during the course of the project:

- Quality assurance activities and quality of collected data
- Equipment and calibration and preventive maintenance activities
- Results of data precision and accuracy calculations
- Evaluation of data completeness
- QA problems and recommended and/or implemented corrective actions. Results of corrective action taken.
- QA performance and system audit findings

The laboratory is required to submit a monthly QC progress report to the NCR.

5.17.2 Reports to NEESA

EnSafe/Allen & Hoshall will provide a data quality assurance summary (QC Data Report) within the draft CAR for submittal to the NCR. A Draft CAR must be submitted to the CHESDIV EIC no later than 90 days after initiation of field activities.

5.17.3 Reports to MDE

A final CAR and Follow-up report (100% complete draft document) must be submitted to MDE 15 days after EIC approval of the draft CAR.

APPENDIX A
LABORATORY QUALITY ASSURANCE PLAN

RFI Stump Neck Annex
Revision #0
June 26, 1991

**LABORATORY QUALITY ASSURANCE PROTOCOL WILL BE INCLUDED IN
THE FINAL QAPP**

APPENDIX B
ANALYTICAL DATA VALIDATION CHECKLISTS

FIELD DATA VALIDATION CHECKLIST

Project Name: _____
Project Number: _____
Sample Identification: _____

Sampling Team: _____
Analyzing Laboratory: _____
Analyses Performed: _____
Sample Matrix: _____
QA Reporting Level: _____

REPORTING REQUIREMENTS

FIELD DATA PACKAGE DOCUMENTATION

	<u>YES</u>	<u>NO</u>	<u>NOT REQUIRED</u>
1. Field (water and soil) sample logs completed properly and signed			
2. Sampling dates noted			
3. Sampling team indicated			
4. Sample identification traceable to location collected			
5. Sample location provided			
6. Sample depth for soils indicated			
7. Collection technique (bailer, pump etc.)			
8. Field preparation techniques and sample type indicated (grab, composite)			
9. Sample container type described			
10. Sample container type proper for analysis requested			
11. Preservation methods indicated			
12. Chain-of-custody form completed			
13. Proper analytical methods requested			
14. Proper number and type of field QC samples were collected (blanks, replicates, splits, etc.)			
15. Field equipment was properly calibrated before use and results documented.			

COMMENTS: _____

FIELD DOCUMENTATION IS COMPLETE: _____

QA Officer _____

ANALYTICAL DATA VALIDATION CHECKLIST

Project Name: _____
Project Number: _____
Sample Identification: _____

Sampling Team: _____
Analyzing Laboratory: _____
Analyses Performed: _____
Sample Matrix: _____
QA Reporting Level: _____

REPORTING REQUIREMENTS
ANALYTICAL DATA PACKAGE DOCUMENTATION
LEVEL A (QUALITATIVE)

Section I: General Information

YES NO NOT
REQUIRED

1. Sample results complete
2. Proper parameters analyzed
3. Method of analysis reported
4. Detection limits of analysis reported
5. Master tracking list provided
6. Sample collection date provided
7. Sample received date provided
8. Sample preparation/extraction date provided
9. Sample analysis date provided
10. Copy of Chain-of-Custody form signed by the lab sample custodian
11. A narrative summary of QA or sample problems is provided.

COMMENTS: _____

Documentation

Section II: Inorganic Analyses

YES

NO

NOT
REQUIRED

1. Results of ICVS and CCVS, %R, expected values
2. Results of Digested LCS (may be called QC Check sample), %R and expected value
3. Results of undigested QC Check sample, %R, Source (Lot No. and manufacturer)
4. Results of method blanks
5. Results of interference check sample (ICS) and expected value (ICP only)
6. Results of a dilution check sample and expected value (ICP only)
7. Results of laboratory duplicate analysis and %RSD or RPD and control value
8. Results of Matrix spike (digested spike) analysis, amount spiked, %R and control limits
9. Results of analytical (post-digested) spike analysis, amount spiked, %R, and control limits (furnace AAS only)

COMMENTS:

Documentation

Section III: Organic Analyses

YES

NO

NOT
REQUIRED

A. GAS CHROMATOGRAPHY (NO MASS SPEC)

1. Results of water blanks (VOA),
Extraction blanks, and/or trip blanks
2. Results of latest independent QC
check samples, expected value, %R
and source (Lot No. and manufacturer)
3. Results of analysis of reagent water
spike, expected value, %R, control
limits
4. Results of reagent water spike
duplicate, expected value, %R,
RPD and control limits;
5. Results of matrix spikes, amount
spiked, %R and control limit
6. Results of matrix spike duplicates,
amount spiked, %R, RPD or %RSD and
control limit
7. Results of laboratory duplicates
(if performed), RPD or %RSD and
control limit
8. Results of surrogate spikes, %R,
control limits

COMMENTS:

Documentation

B. GAS CHROMATOGRAPHY/MASS SPECTROMETER

YES

NO

NOT
REQUIRED

1. Verification statement acknowledging tuning with BFB or DFTPP that indicates compliance with acceptance criteria
2. Results of continuing calibration standards (SPCC and CCC), expected value
3. Results of water blanks, extraction (method) blanks, and trip blanks
4. Results of analysis of reagent water spike, expected value, %R, control limits
5. Results of reagent water spike duplicate, expected value, %R, RPD, and control limits
6. Results of matrix spikes analysis, amount spiked, %R, and control limits
7. Results of matrix spike duplicate analysis amount spiked, %R, RPD or %RSD and control limits
8. Results of surrogate spike analysis, %R, control limits
9. Results of latest Independent QC check samples (EPA or NBS traceable) analyzed expected value, and source (Lot No. and manufacturer)
10. Results of blank spike analysis for matrix spike or matrix spike duplicate parameters not meeting recovery requirements

COMMENTS:

QUANTITATIVE STATISTICAL SIGNIFICANCE
LEVEL B (QUANTITATIVE)

DATA EVALUATION

PASS

FAIL NOT APP

1. Samples were properly collected
2. Samples were properly preserved
3. Field measurements of pH and specific conductance are consistent with historical data.
4. Samples were analyzed by the proper methods
5. Sample extracted within holding time
6. Sample analyzed within holding time
7. Required detection limits were employed by the laboratory
8. Results of Sampler rinsate blanks were contaminant free or less than five times the detection limit
9. Sampler rinsate blanks were not contaminant free and field blanks were analyzed properly
10. Field blanks were contaminant free
11. Field blanks were not contaminant free and trip blanks were properly analyzed
12. Trip blanks were contaminant free
13. Trip blanks were not contaminant free
14. Laboratory blanks (method blanks, extraction blanks, water blanks) are contaminant free
15. Blanks summary (conclusions reached): _____

16. RPD of field replicates is less than 25% for water matrices and less than 40% for soil matrices or the difference can be explained

COMMENTS: _____

INORGANIC ANALYSES

PASS

FAIL

NA

1. ICVS and CCVS %R within control limits
2. LCS %R within control limits
3. QC Check Sample %R within control limits and source given
4. Laboratory blanks acceptable
5. Interference Check sample within control limits (ICP only)
6. Dilution Check sample within control limits (ICP only)
7. RPD for laboratory duplicate within allowable limits
8. Matrix spike %R within control limits
9. Analytical post digested spike within control limits (furnace AAS only)

COMMENTS:

ORGANIC ANALYSES

PASS

FAIL

NA

1. Laboratory blanks are acceptable
2. QC check samples %R were within control limits and source given
3. GC/MS properly tuned with BFB or DFTPP
4. GC/MS continuing calibration (SPCC and CCC) standards within acceptable control limits
5. Matrix spikes or reagent water spikes %R within control limits
6. Matrix spike duplicates %R within control limits
7. RPD of matrix spike duplicate or reagent water spike duplicate was within control limits
8. Surrogate spikes within control limits
9. Laboratory duplicates have acceptable RPD

COMMENTS:

DATA VALIDATION QUALIFIER CODES
FOR ORGANIC ANALYSES

U J C B E R CODES
s * +

The analytical data
validation level is
(check one):

EXPLANATION: _____

FINAL CONCLUSION: _____

VALIDATION PERFORMED BY: _____

REPORTING QUALIFIERS:

- U code: Indicates that compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g., 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read: U-Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.
- J code: Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the specified detection limit but greater than zero (e.g., 10J).
- C code: This flag applies to pesticide parameters where the identification has been confirmed by GC/MS. Single component pesticides ≥ 10 ng/ul in the final extract should be confirmed by GC/MS.
- B code: This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.
- E code: Indicates a value estimated or not reported due to the presence of interference. Explanatory note included on cover page.
- R code: Indicates spike sample recovery is not within control limits.
- s code: Indicates value determined by Method of Standard Addition.
- * code: Indicated duplicate analysis is not within control limits.
- + code: Indicates the correlation coefficient for method of standard addition is less than 0.995.
- Other: Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the data summary report.

