4/1/07-02080

Final

Work Plan for the Expanded Site Inspections for MWR Skeet Range Naval Weapons Station Yorktown Yorktown, Virginia and Marine Pistol Rifle Range, Cheatham Annex Williamsburg, Virginia

NAVFAC
Naval Facilities Engineering Command

Prepared for

Department of the Navy

Naval Facilities Engineering Command Mid-Atlantic Division

Contract No. N62470-02-D-3052
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April 2007

Prepared by

CH2MHILL

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Under the

CLEAN III Program
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Chantilly, Virginia

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Acronyms and Abbreviations

bgs	below ground surface
BTAG	Biological Technical Assistance Group
CAX	Cheatham Annex
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	chain-of-custody
CSM	conceptual site model
CTO	contract task order
DGPS	differential global positioning system
DQO	data quality objective
EOD	explosive ordnance disposal
ESI	Expanded Site Inspection
FTL	Field Team Leader
FSP	Field Sampling Plan
GPS	Global Positioning System
HASP	Health and Safety Plan
ICP	inductively coupled plasma
IDW	investigation-derived waste
MC	munitions constituents
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
MIDLANT	Mid-Atlantic Division
MRP	Munitions Response Program
MS/MSD	matrix spike/matrix spike duplicate
MWR	Morale, Welfare, and Recreation
NAVFAC	Naval Facilities Engineering Command
NERP	Navy Environmental Restoration Program
ORE	ordnance risk evaluation
PA	Preliminary Assessment
PAHs	polycyclic aromatic hydrocarbons
QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
RBC	risk-based concentration
RI	Remedial Investigation
RPM	Remedial Project Manager

SOP	standard operating procedure
SSC	Site Safety Coordinator
TAL	Target Analyte List
TNT	trinitrotoluene
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UTL	upper tolerance limit
UXO	unexploded ordnance
VDEQ	Virginia Department of Environmental Quality
WPNSTA	Weapons Station

SECTION 1

Introduction

This work plan presents the technical approach to the Expanded Site Inspections (ESIs) to be conducted by CH2M HILL under the Navy Munitions Response Program (MRP) at Naval Weapons Station Yorktown (WPNSTA Yorktown), Yorktown, Virginia, and the WPNSTA Yorktown Cheatham Annex (CAX), Williamsburg, Virginia. The ESIs are being conducted for the Department of the Navy, Naval Facilities Engineering Command, Mid-Atlantic Division (NAVFAC MIDLANT), under the Comprehensive Long-Term Environmental Action Navy (CLEAN) III Program. This work is being performed under Contract Task Order 122 (CTO-122) of Contract No. N62470-02-D-3052.

1.1 Project Objectives and Approach

This work plan describes the ESI activities for the Morale, Welfare, and Recreation (MWR) Skeet Range at WPNSTA Yorktown and the Marine Pistol and Rifle Range at CAX. The objective of this project is to determine whether a release that has the potential to adversely affect human health or the environment has occurred at either site. CH2M HILL will perform the following tasks in the field to support this objective:

- Complete a visual survey of the ranges aided by a handheld all-metal detector in order to identify areas with more expended casings, rounds, and/or shot and therefore potentially more past activity
- Collect surface and subsurface soil samples at both ranges

Following the field event, select soil samples collected at the MWR Skeet Range will be analyzed for lead and polycyclic aromatic hydrocarbons (PAHs). Select soil samples collected at the Marine Pistol and Rifle Range will be analyzed for antimony, arsenic, copper, iron, lead, tin, and zinc. The analytes were chosen based on the past use of each site. Shotgun ammunition utilized at the MWR Skeet Range consisted of lead shot enclosed in plastic casings and the makeup of the clay targets potentially included PAHs. Historical use of the Marine Pistol and Rifle Range included the use of rifle ammunition, which is typically constructed of a lead projectile and a casing of various compositions, possibly including mixtures of antimony, copper, zinc, iron, arsenic, and/or tin.

A population to population comparison will be conducted between the site data set and the background soil data set in order to identify whether a release has occurred at either range. If a release is not identified relative to background, no additional screening or analysis will be performed and the results of the investigation will be documented in an ESI report. If a release is identified at either site, analytical results will be screened against human health and ecological screening values to determine if the release poses a potential risk to human health and the environment. If no potential risks are identified, no additional screening or analysis will be performed and the results of the investigation will be documented in an ESI report. If a potential risk is identified, individual site sample results will be screened against

background upper tolerance limits (UTLs). Sample locations with analytical results exceeding these UTLs will be identified. Additional samples collected from locations adjacent to these samples that have been collected but not analyzed will be analyzed to assist in delineation of the extent of contamination. This additional sample data will also be used to determine if remedial investigations (RIs), quantitative risk assessments and/or removal actions are necessary at the sites. These recommendations will then be documented in an ESI Report. The decision tree described above is presented as Figure 1-1. Specifics of the sampling, analytical screening, and reporting processes are discussed in Sections 3 and 4.