DATA CLASSIFICATION SUMMARY CHECKLIST

Class A Criteria

Matrix Ground Water

To be classified for Class A use, the data must meet the following criteria:

Criteria	Evaluation Result
1. Sampling dates were recorded;	
2. Signatures of Sampling Team on each water sample log or soil sample log;	
3. Sampling locations were clearly designated and described;	
4. Sampling depth increment for soils was recorded;	
5. Sample collection technique was described on water sample log or soil sample log;	
6. Field preparation techniques were clearly described where applicable;	
7. Sample preservation techniques were clearly described, consistent, and adequate for the parameters to be analyzed and the sample matrix;	
8. Shipping bill of lading or constant surveillance documentation is available;	
9. The laboratory sample preparation or extraction date is recorded and available;	
10. The laboratory sample analysis date is recorded and available;	

Class A Criteria (continued)

Criteria	Evaluation Result
11. The laboratory sample preparation technique is recorded and available either in the laboratory report or in the laboratories approved SOP;	
12. The methods of analysis are listed in the laboratory reports and are consistent with the methods specified in the QAPP and laboratory contract;	
13. The laboratory analytical detection limits or limits of quantitation (LCQ) are given in lab reports and are adequate for project objectives;	
14. Field records include: <ul style="list-style-type: none">• Soil/sediment log sheets• Water sampling log sheets• QC field checklist• Field instrument calibration logs• Master bound log book with sequentially numbered pages• Daily log book• Chain-of-custody forms	
15. All applicable records described above were properly created and are on file;	
16. Samples passed laboratory data validation without any R flags (samples with J flags may be accepted at this level).	

Remarks:

Conclusion:

DATA CLASSIFICATION SUMMARY CHECKLIST

Class B Criteria

Matrix: Ground Water

To be classified for Class B use, the data must meet the following criteria:

Criteria	Evaluation Result
<p>A. <u>Data Validation Result</u></p> <ol style="list-style-type: none">1. Samples of this matrix have not been flagged J or R during data validation;2. All samples of this matrix have been classified as Level A data;	
<p>B. <u>Quantitative Statistical Significance</u></p> <ol style="list-style-type: none">1. Laboratory and field instruments were properly standardized (calibrated) employing proper methods and records are available;2. Sample bottle preparation was proper and appropriate for the parameters measured and the sample matrix;3. All laboratory procedures were referenced to approved EPA methods and were contained in an approved SOP manual;4. Analytical QC data was available to demonstrate proper instrument calibration;5. Laboratory QC check sample standards are EPA and NBS traceable and were used at least once each three months;6. Laboratory reagent (method) blanks were analyzed at a frequency of at least 1 per 20 samples;	

Class B Criteria (continued)

Criteria	Evaluation Result
7. Laboratory duplicates were analyzed at a frequency of at least 1 per 20 samples;	
8. Laboratory matrix spikes and matrix spike duplicates were analyzed at a frequency of at least 1 per 20 samples;	
9. Field replicates if required were analyzed at a frequency of at least 1 per 10 samples;	
10. Field blanks were submitted at a frequency of at least 1 per 20 samples;	
11. One trip blank was submitted for VOCs analysis with each cooler;	
12. Field split samples if required were analyzed at a frequency of at least 1 per 20 samples per matrix;	
13. Appropriate and sufficient QC data with acceptance criteria were presented to allow data validation by the project QA officer;	
14. If required for the project, the laboratories used were approved by the EPA for participation in the Contract Laboratory Program (CLP);	
15. The laboratories participated in round-robin testing program by WPA or other accrediting agency;	
16. Quality control limits were consistent with or exceed the limits established by the EPA for all methods of analysis or the EPA CLP;	
17. All samples submitted were analyzed for the requested parameters.	

Class B Criteria (continued)

Criteria	Evaluation Result
C. <u>Custody and Document Control</u>	
<ol style="list-style-type: none"><li data-bbox="228 499 706 569">1. Field custody of all samples was noted in a bound field log book;<li data-bbox="228 579 816 705">2. Transfer of custody documentation (chain-of-custody form) signed by field and laboratory sample custodians is available and properly completed;<li data-bbox="228 716 812 821">3. Laboratory custody is documented by a designated lab sample custodian in a master log and a secured sample storage area;<li data-bbox="228 831 787 936">4. Sample identification and assigned laboratory tracking numbers are traceable through the entire monitoring system;<li data-bbox="228 947 829 1094">5. Field notebooks, log sheets, log books, checklists, reports, data validations, and all custody documents are stored in a secure repository or under the control of a document custodian;<li data-bbox="228 1104 735 1209">6. All records, forms, log books, etc., are filled out completely in indelible ink without alterations except as initialed;<li data-bbox="228 1220 703 1283">7. All sample log sheets have been signed by the sample collector;<li data-bbox="228 1293 711 1356">8. Field log book sheets signed by the field sample custodian.	
D. <u>Sample Representativeness</u>	
<ol style="list-style-type: none"><li data-bbox="228 1455 816 1560">1. Compatibility exists between field and laboratory measurements or incompatibilities have been suitably explained;	

Class B Criteria (continued)

Criteria	Evaluation Result
2. Laboratory analysis and/or sample preparation or extraction were within allowable holding times established for the sample preservation and methods used;	
3. Sample storage was maintained within suitable temperature, light and moisture conditions to guarantee sample integrity;	
4. Proper sample containers were used for the parameters analyzed;	
5. Proper sample collection equipment was used such that the equipment would neither contribute nor remove any substance to or from the sample;	
6. The sample site selection criteria are consistent with the objectives of the investigation and will provide the required data.	

Remarks:

Conclusion:

APPENDIX C
USATHAMA METHODS

R. B. Baylock ^{6/29}

CERTNF/UW14.1
06/30/88

USATHAMA METHOD NUMBER: UW14

DETERMINATION OF EXPLOSIVES IN WATER
BY HIGH PRESSURE LIQUID CHROMATOGRAPHY

I. SUMMARY

A. ANALYTES

This method is applicable to the Class 1 analysis of the following organic compounds in environmental water samples.

Analytes

- 1,3-Dinitrobenzene
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- EMX (octahydro-1,3,5,7-tetranitro-s-tetrazocine)
- Nitrobenzene
- RDX (hexahydro-1,3,5-trinitro-s-triazine)
- Tetryl (N-methyl-N,2,4,6-tetranitrobenzenamine)
- 1,3,5-Trinitrobenzene
- 2,4,6-Trinitrotoluene

B. MATRIX

This method is applicable to all environmental water matrices.

C. GENERAL METHOD

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Detection Limit 5 ppb

CERTNF/UW14.2
06/30/88



II. APPLICATION

A. TESTED CONCENTRATION RANGE.

The certification testing ranges in micrograms per liter (ug/L) are:

Analyte	Tested Range (ug/L)
1,3-Dinitrobenzene	0.501 - 40.1
✓ 2,4-Dinitrotoluene	0.503 - 40.2
✓ 2,6-Dinitrotoluene	0.655 - 52.4
✓ HMX	0.361 - 28.9
Nitrobenzene	0.686 - 54.9
✓ RDX	0.549 - 43.9
✓ Tetryl	0.556 - 44.5
✓ 1,3,5-Trinitrobenzene	0.526 - 42.1
✓ 2,4,6-Trinitrotoluene	0.502 - 40.2

C. SENSITIVITY

The instrumental responses for each compound, reported in peak area units at the certified reporting limit (CRL) are

Analyte	Certified Reporting Limit (ug/L)	Area Counts
1,3-Dinitrobenzene	0.519	75000
2,4-Dinitrotoluene	0.612	80300
2,6-Dinitrotoluene	1.15	83200
HMX	1.65	43700
Nitrobenzene	1.07	104000

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RDX	2.11	85100
Tetryl	0.556	36300
1,3,5-Trinitrobenzene	0.626	63100
2,4,6-Trinitrotoluene	0.588	58700

C. REPORTING LIMITS.

The certified reporting limits and upper certified limit for each analyte in environmental water samples are:

Analyte



1,3-Dinitrobenzene	0.519	40.1
2,4-Dinitrotoluene	0.612	40.2
2,6-Dinitrotoluene	1.15	52.4
HMX	1.65	28.9
Nitrobenzene	1.07	54.9
RDX	2.11	43.9
Tetryl	0.556	44.5
1,3,5-Trinitrobenzene	0.626	42.1
2,4,6-Trinitrotoluene	0.588	40.2

D. INTERFERENCES.

Any materials which are adsorbed from water on the cartridge, coelute with the explosives through the HPLC column, and which absorb ultraviolet radiation at 250 nm may cause interferences.

The Porapak R material must be thoroughly cleaned to minimize interference. A late eluting component arising from the Porapak R required a 5 minute delay in sample injection following analysis of an extract. Carryover from analysis of a highly contaminated sample can result in apparent contamination of the succeeding samples analyzed. Such contamination is

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often manifest by the presence of unusually broad chromatographic peaks nested among narrower peaks. This interference is minimized by reanalyzing heavily contaminated samples following dilution, running blanks after heavily contaminated samples until carry over is removed, and/or rinsing the system with a mobile phase containing a high proportion of organic modifier until the contamination is removed.

V.I.P.
E. ANALYSIS RATE.

After instrument calibration, one analyst can analyze approximately 8 samples per 8-hour day.

F. SAFETY INFORMATION.

The target compounds in this method are toxic explosives and some are known carcinogens, e.g. 2,4-Dinitrotoluene. The preparation of all standards should be performed in a laboratory hood. Adequate dermal protection must be used when handling samples and standards.

Most of these compounds are either primary or secondary explosives and should be handled with care to avoid contact with electrostatic shocks or impacts. Tetryl and RDX have intermediate sensitivity between initiating explosives and explosives used as bursting charges. Tetryl is toxic when taken internally or by skin contact. RDX, EMX, and TNT are used as bursting charge explosives. Although TNT is less sensitive to friction and impact than many other high explosives, it can be detonated with moderate force when confined between metal surfaces such as on the threads of bolts. TNT will form sensitive materials in the presence of alkalies.

CERTNF/UW14.5
06/30/88**III. APPARATUS AND CHEMICALS.****A. GLASSWARE/HARDWARE.**

1. Sorbent Cartridge - 6 mL OctyL Disposable Extraction Columns (J.T. Baker, Phillipsburg, N.J.) were used. After removing the top plug and the packing material, 0.5 gm of cleaned Porapak R was added to each tube.
2. Baker 10 Solid Phase Extraction System, (J.T. Baker, Phillipsburg, NJ) including manifold, 75 mL reservoirs and adapters.
3. Class A Volumetric flasks - 10, 100 and 500 mL.
4. Class A Volumetric pipets - 0.5, 1.0, 2.0 mL.
5. Aspirator
6. Disposable micro pipets - 25, 50, 100 and 200 uL.

B. INSTRUMENTATION

1. HPLC: Shimadzu model LC-6A high-pressure liquid chromatograph (or, equivalent).
- ② Detector: Perkin-Elmer LC-75 variable wavelength ultraviolet absorbance detector (UV) set at 250 nanometers.
- ③ Column: Zorbax ODS (octadecylsilane), reverse-phase column, 25 centimeters (cm) length x 4.6 millimeters (mm) I.D., 5 micrometers (um) particle size (Mac-Mod Analytical Inc., Chadds Ford, PA).
4. Altex 210A Injection Valve, (Beckman Instr. Inc., Berkeley, CA).
- ⑤ Mobile phase: Isocratic, 25% methanol/17% acetonitrile/48% water.
- ⑥ Flow rate: 1.0 milliliters per minute (mL/min).
- ⑦ Sample Volume: 500 microliters (uL).

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C. ANALYTES

<u>Analyte</u>	<u>USATHAMA Abbrev.</u>	<u>CAS Number</u>
1,3-Dinitrobenzene	DNB	99-65-01
2,4-Dinitrotoluene	24DNT	121-14-2
2,6-Dinitrotoluene	26DNT	606-20-2
HMX	HMX	2691-41-0
Nitrobenzene	NB	98-95-3
RDX	RDX	121-84-4
Tetryl	TETRYL	479-45-8
1,3,5-Trinitrobenzene	TNB	25377-32-6
2,4,6-Trinitrotoluene	TNT	118-96-7

D. REAGENTS AND SARMS

1. The standards used for target compound certification and calibration are USATHAMA supplied standard analytical reference materials (SARMS). Equivalent standards may be used as long as they have been characterized according to Section 6.5.3 of the USATHAMA Quality Assurance Plan (2nd Edition, March, 1987). USATHAMA SARMS were used in this certification, and their lot numbers are listed below:

<u>Analyte</u>	<u>SARM LOT NUMBER</u>
1,3-Dinitrobenzene	2250
2,4-Dinitrotoluene	1147
2,6-Dinitrotoluene	1148
HMX	1217
Nitrobenzene	2177
RDX	1130
Tetryl	1149
1,3,5-Trinitrobenzene	1154
2,4,6-Trinitrotoluene	1129

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2. Methanol (HPLC grade - American Burdick & Jackson, McGaw Park, Illinois).
3. Water (ASTM Type II/HPLC grade - American Burdick & Jackson, McGaw Park, Illinois).
4. Acetonitrile (HPLC grade - American Burdick & Jackson, McGaw Park, Illinois).
5. Acetone (HPLC grade - American Burdick & Jackson, McGaw Park, IL).
- ⑥ Porapak R, 80-100 Mesh - (Suplaco, Inc., Bellefont, PA), cleaned by six acetone extractions, six acetonitrile extractions and six methanol extractions followed by air drying. (75 cc of the resin was contacted with 200 mL of solvent for 10 minutes in a sonicator at each extraction step.

IV. CALIBRATION

A. INITIAL CALIBRATION.

1. Preparation of Standards.

Precertification Calibration. Separate primary stock standards (SPSS) for each target analyte are prepared according to the dilution scheme presented in Table 4-1. The SPSS solutions should be prepared fresh every 2 months. Tetrayl needs to be made fresh every 2 weeks. Each separate stock solution is made to volume with acetonitrile.

Aliquots of the separate primary stock standards (SPSS) are used to prepare the combined stock standard (CSS) by dilution to a final volume of 10 mL using acetonitrile as described in Table 4-2. The CSS solution should be prepared fresh every day.

For precertification calibration, duplicate composite

Table 4-1. Preparation of Separate Primary Stock Standards (SPSS).

Analyte	13DNB	24DNT	26DNT	RMX	NB	RDX	TETRYL	135TNB	246TNF
mg SARM added	100.2	100.5	13.1	97.6	13.7	109.8	27.8	105.2	100.4
Final Volume (ml)	100	100	10.0	100	10.0	100.0	25	100	100
Conc. of SPSS (ug/ml)	1002	1005	1310	976	1370	1098	1112	1052	1004

Note: Each SARM diluted to the volume indicated with acetonitrile.

Source: ESE, 1988.

Table 4-2. Preparation of Composite Stock Standard (CSS).

Analyte	13DNB	24DNT	26DNT	HMX	NB	RDX	TETRYL	135TNB	246TNT
ml SPSS added	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Final Volume (ml)	10	10	10	10	10	10	10	10	10
Conc. of CSS (ug/ml)	10.02	10.05	13.1	9.76	13.7	10.98	11.12	10.52	10.04

Note: Acetonitrile used for dilution to the 10 ml final volume for the Composite Stock Standard (CSS).

Source: ESE, 1988.

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calibration standards (CCS-1 through CCS-7) are prepared from the combined stock standard (CSS) as given in Tables 4-3 and 4-4. HPLC-grade water is used for dilution to final volumes for the composite calibration standards. Standards are prepared fresh daily.

Initial Calibration. Standards CCS-1, CCS-3, CCS-5, CCS-6, CCS-7, and a blank described in Tables 4-3 and 4-4 are prepared. These solutions are prepared fresh for every run. Reference materials are not available for verification of the calibration curve, therefore staggering of spikes will be important.

2. Instrument Calibration.

To calibrate the instrument, 500 μL of each standard in Tables 4-3 and 4-4 is injected into the instrument in the same manner as a sample extract. Each duplicate composite calibration standard is analyzed during precertification calibration, and the single dilutions of the composite standards are analyzed during initial calibration.

3. Independent Reference Standard.

An independent stock will be prepared to serve as a reference standard for explosives in water. The independent reference standard must be analyzed along with the initial and precertification calibration standards, and the results must be within $\pm 25\%$ of the expected value, for the calibration to be considered valid. If the analysis of the independent reference standard fails, the source of the problem must be identified and corrected. The results of the second analysis of the independent reference standard must be within the acceptable limits before the analysis of samples may proceed. Since a new initial calibration is

Table 4-3. Preparation of Composite Calibration Standards 1 Through 4 (CCS-1 through CCS-4).

Analyte	13DNB	24DNT	26DNT	BMX	NB	RDX	TETRYL	135TNB	246TNT
Conc. in CCS-1 (ug/L)	2000	2010	2620	1950	2740	2200	2220	2100	2010
Conc. in CCS-2 (ug/L)	1000	1010	1310	976	1370	1100	1110	1050	1000
Conc. in CCS-3 (ug/L)	501	503	655	488	686	549	556	526	502
Conc. in CCS-4 (ug/L)	200	201	262	195	274	220	222	210	201

Note: CCS-1 prepared by diluting 2.0 mL of CSS to 10 mL with ASTM Type II/HPLC-grade water.
 CCS-2 prepared by diluting 1.0 mL of CSS to 10 mL with ASTM Type II/HPLC-grade water.
 CCS-3 prepared by diluting 0.5 mL of CSS to 10 mL with ASTM Type II/HPLC-grade water.
 CCS-4 prepared by diluting 0.2 mL of CSS to 10 mL with ASTM Type II/HPLC-grade water.

Source: ESE, 1988.

Table 4-4. Preparation of Composite Calibration Standards 1 Through 4 (CCS-5 through CCS-7).

Analyte	13DNB	24DNT	26DNT	BMX	NB	RDY	TETRYL	135TNB	246TNT
Conc. in CCS-5 (ug/L)	100	101	131	97.6	137	110	111	105	100
Conc. in CCS-6 (ug/L)	50.1	50.3	65.5	48.8	68.6	54.9	55.6	52.6	50.2
Conc. in CCS-7 (ug/L)	25.1	25.1	32.8	24.4	34.3	27.5	27.8	26.3	25.1

Note: CCS-5 prepared by diluting 0.1 mL of CSS to 10 mL with ASTM Type II/HPLC-grade water.
 CCS-6 prepared by diluting 0.05 mL of CSS to 10 mL with ASTM Type II/HPLC-grade water.
 CCS-7 prepared by diluting 0.025 mL of CSS to 10 mL with ASTM Type II/HPLC-grade water.

Source: ESE, 1988.

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performed daily, a reference is required at least weekly.

4. Analysis of Calibration Data.

After analyzing the standards (i.e., one blank and seven standards), the data are tabulated and graphed. For precertification calibration, the duplicate calibration data are analyzed using the lack of fit (LOF) and zero intercept (ZI) tests (USATHAMA QA Plan, 2nd Edition, March, 1987).

B. DAILY CALIBRATION.

1. Preparation of Standards

The daily calibration standards are CCS-1, CCS-3, CCS-5, CCS-6, CCS-7, and a blank as presented in Tables 4-3 and 4-4. These standards must be prepared fresh daily. The daily calibration curve used by ESE for this method is actually the same as an initial calibration curve defined by the USATHAMA QA Plan, March 1987.

2. Instrument Calibration

At the beginning of each analytical run, inject 500 ul of each standard presented in Section IV.B.1, above. At the end of the analytical run, the CCS-1 standard will be analyzed.