1.2 Work Plan Scope and Organization

This work plan is organized into five sections. Section 2 provides background information for each site. Section 3 describes the technical approach for the ESI field investigation and subsequent data analysis and documentation. Section 4 provides information on project staffing, scheduling, and deliverables. Section 5 lists references used to complete this work plan. Tables and figures are provided at the end of each section. Appendices are provided at the end of the plan.

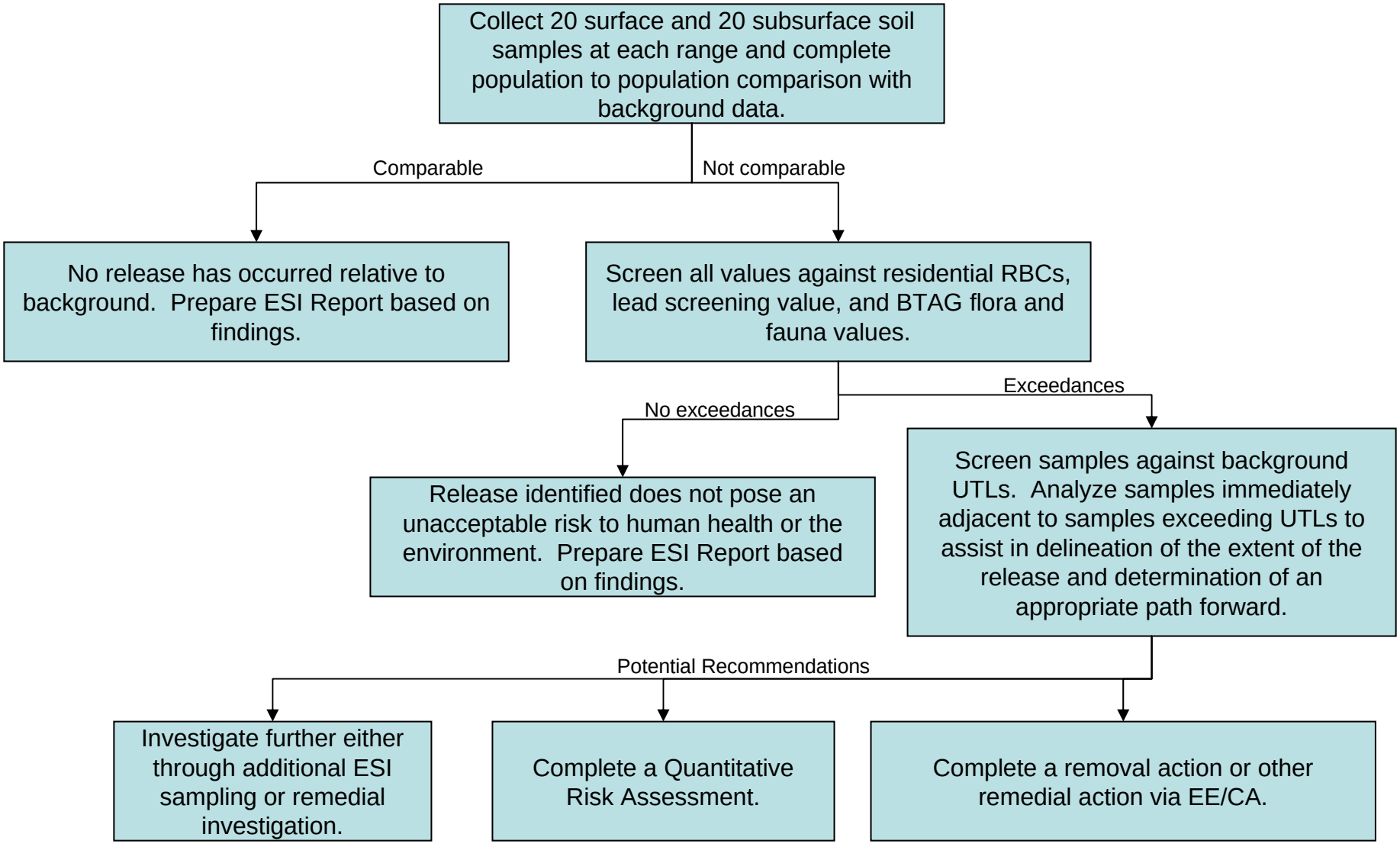

Figure 1-1
ESI Decision Tree
MWR Skeet Range, Cheatham Annex
Marine Pistol and Rifle Range, WPNSTA Yorktown
Yorktown, Virginia