3. Analysis of Calibration Data

The response for the target compounds does not have to be less than 25 percent different from the response obtained during the previous initial calibration, because each run is an initial calibration. Since reference solutions are not readily available, responses should be monitored to evaluate trends changes in stocks. It is advised that stocks for standards and spike solutions be staggered to monitor for degradation of the solutions.

The response of the target compounds in the end run

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standard (CSS-1) must be less than 25 percent different from response factors obtained from the CSS-1 standard analyzed at the beginning of the day. If the response is greater than 25 percent different, the standard will be reanalyzed. If reanalysis still fails the 25-percent criterion, a new initial calibration must be performed and all analyses since the last acceptable calibration must be repeated. After seven calibrations have been completed, the end of run response must agree to within two times the standard deviation of the mean response rather than a percentage. Failure of the tighter criteria will not be an automatic requirement for reanalyses if documentation exists to ensure that data quality of the samples is not affected by instrument drift (i.e. increase in sensitivity and all samples less than the CRL). In addition, drifts outside criteria and within 25 percent should be evaluated in the light of expected method performance.

V. CERTIFICATION TESTING.

Spiked samples for certification testing are prepared in standard water (ASTM Type II grade water containing 100 mg/L of sulfate and chloride, see Section 4.5.1 of the USATHAMA QA Plan, March, 1987 Edition) as outlined in Tables 4-5 and 4-6. A composite stock standard (CSS) (see Table 4-2) is prepared for use as a spiking solution. Spiking is performed for certification testing on four separate days. Analysis of the spiked samples follows the procedure outlined in Section VII.

The target versus found data are analyzed using the lack of fit (LOF) and zero intercept (ZI) tests (USATHAMA QA Plan, March, 1987). The result of these tests and the certification data are presented in Section XI.D (see Attachment 3) for each target analyte.

Table 4-5 Spiking Scheme for Certification Testing (0X through 2X levels).

Analyte	HMX	RDX	TNB	DNB	NB	Tetryl	TNT	26DNT	24DNT
Conc. in 0X (ug/L) Level	0	0	0	0	0	0	0	0	0
Conc. in 0.5X (ug/L) Level	0.361	0.549	0.526	0.501	0.686	0.556	0.502	0.655	0.503
Conc. in 1X (ug/L) Level	0.722	1.10	1.05	1.00	1.37	1.11	1.00	1.31	1.01
Conc. in 2X (ug/L) Level	1.44	2.20	2.10	2.00	2.74	2.22	2.01	2.62	2.01

Note: 0X Level was 500 ml. of unspiked standard water.
 0.5X Level prepared by spiking 25 ul. of CSS into 500 mL of standard water.
 1X Level prepared by spiking 50 ul. of CSS into 500 mL of standard water.
 2X Level prepared by spiking 100 ul. of CSS into 500 mL of standard water.

Source: ESE, 1988

Table 4-6 Spiking Scheme for Certification Testing (5X through 40X levels).

Analyte	HMX	RDX	TNB	DNB	NB	TetryL	TNT	26DNT	24DNT
Conc. in 5X (ug/L) Level	3.61	5.49	5.26	5.01	6.86	5.56	5.02	6.55	5.03
Conc. in 10X (ug/L) Level	7.04	11.0	10.5	10.0	13.7	11.1	10.0	13.1	10.1
Conc. in 20X(ug/L) Level	14.4	22.0	21.0	20.0	27.4	22.2	20.1	26.2	20.1
Conc. in 40X(ug/L) Level	28.9	43.9	42.1	40.1	54.9	44.5	40.2	52.4	40.2

Notes: 5X Level prepared by spiking 250 ul of CSS into 500 ml of standard water.
 10X Level prepared by spiking 0.50 ml of CSS into 500 ml of standard water.
 20X Level prepared by spiking 1.0 ml of CSS into 500 ml of standard water.
 40X Level prepared by spiking 2.0 ml of CSS into 500 ml of standard water.

Source: ESE, 1988.

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06/30/88**VI. SAMPLING HANDLING AND STORAGE****A. SAMPLING PROCEDURE**

Samples will be collected using adequate dermal and inhalation protection and must follow Sections 5.6 and 5.7 of the USATHAMA Quality Assurance Plan (March 1987).

B. CONTAINERS

One Liter amber colored glass jars with Teflon-lined lids are required.

C. STORAGE CONDITIONS

Samples and extracts should be kept chilled to 4 C and in the dark.

D. HOLDING TIME LIMITS

Samples must be extracted within 7 days of sampling date, and the extract must be analyzed within 40 days of extraction date.

E. SOLUTION VERIFICATION

Verification of the calibration standards is based on the analyses of daily QC spikes and analysis of independent reference standards (if available). Since stable reference solutions are not readily available, staggered preparation of stock solutions for control spikes and standards needs to be implemented to ensure acceptable solution verification. An unextracted control spike solution should be analyzed weekly as a reference to check extraction and storage affects. The recovery of this reference must be within 25 percent of the true value or ± 2 standard deviations for recent performance (last 7 runs). If criteria cannot be met for the target compounds new stock solutions might need to be prepared.

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06/30/88**VII. PROCEDURE****A. EXTRACTION**

A 6 mL Baker Disposable Extraction Column is repacked with 0.5 grams of cleaned Porapak R. The column is rinsed with 15 mL of acetonitrile and 30 mL of water. 500 mL of the sample is measured out and passed through the column at a rate of 10 mL/minute. The column is then slowly eluted with 3 mL of acetonitrile which is collected in a 10 mL volumetric flask. The extract is diluted to volume with ASTM Type II/HPLC water.

B. CHEMICAL REACTIONS.

This method does not involve any chemical reactions.

C. INSTRUMENTAL ANALYSIS

Instrumental analysis involves injection of 500 mL of the extract onto the analytical column described in Section III.B. The instrumental conditions are specified in Section III.B.3, and the integrated output of the UV detector is used in the calculations of Section VIII. A six minute delay of injection is required following analysis of any extracts to allow a late eluting component (arising from the Porapak R) to elute.

VIII. CALCULATIONS

A linear regression equation is calculated from calibration data by regressing the response versus the concentration for each compound. The concentration of a target compound in the sample extract is calculated by substituting the response into the calibration curve equation. The same injection volume is used for standards and sample extracts. The following formula is used to calculate the analytical concentration in the

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samples (SC).

$$SC \text{ (ug/L)} = \frac{EC \times EV}{SV}$$

Where:

EC is the extract concentration determined from the calibration curve in ug/L.

EV is the extract volume (10 mL).

SV is the sample volume (500 mL).

Method blank correction may be necessary and can be in terms of instrument response or concentration of the blank.

IX. DAILY QUALITY CONTROL

A. CONTROL SAMPLES.

Daily quality control samples consist of a standard matrix method blank (ASTM Type I water), duplicate spikes at the upper concentrations of the certified range, and a single level spike at approximately twice the certified reporting limit. These quality control samples should be carried throughout the entire method at the same time samples are run. Primary Stock Standards (SPSS) at a concentration of 1000 mg/L are weighed up using 0.010 gm of each analyte diluted to 10 mL of acetonitrile. The SPSS are diluted to obtain a daily control spiking solution (DCSS) as presented in Table 4-7. Table 4-8 shows how the daily control spikes are prepared. Control analytes for this method are RDX, NB, TNE, TNT, and 24DNT.

B. CONTROL CHARTS.

Control charts are prepared for all of the target analytes

Table 4-7 Preparation of Daily Control Spiking Solution (DCSS).

Analyte	13DNB	24DNT	26DNT	HMX	NB	RDX	TETRYL	135TNB	246TNT
ml SPSS added	0.1	0.1	0.1	0.2	0.1	0.2	0.05	0.1	0.1
Final Volume (ml)	10	10	10	10	10	10	10	10	10
Conc. of CSS (ug/ml)	10.0	10.0	10.0	20.0	10.0	20.0	10.0	10.0	10.0

Note: Acetonitrile used for dilution to the 10 ml final volume for the Daily Control Spiking Solution (DCSS).

Source: ESE, 1988.

Table 4-8. Daily Control Spiking Scheme

	Spiking Volume of DCSS (mL)	Final Volume (mL)	13DNB	24DNT	26DNT	HMX	NB	RDX	TetryL	135TNB	246TNT
Low Level Spike	0.1	500	2.00	2.00	2.00	4.00	2.00	4.00	2.00	2.00	2.00
High Level Spike	1.0	500	20.0	20.0	20.0	40.0	20.0	40.0	20.0	20.0	20.0

Note: Standard Water (See Section V) used for dilution to the 500 mL final volume for the Spikes.

Source: ESE, 1988.

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being analyzed for using the percent recovery data from both the duplicate high level spikes and the low level spikes calculated according to the following equation:

$$\ast \text{ Recovery} = \frac{\text{Found Conc.}}{\text{Spiked Concentration}} \times 100 \text{ percent}$$

The found response is corrected for method blank response prior to calculation of the found concentration. Method blank correction may be in terms of instrument response or in terms of the concentration in the blank.

Preparation of control charts requires the following data:

1. Average percent recovery (X) of the two high concentration spiked QC samples in each lot,
2. Difference (R) between the two high concentration spiked QC samples in each lot,
3. Three-point moving average (X) percent recovery control chart for the low level spike in each lot, and
4. Three-point moving average difference (R) control chart for the high concentration spike.

For values that fall outside the control limits and data points that are deemed as outliers, the data will be evaluated and corrective action will be taken.

X. REFERENCES.

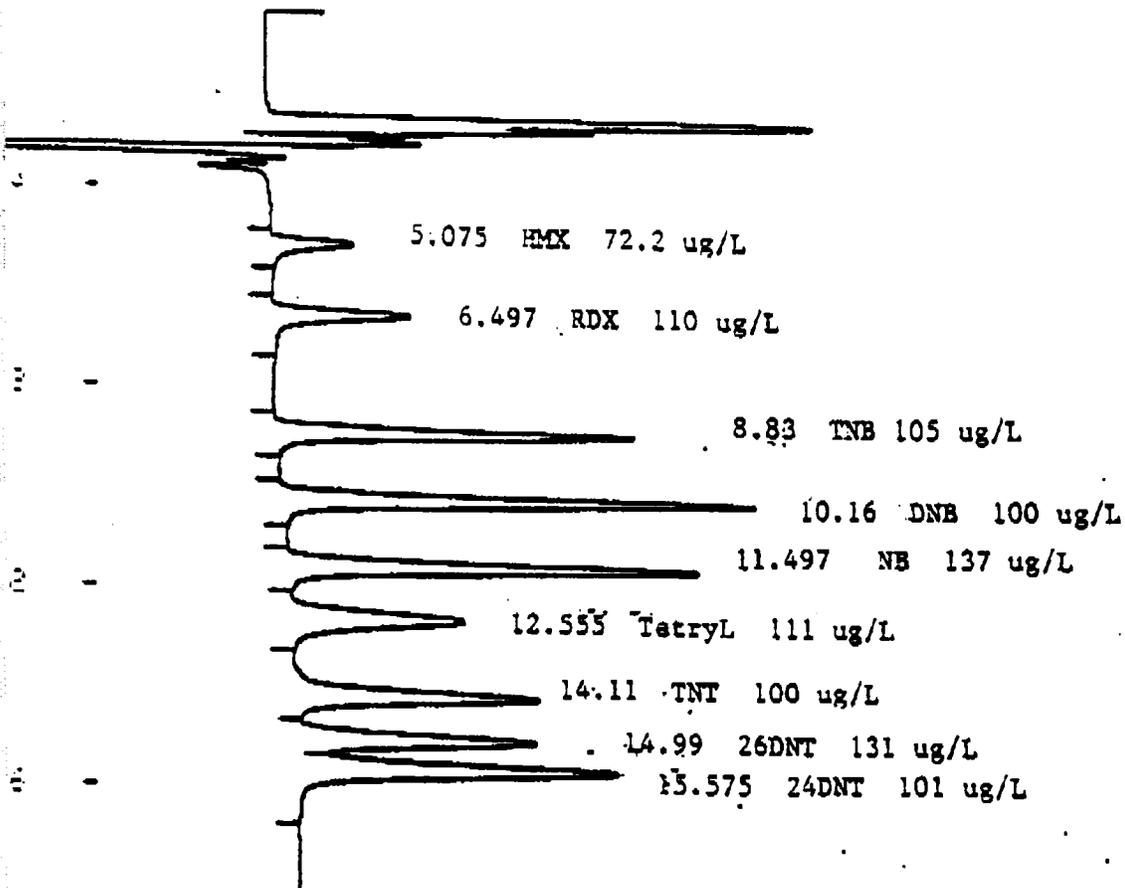
- A. U.S. Army Toxic and Hazardous Materials Agency, 1987, USATHAMA QA Program (December 1985, 2nd Ed., March 1987).

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xI. DATA

- A. OFF-THE-SHELF ANALYTICAL REFERENCE MATERIALS CHARACTERIZATION**
Only SARMS were used in this certification.
- B. INITIAL/PRE-CERTIFICATION CALIBRATION - see ATTACHMENT 1.**
Response of each target analyte is tabulated at each calibration target concentration. The results from the lack of fit (LOF) and zero intercept (ZI) tests are presented.
- C. DAILY CALIBRATION DURING CERTIFICATION - see ATTACHMENT 2.**
Calibration responses and required percentage on the end run standard.
- D. STANDARD CERTIFICATION SAMPLES - see ATTACHMENT 3.**
- E. INDEPENDENT REFERENCE STANDARDS DURING CERTIFICATION - see ATTACHMENT 4.**

CHROMATOGRAM OF EXPLOSIVES IN WATER



6.0 HEALTH AND SAFETY PLAN

6.1 INTRODUCTION

The following is the Health and Safety Plan for the Stump Neck Annex, Indian Head, Maryland RCRA Facility Investigation (RFI). The investigation is being conducted to: a) determine the nature, extent, concentration, and rate of migration of hazardous waste or hazardous constituents from each SWMU into ground water, surface water, soils, and sediments; b) identify potential receptors; c) provide detailed geologic and hydrogeologic characterization of the area surrounding and underlying each SWMU; d) determine the need for and scope of corrective measures; and e) to generate the information described in permit condition II.C.3. of permit #MD 417-009-0001.

6.2 APPLICABILITY

The provisions of this plan are mandatory for all on site EnSafe/Allen & Hoshall employees and EnSafe/Allen & Hoshall subcontractors engaged in on-site operations who will be exposed or have the potential to be exposed to on-site hazardous substances.

EnSafe/Allen & Hoshall subcontractors may choose to use this health and safety plan as a guide in developing their own plan or may choose to adopt in full (by giving formal written notice to EnSafe/Allen & Hoshall) the EnSafe/Allen & Hoshall plan. If the EnSafe/Allen & Hoshall plan is adopted, all personnel assigned to field activities for the project must read and sign the plan acceptance form before commencing site activities. EnSafe/Allen & Hoshall reserves the right to review and approve the subcontractor's plan at any time. In either case subcontractors will hold EnSafe/Allen & Hoshall

harmless from, and indemnify it against, all liability in the case of any injury. At a minimum, all provisions of the EnSafe/Allen & Hoshall health and safety plan will be followed.

Inadequate health and safety precautions by the subcontractor or the belief that the subcontractor's personnel are or may be exposed to an immediate health hazard, can be cause for EnSafe/Allen & Hoshall to suspend the site work and ask the subcontractor to evacuate the hazard area.

All EnSafe/Allen & Hoshall subcontractors, and EnSafe/Allen & Hoshall personnel will be responsible for operating in accordance with the most current Occupational Safety and Health Administration (OSHA) regulations including 29 CFR 1910.120 - Hazardous Waste Operations and Emergency Response. These regulations include the following provisions for employees exposed to hazardous substances, health hazards, or safety hazards: training as described in 120(e), medical surveillance as described in 120(f), and personal protective equipment described in 120(g).

6.3 SITE CHARACTERIZATION

6.3.1 SITE CONTROL

Site control will be established and maintained according to the recommendations set forth in the EPA's "Interim Standard Operating Safety Guides, Revised September, 1982". Three general zones of operation will be established to reduce the potential for contaminant migration and risk of personnel exposure. These zones are (1) the exclusion zone, (2) the contamination reduction zone and (3) the support zone. The

exclusion zone will be located such that the area between the decontamination station and the site will be included; the contamination reduction zone will include the decontamination station and the support zone will be located beyond the contamination reduction zone. Only authorized personnel with a minimum of 40 hours health and safety training meeting the requirements of OSHA 29 CFR 1910.120 are permitted within the exclusion and contamination reduction zones. The exclusion zone is considered contaminated and all personnel within the area must use the prescribed level of personal protection. A checkpoint will be established at the periphery of the exclusion zone to regulate the flow of personnel and equipment in and out of the area. The exclusion zone boundary is the "hotline".

A check in/check out log will be kept at the checkpoint established at the periphery of the exclusion zone. All personnel crossing the "hotline" will be required to log in and log out prior to and after each ingress/egress cycle. The check in/check out log will include name, signature, site function/reason for visit, company/organization affiliation, and date and time of ingress and egress. The log will be retained at the operations trailer/command post during non-work hours. An example of log format is provided in Section 7.11-Forms.

All personal crossing the hotline into the exclusion zone must be done using the "buddy system".

The "buddy system" as used in this document means that the person entering the exclusion zone is accompanied by a person who is able to:

- Provide his/her partner with assistance.

- Observe his/her partner for signs of chemical or heat/cold exposure.
- Periodically check the integrity of his/her partner's protective clothing.
- Notify the shift supervisor or his representative or others if emergency help is needed.

Additionally, at least one person shall remain outside the exclusion zone and have available at least the same level of PPE as the "buddies" that are entering the exclusion zone. This person will act as the safety observer and perform the security duties described in section 7.9 of this plan.

The contamination reduction zone serves as a buffer between the exclusion zone and the support zone and is intended to prevent the spread of contaminants from the work areas. All decontamination procedures will be conducted in this area. Entry into the contamination reduction zone from the support zone will be through a controlled access point. Personnel entering into this area must wear the prescribed personal protective equipment. Exit from the contamination reduction zone requires the removal of all contaminants through compliance with established decontamination procedures.

The support zone is the outermost zone and is considered a non-contaminated or clean area. The command post for field operations, first aid station and other site support elements are located in this area. The location of the command post was determined by the topography of the terrain.

Due to the unique nature of this facility as an explosive ordnance disposal station, special precautions will be taken to ensure the safety of all personnel. Previous to any and all investigation of known or suspected areas, by Ensafe/Allen & Hoshall personnel

or their subcontractors, in which ordnance may be interned an explosive ordnance disposal (EOD) unit, either Naval or civilian contract, shall certify the area safe for drilling activity.

6.3.2 SITE COMMUNICATIONS

Communications between team members (including persons responsible for team safety) will be through the use of intrinsically safe Kenwood FM radios. Radios will be checked daily prior to commencing field operations to ensure proper operation. Radios will be maintained in accordance with the manufacturer's recommendations. These forms of communication will be used to:

- Alert team members of emergency situations
- Transmit safety information
- Communicate changes in work schedule or site conditions
- Maintain site control

External communications between on-site and off-site personnel will be through the use of telephones located in the site office. Additionally, a FAX machine and a PC with a modem for data and electronic mail transmissions will be located in the site office.

These forms of communication will be used to:

- Coordinate emergency response
- File reports
- Maintain contact with off-site personnel

A daily review of safety procedures will be conducted prior to the initiation of site activities. This review will include (but is not limited to):

- Proper function, and donning and doffing of personal protective equipment
- Proper function and maintenance of ambient air monitoring equipment used in conjunction with the Site Health and Safety Plan
- Review of emergency response protocol and plans of action
- Field equipment usage and safety considerations
- Changes or recent manifestations of hazardous conditions at the site which may require modification of established procedures

There will only be one (1) work shift per day for the duration of the Verification Investigations.

6.4 SITE ACTIVITIES

The activities to be performed during the VI will include surface soil sampling, subsurface soil borings, groundwater monitoring well installation and sampling, and waste material sampling for source characterization.

6.5 HAZARD EVALUATION

A review of the site history indicates that the site was used for "OBOD" of high energy explosives (HMX, RDX, and TNT), ordinance disposal, and disposal of other hazardous and nonhazardous wastes. Only the general locations of the buried ordinance are

known. This will be of significant concern when collecting subsurface soil and ground water samples at this site. The site is known to have been used for the disposal of arsenic. The arsenic is reportedly buried in bags in a landfill area on site. Other hazards may also exist, but no preliminary data has been provided or collected.

An initial hazard evaluation will be conducted at the site prior to initiation of site work. The initial hazard evaluation will include air monitoring and soil sampling to determine which contaminants, if any, are present.

Arsenic, a suspected site contaminant, is commonly found as a gray, brittle crystalline solid with a specific gravity of 5.72. It also exists in amorphous forms: black, specific gravity of 4.7 and yellow, specific gravity of 2.0, which is relatively volatile. Yellow arsenic is soluble in carbon disulfide; the other forms are insoluble in water ore solvents, but dissolved by oxidizing acids.

Arsenic is regulated by OSHA as an occupational carcinogen (See 29 CFR 1910.1018 which is included as Appendix A to this plan). Arsenic compounds are irritants of the skin, mucous membranes, and eyes. Arsenical dermatosis and epidermal carcinoma are reported risks of exposure to arsenic compounds, as are other forms of cancer.

Conjunctivitis produced by inorganic arsenical dusts is characterized by itching, burning, and watering of eyes with photophobia and sometimes hyperemia and chemosis. Other chronic effects of arsenic exposure include generalized itching, sore throat, coryza, lacrimation, numbness, burning or tingling of extremities, dermatitis, vitiligo, alopecia.

Upon completion of the initial site sampling, health hazards from other site contaminants, if any, will be evaluated.

6.6 EMPLOYEE PROTECTION

Employee protection for this project includes standard safe work practices, personal protective equipment, procedures and equipment for extreme weather conditions, work limitations and exposure evaluation.

6.6.1 STANDARD SAFE WORK PRACTICES

Standard safe work practices that will be followed include:

- Eating, drinking, chewing gum or tobacco, smoking or any activity that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated, unless authorized by the Site Health and Safety Officer.
- Hands and face must be thoroughly washed upon leaving the work area.
- Contact lenses shall not be worn on site.

FIELD ACTIVITY	MECH. EQUIPMENT USED	ELEC HAZARD	CHEM HAZARD	PHYS. HAZARD	TEMP. HAZARD	ORDINANCE
Surface soil sampling	None	None	Inhalation of dust particles, vapors, or gases. Accidental ingestion, skin absor., eye contact.	Slip, trip, fall.	H/C Stress	Explosives
Subsurface soil sampling	Auger	Check to make sure there are no underground electrical cables	Inhalation of dust particles, vapors, or gases. Accidental ingestion, skin absor., eye contact.	Slip, trip, fall.	H/C Stress	Explosives
Groundwater monitoring well, install.	Drill Rig	None	Inhalation of dust particles, vapors, or gases. Accidental ingestion, skin absor., eye contact.	Struck by, caught between, pinch points on machinery. Slip, trip, fall. Noise.	H/C Stress	Explosives
Surface water sampling	Boat	None	Inhalation of vapors, or gases. Accidental ingestion, skin absor., eye contact.	Slip, trip, fall. Drowning. All work on or near bodies of water require CG approved life jackets.	H/C Stress	Explosives

- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate or discolored surfaces; or lean, sit or place equipment on drums, containers or on soil suspected of being contaminated.
- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on cleanup or response operations where the potential for absorption, inhalation or ingestion of toxic substances exists unless specifically approved by a qualified physician. Consumption of alcoholic beverages should be avoided during operations.
- Under garments should be made from natural fibers (i.e., cotton or wool).

6.6.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The initial sampling of the site for air borne contaminants will be conducted in Level B consisting of a one or two piece chemical resistant suit, chemical-resistant boots with steel toe and steel reinforced puncture resistant sole or equivalent, boot covers, inner and outer gloves and approved positive pressure, self-contained breathing apparatus. This level of protection was chosen because of the unknown nature of the type and concentrations of site contaminants. However, it is anticipated that there are no contaminants on site which would require the use of Level A PPE.

Once initial air sampling is completed, levels of PPE will be assigned based upon the concentrations of all contaminants on site.

During soil sampling in areas suspected of containing arsenic, PPE and monitoring required by 29 CFR 1910.1018 will be followed. The Action Level for organic arsenic is 0.25 mg/m³ and for inorganic arsenic is 5 µg/m³. Above the action levels, positive pressure, self-contained breathing apparatus are required.

Additionally, if the concentrations of respirable airborne dust contaminants exceed 5 mg/m³ or the total concentration of airborne dust contaminants exceed 15 mg/m³, a minimum of Level C respiratory protection will be required.

For additional information on selection of PPE see the Ensafe/Allen & Hoshall Joint Venture "Health and Safety Manual", JVM-1.

6.6.3 PROCEDURES AND EQUIPMENT FOR EXTREME WEATHER CONDITIONS

Field activities for this site are scheduled to last two years. Therefore, both heat and cold stress will be concerns for the health and safety personnel. Adverse weather conditions are important considerations in planning and conducting site operations. Extremes in hot and cold weather can cause physical discomfort, loss of efficiency and personal injury.

6.6.3.1 Heat Stress

Heat stress can result when the protective clothing decreases natural body ventilation even when temperatures are moderate. Working under various levels of personal protection may require the wearing of low permeability disposable suits, gloves and boots. This clothing will prevent most natural body ventilation. Discomfort due to

increased sweating and body temperature (heat stress) will be expected at the work site.

Recommendations to reduce heat stress follow:

- Drink plenty of fluids (to replace loss through sweating).
- Wear cotton undergarments to act as a wick to absorb moisture.
- Make adequate shelter available for taking rest breaks to cool off.

In extremely warm weather, the Site Health and Safety Officer may also require these additional measures:

- Wear cooling devices to aid in ventilation (NOTE: the additional weight may affect efficiency).
- Install portable showers or hose down facilities to cool clothing and body.
- Shift working hours to early morning and early evening. Avoid the hottest time of the day.
- Frequently rotate crews wearing the protective clothing.

6.6.3.2 Cold Exposure

Persons working outdoors in temperatures at or below freezing may experience frostbite or hypothermia. Extreme cold for a short time may cause severe injury to the surface of the body. Areas of the body that have a high surface-area-to volume ratio, such as fingers, toes, and ears are the most susceptible.

Two factors influence the development of cold injury: Ambient temperature and the velocity of the wind. As a general rule, the greatest incremental increase in wind chill

occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus the body cools suddenly when protective equipment is removed if the clothing underneath is soaked with perspiration.

Recommendations to reduce effects of cold exposure:

- Stay dry. When the temperature drops below 40°F, change perspiration soaked clothes frequently. When clothes get wet, they lose about 90% of their insulating value.
- Beware of the wind. A slight breeze carries heat away from bare skin much faster than still air. Wind drives cold air under and through clothing. Wind refrigerates wet clothes. Wind multiplies the problems of staying dry.
- Understand cold. Most hypothermia cases develop in temperatures between 30°F and 50°F. Cold water running down the neck and legs or cold water held against the body by sopping clothes causes hypothermia.
- Make adequate dry, warm shelter available.
- Provide warm drinks.

Never ignore shivering. Persistent shivering is a clear warning that a person is on the verge of hypothermia. Allow for the fact that exposure greatly reduces normal endurance. Physical activity may be the only thing preventing hypothermia.

6.6.4 WORK LIMITATIONS

All site activities will be conducted during daylight hours only. All personnel scheduled for these activities will have completed initial health and safety training which includes

recognition of the symptoms and signs of over-exposure to the chemical hazards present at this site. Prior to starting work at the site, each employee must have three days of actual field training under the supervision of an experienced supervisor as specified in 29 CFR 1910.120. All supervisors must complete eight hours of training in site management. All personnel must complete an eight hour refresher training course on an annual basis in order to continue working at this site.

6.6.5 EXPOSURE EVALUATION

All personnel scheduled for site activities will have a baseline physical examination which will include a physical examination, stressing examination of the neurologic, cardio-pulmonary, musculoskeletal and dermatological systems, pulmonary function testing, multi-chemistry panel and urinalysis and be declared fit for duty. An exposure history form will be completed for each worker participating in site activities. An examination and updated occupational history will be repeated on an annual basis and upon termination of employment as required by 29 CFR 1910.120(f). The content of the annual/termination examination will be the same as the baseline physical. A qualified physician will review the results of the annual/termination examination and exposure data and request further tests or issue medical clearances as appropriate.

After any job-related injury or illness, there will be a medical examination to determine fitness for duty or for the need of any job restrictions. The site health and safety officer will review the results with the examining physician prior to releasing the employee for work. A similar examination will be performed if an employee has missed at least three (3) days of work due to a non-job-related injury or illness requiring medical attention.

Medical records shall be maintained by the employer or the physician for at least thirty (30) years following the termination of employment.

6.7 MONITORING REQUIREMENTS

Initial air monitoring will be accomplished using an Hnu organic vapor detector, an oxygen/flammable gas detector, an H₂S detector, and, in the areas of suspected arsenic contamination, air pump/filter samplers to determine the probable eight hour exposure of employees to inorganic arsenic. A Mini-Ram will be used to monitor dust particle concentrations.

A field calibration check will be performed on each instrument daily prior to commencement of site work, at the end of each work day and at other times as deemed appropriate by the site health and safety officer. Each instrument will be maintained in accordance with the manufacturer's recommendations.

6.8 DECONTAMINATION

A decontamination zone will be established at each of the two work site entrances which will include an area for sampling equipment and personnel decontamination.

6.8.1 PERSONNEL DECONTAMINATION

The decontamination procedures, based on Level B protection, will consist of brushing heavily soiled boots, rinsing outer gloves and boots with soap and water. Rinsing and removing facepiece and air bottle. Removing outer gloves depositing them in a plastic

lined container. Washing and rinsing safety suit, removing safety suit and boots. Safety suits to be deposited in a plastic lined container. Washing and rinsing inner gloves, removing facepiece, washing and rinsing inner gloves and removing inner gloves. Facepieces will be decontaminated and cleaned for reuse, inner gloves will be deposited in a plastic lined container.

The decontamination procedures for Level C protection will be similar. Decontamination procedures will be conducted at the lunch break and at the end of each work day. If the field activities zone is left at other times during the work day, contaminated clothing will be left at the decontamination station on plastic sheeting to be reworn on returning.

If higher levels of personal protection equipment are needed, adjustments will be made to these procedures and an amendment will be made to this health and safety plan.

6.8.2 CLOSURE OF THE PERSONNEL DECONTAMINATION STATION

All disposable clothing and plastic sheeting used during site activities will be double-bagged and disposed in a refuse container. Decontamination and rinse solutions will be allowed to drain onsite. Reusable clothing will be dried and prepared for future use. All washtubs, pails, buckets, etc. will be washed, rinsed and dried at the end of each workday.

- g. Site control measures, decontamination procedures, site standard operating procedures and the contingency plan and responses to emergencies including the necessary PPE.
- Assuring that all employees have received a minimum of 40 hours health and safety instruction, off the site, and actual field experience under the direct supervision of a trained, experienced supervisor. Workers who may be exposed to unique or special hazards shall be provided additional training.
 - Monitoring the performance of personnel to ensure that mandatory health and safety procedures are being performed and correcting any performances that do not comply with the Health and Safety Plan.
 - Ensuring that all field personnel employed on the site are covered by a medical surveillance program as required by 29 CFR 1910.120(f)
 - Consulting with the Health and Safety Officer and/or other personnel.
 - Preparation and submittal of any and all project reports includes progress, accident, incident, contractual, etc.

6.9.2 Responsibilities of EnSafe Site Health and Safety Officer:

- Assure that a copy of the health and safety plan is maintained onsite during all field activities.
 - Advise the project/site manager on all health and safety related matters involved at the site.
-

- Direct and ensure that the safety program is being correctly followed in the field, including the proper use of personal protective and site monitoring equipment.
- Ensure that the field personnel observe the appropriate work zones and decontamination procedures.
- Report any safety violations to the project manager.
- Conduct safety briefings during field activities.

Initially, the site health and safety officer will be a person trained in safety and industrial hygiene. After the project begins and the site safety officer has had time to evaluate actual hazardous site conditions, he/she may determine that a member of the project team may assume the duties of site health and safety officer.

6.9.3 Responsibilities of Onsite Field Personnel:

- All personnel going on site must be thoroughly briefed on anticipated hazards and trained on equipment to be worn, safety procedures to be followed, emergency procedures and communications.
- Required respiratory protective devices and clothing must be worn by all personnel going into areas designated for wearing protective equipment.
- Personnel must be fit-tested prior to use of respirators.
- No facial hair which intrudes on the sealing surface of the respirator is allowed on personnel when respiratory protection is required.
- Personnel on site must use the buddy system, especially when wearing respiratory protective equipment. As a minimum, a third person, suitably equipped as a safety backup, is required during all entries requiring respiratory protection.

- Visual and/or radio contact must be maintained between pairs onsite and site safety personnel. Field personnel should remain close together to assist each other during emergencies.
 - All field personnel should make use of their senses to alert themselves to potentially dangerous situations which they should avoid, e.g., presence of strong and irritating or nauseating odors.
 - Personnel should practice unfamiliar operations prior to doing the actual procedure in the field.
 - Field personnel shall be familiar with the physical characteristics of the site, including:
 - wind direction in relation to contamination zones;
 - accessibility to associates, equipment and vehicles;
 - communications;
 - operation zones;
 - site access; and
 - nearest water sources.
 - Personnel and equipment in the contaminated area must be kept to a minimum, consistent with effective site operations.
 - Procedures for leaving a contaminated area must be planned and implemented prior to going onsite in accordance with the Site Health and Safety Plan.
 - All visitors to the job site must comply with the Health and Safety Plan procedures. Personal protection equipment may be modified for visitors depending on the situation. Any modifications must be approved by the Site Health and Safety Officer.
-

6.10 EMERGENCY INFORMATION

All hazardous waste site activities present a potential risk to onsite personnel. During routine operations, risk is minimized by establishing good work practices, staying alert and using proper personal protective equipment. Unpredictable events such as physical injury, chemical exposure or fire may occur and must be anticipated.

If any situation or unplanned occurrence requires outside or support services Naval representatives will be informed and the appropriate contact from the following list will be made:

Law Enforcement, Charles County Sheriff's Office (301) 934-2222

Fire Department, Charles County Fire Board (301) 934-2211

Ambulance Services, Charles County Business (301) 934-2214

Regional Poison Center, Maryland Poison Center (Waldorf) 1-800-492-2414

6.10.1 SITE RESOURCES

Telephones for communications with outside agencies and in case of an emergency are located at the site office. Portable radios will be used for on site communications. A first aid kit, stretcher, eye wash station and other emergency supplies are located in the site office. Restroom facilities and water supply are be available near the site office.

6.10.2 EMERGENCY PROCEDURES

In the event that an emergency develops onsite, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on site; or
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

The following emergency procedures should be followed:

- Report any emergency situation, such as fire, or personnel injury immediately to the project manager.
- Emergency alerting will be accomplished by use of radios or through use of hand signals.
- Exclusion Zone will be evacuated through the hotline control point. After emergency decontamination, all personnel will muster at the command post/site office. All other persons on site who are not in the Exclusion Zone will evacuate the site through the nearest exit but may not cross through the Exclusion Zone.
- In the event that any member of the field team experiences any effects or symptoms of exposure while on the scene, the entire field crew will immediately halt work and act according to the instructions provided by the Site Health and Safety Officer.
- For applicable site activities, wind indicators visible to all onsite personnel will be provided by the site safety officer to indicate possible routes for upwind escape.
- The discovery of any conditions that would suggest the existence of a situation more hazardous than anticipated will result in the suspension of work until the safety officer has evaluated the situation and provided the appropriate

instructions to the field team. During this evaluation, all personnel in the exclusion zone will muster in the contamination reduction zone.

- In the event of fire or other disaster, evacuate the exclusion zone, muster in the contamination reduction zone and notify local authorities of the incident.
- In the event of an accident, decontamination of the injured person, as well as any persons accompanying the injured person to the hospital, will be required. A minimal level of decontamination will be needed to prevent contamination of the hospital and medical personnel. Care must be exercised so as not to cause further or additional injury to the individual.
- In the event of an emergency, entry into the exclusion zone will initially be controlled by the site manager and will be limited to life saving operations.
- Emergency response beyond evacuation of the exclusion zone and operations necessary for life saving shall not be attempted by on-site personnel. Those type operations will be left for organizations who have been trained for these type activities (e.g. fire department).
- In the event that an accident occurs, the project manager is to complete an accident report form for submittal to the managing principal-in-charge of the project.
- This contingency plan shall be updated whenever changes occur which may affect the effective implementation. After each incident/accident, the effectiveness of this plan shall be evaluated and the plan shall be modified as needed.
- In the event of a release that threatens the any streams, creeks or rivers; or releases onto the land surrounding the site, notify:

Maryland Department of Environment,
Baltimore, Maryland

Hazardous and Solid Waste Management

(24-hour) (301) 974-3551

Maryland Emergency Management & Civil Defense

(24-hour) (301) 486-4422

6.11 FORMS

The following forms will be used in implementing this health and safety plan:

Plan Acceptance Form

Plan Feedback Form

Accident Report Form

Exposure History Form

The Plan Acceptance Form will be filled out by all employees working on the site prior to commencement of site activities. The Plan Feedback Form will be filled out by the site safety officer and any other onsite employee who wishes to fill one out. The Accident Report Form will be filled out by the Project Manager in the event that an accident occurs. The Exposure History Form will be completed by both the project manager and the individual(s) for whom the form is intended.

All completed forms must be returned to the Principal-in-Charge at EnSafe/Allen & Hoshall, Memphis, Tennessee.

**LOCATION OF THE NEAREST HOSPITAL
CAPABLE OF TREATING CHEMICAL EXPOSURES**

Data is currently unavailable. As soon as it is obtained we will send you updated documentation.

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each person working on the project work site and returned to, EnSafe, Memphis, Tennessee.

Job No. _____

Project _____

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

Signed

Print Name

Company

Date

PLAN FEEDBACK FORM

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for revisions:

ACCIDENT REPORT FORM

SUPERVISORS REPORT OF ACCIDENT		DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS							
TO		FROM							
		TELEPHONE (Include area code)							
NAME OF INJURED OR ILL WORKER AND COMPANY									
WORKER'S SOCIAL SECURITY NUMBER									
DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT							
NARRATIVE DESCRIPTION OF ACCIDENT									
NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;">LOST TIME</td> </tr> <tr> <td style="text-align: center;">YES</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td style="text-align: center;">NO</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </table>	LOST TIME		YES	<input type="checkbox"/>	NO	<input type="checkbox"/>
LOST TIME									
YES	<input type="checkbox"/>								
NO	<input type="checkbox"/>								
PROBABLE DISABILITY (Check one)									
FATAL <input type="checkbox"/>	LOST WORK DAY WITH ___ DAYS AWAY FROM WORK	LOST WORK DAY WITH ___ DAYS OF RESTRICTED ACTIVITY	NO LOST WORK DAY <input type="checkbox"/> FIRST-AID ONLY <input type="checkbox"/>						
CORRECTIVE ACTION RECOMMENDED (By whom and by when)									
NAME OF SUPERVISOR		TITLE							
SIGNATURE		DATE							

EMPLOYEE EXPOSURE HISTORY FORM

EMPLOYEE NAME: _____

JOB NAME: _____

JOB NUMBER: _____

DATE(S) ON SITE (FROM/TO): _____

HOURS ON SITE: _____

CONTAMINANTS (SUSPECTED/REPORTED)

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

(SEE ATTACHED LABORATORY ANALYSIS)

7.0 POTENTIAL CORRECTIVE MEASURES

The nature of the potential wastes associated with Range 6, Chicamuxen Creek's Edge - Dump Site A, and Range 3 Burn Point, as well as, the physical characteristics of the facility will dictate the choice of corrective measures technologies which may be appropriate. Since the nature and extent of contamination is currently unknown, evaluation of potential corrective methods are speculative and based on the assumption that some or all of the contaminants tested for will be present in significant quantities. Present characterization of site geology, soils, surface water, hydrogeology, groundwater, and sediments is extrapolated from regional data.

7.1 Data Requirements

Available data indicates that the near surface groundwater aquifer present at Stump Neck Annex is hydrologically connected to the adjacent surface water systems and flow appears to be mostly lateral in nature. The area is part of the Potomac River estuary and as such is subject to tidal, diurnal, and seasonal influences which allow for fluctuations in the quality and position of the groundwater. Soils in the area are typically silty loams, exhibiting a relatively low permeability, and tidal marsh. Furthermore, records indicate (IAS 1983; RFA 1989) that there has been significant alterations in the form of added fill at Chicamuxen Creek's Edge - Dump Site A/Range 3 Burn Point.

In order to evaluate the potential of the various technologies available it is necessary to collect extensive, detailed, and accurate geologic, soil, surface water, hydrogeologic, groundwater, sediment, and contamination data. The methodology of data collection is described in Section 4 of this document.

7.2 Available Technologies

7.2.1 Extraction Methods

Pump and Treat Systems

Pump and treat systems are capital & maintenance cost intensive.

The effectiveness of a pump and treat system is dependent upon the aquifer characteristics and the chemical nature of the contaminant. Such systems, probably, will not remediate an aquifer to required levels without some form of complimentary technology.

Given what is currently known about the facility, pumping systems do not appear to be appropriate. The reported low soil permeabilities and the interconnection of hydrologic provinces preclude effective treatment by such methods.

Soil Vapor Extraction

Soil vapor extraction techniques require fairly permeable, unsaturated soils. The success of this technique depends on the volatility of the contaminant and the ability to sufficiently dewater the upper groundwater regime.

7.2.2 Insitu Remediation Technologies

Insitu biodegradation techniques show promise for sites in which an indigenous microbial population exists and is capable of using the contaminants present as a food stock. It will be necessary to implement biological testing of soil and groundwater samples in

order to determine the presence of the bacteria, its viability, and nutrient requirements. If such microorganisms exist, and are capable of degrading the contaminants present, enhancing their environment may prove to be a viable method of site remediation.

7.2.3 Excavation and Disposal

Excavation of contaminated soils and cessation of contaminating operations will effectively remove the source of the problem. It is then necessary to dispose of the contaminated soil in a proper manner. The available options for disposal are landfilling and incineration.

Landfilling

Excavation and landfilling of contaminated soils, on or off site, must take into account pertinent local, state, and federal regulations. Extensive permitting requirements may make this approach unworkable.

Incineration

The incineration of contaminated soils will reduce the volume of waste product, but there must still be a final disposition of the residue. The regulations pertaining to soil incineration may require extensive efforts toward permitting.

7.3 Source Control

Considering the nature of the potential contamination, the proximity of the surface water, probable hydrologic interface between the aquifer and the surface water, depth to ground water, and the relative impermeability of the soils, remediation methods directed toward groundwater are probably not viable. Removal of the source of contamination in conjunction with soils remediation appears to be the best alternative at this juncture. Further information is necessary in order to make a final determination.

Community Relations Plan

In 1991, a permit was issued by the United States Environmental Protection Agency (EPA) under the authority of the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976 (RCRA) and the Hazardous and Solid Waste Amendments of 1984 (HSWA), to the U.S. Department of the Navy to meet the requirements of HSWA at the NAVAL EXPLOSIVE ORDNANCE DISPOSAL TECHNOLOGY CENTER located on STUMP NECK ANNEX, INDIAN HEAD, MARYLAND.

The purpose of this permit is to provide the United States Environmental Protection Agency (EPA), interested citizens, and other governmental agencies the opportunity to evaluate the ability of the Permittee to comply with the requirements of the permit. EPA is required to prepare a draft permit which summarizes all the requirements the Permittee is expected to comply with during the ten year duration of the permit. The Public is given forty-five (45) days to review and comment on the draft permit before the EPA takes any action on the final draft.

This permit requires the Navy to conduct a RCRA facility Investigation (RFI). There are currently three sites known to be contaminated and the investigation of those sites will begin with an RFI.

Information of any noncompliance that may endanger human health or the environment, such as hazardous waste or its constituents endangering the public water supply, fire or explosion, will be orally provided to the Regional Administrator within 24 hours of the incidents occurrence.

References

1. RCRA Facility Assessment Report of the Naval Explosive Ordnance Disposal Technology Center Stump Neck Annex, Indian Head, Maryland (RFE Report). EPA I.D. Number MD4170090001. Dated 1989.
2. U.S.G.S. Quadrangle Indian Head Topographical Map
3. Initial Assessment Study, Naval Ordnance Station, Indian Head, Maryland. UIC: N00174
4. Outbrief Naval Explosive Ordnance Technology Center. Dated November 5, 1990.
5. Sampling and Analysis Quality Assurance Requirements for the Navy Installation Restoration Program. NEESA 20.2-047b. Dated June, 1988
6. Ground-Water Monitoring Guide. NEESA 20.2-031a. Dated February, 1985.

ABBREVIATIONS

RCRA	Resource Conservation and Recovery Act
HSWA	Hazardous and Solid Waste Amendments
NEODTC	Naval Explosive Ordnance Disposal Technology Center
SWDA	Solid Waste Disposal Act
EPA	Environmental Protection Agency
MDE	Maryland Department of Environment
RFI	RCRA Facilities Investigation
SWMU	Solid Waste Management Unit
VSI	Visual Site Inspection
EOD	Explosive Ordnance Disposal
FSP	Field Sampling Plan
SOP	Standard Operating Procedure
QA/QC	Quality Assurance / Quality Control
VOA	Volatile Organic Analysis
DQO	Data Quality Objectives
NEESA	Naval Energy and Environment Support Activity
EFD	Engineering of Field Division
CLEAN	Comprehensive Long term Environmental Action Navy
NCR	NEESA Contact Representative
EIC	Engineer In Charge
CAR	Contamination Assessment Report
LCAC	Laboratory Quality Assurance Coordinator
CFR	Code of Federal Regulations
PID	Photoionization Detector
SOP/QAM	Standard Operating Procedure/Quality Assurance Manual
HSA	Hollow Stem Auger
USGS	United States Geological Survey
NAD	North American Datum
QAPP	Quality Assurance Project Plan
NBS	National Bureau of Standards
CLP	Contract Lab Program
SOUTHDIIV	U.S. Navy Southern Division

VI	Verification Investigation
STEL	Short Term Exposure Limit
PEL	Permissible Exposure Limit
PPE	Personal Protective Equipment
IDLH	Immediately Dangerous to Life and Health
CFR	Code of Federal Regulations
MSA	Mine Safety Appliances Co.
SCBA	Self Contained Breathing Apparatus