SECTION 2

Background

2.1 WPNSTA Yorktown MWR Skeet Range

This section provides a brief description of WPNSTA Yorktown, the site-specific history and physical setting of the WPNSTA MWR Skeet Range, and a summary of previous investigations conducted at the range.

2.1.1 WPNSTA Yorktown Location and History

WPNSTA Yorktown is a 10,624-acre installation located on the Virginia Peninsula in York and in James City counties and the city of Newport News, Virginia (Figure 2-1). WPNSTA Yorktown is bounded on the northwest by WPNSTA Yorktown CAX and the King's Creek Commerce Center; on the northeast by the York River and the Colonial National Historic Parkway; on the southwest by Route 143 and Interstate 64; and on the southeast by Route 238 and the town of Lackey.

Originally named the U.S. Mine Depot, WPNSTA Yorktown was established in 1918 to support the laying of mines in the North Sea during World War I. For 20 years after World War I, the depot continued to receive, reclaim, store, and issue mines, depth charges, and related materials. During World War II, the facility was expanded to include three trinitrotoluene (TNT) loading plants and new torpedo overhaul facilities. A research and development laboratory for experimentation with high explosives was established in 1944. In 1947, a quality evaluation laboratory was developed to monitor special tasks assigned to the facility that included the design and development of depth charges and advanced underwater weapons. On August 7, 1959, the depot was renamed the U.S. Naval Weapons Station. Today, the primary mission of WPNSTA Yorktown is to provide ordnance, technical support, and related services to sustain the war-fighting capability of the armed forces in support of national military strategy.

2.1.2 MWR Skeet Range Location and History

The MWR Skeet Range consists of a 30-acre parcel of land located in the eastern portion of WPNSTA Yorktown adjacent to the York River (Figure 2-1). The range includes a cleared portion on which the skeet and trap houses were previously located and a shotfall zone that extends northward into a wooded area (Figure 2-2). The site is located northwest of Barracks Road and east of Teague Road. Navy Environmental Restoration Program (NERP) Site 5, Surplus Transformer Storage Area, is approximately 800 feet east of the range. The shotfall zone of the range extends in a 900-foot arc from the southern portion of the range and overlaps the railroad line on the northeast portion of the site.

The MWR Skeet Range is located approximately 1500 feet southwest of the York River. There is a small, intermittent streambed along the eastern edge of the cleared area onsite, and an engineered drainage swale runs along the center of the site north of the concrete

firing pad. Surface runoff collects in the swale and the streambed, eventually draining to the York River.

The vegetation on the MWR Skeet Range consists of a grassy area surrounded by a mix of hardwood and pine forests. The edge of the cleared land is mainly brush and small shrubs that transition into dense, mature forest.

The MWR Skeet Range was used for recreational purposes on the weekends by facility personnel from 1980 to 1982 and then used sporadically until 1994, at which time it was closed. The activities on the range site were limited to skeet shooting with shotguns. Shots were fired from a launching pad in the south toward the northern tree line. Demolished or removed site structures included high, low, and trap houses along the southern edge of the site. The high house was located on the west side of the range and threw targets from west to east; the low house was located on the east side of the range and threw targets from east to west; the trap house was located in the center of the range and randomly threw targets around the site. The site also contained one small administrative building and a storage trailer. The former skeet range was built on a naturally flat area. Before construction of the range, the land was used by Marines as a physical training area.

Aerial photographs reviewed during the preliminary assessment (PA) field investigation indicate that the range may have expanded in size between 1980 and 1986 (Malcolm Pirnie, 2004). In 1980, the site appeared to be a 300-foot by 200-foot rectangular cleared area. By 1986 the range had the same size and shape as it presently does (30 acres). It also appears from the photos that a portion of the area on and around the skeet range was logged in 1985 and then replanted with pines.

2.1.3 MWR Skeet Range Hydrogeologic Setting

Geology

The WPNSTA Yorktown lies within the Atlantic Coastal Plain physiographic province, which is underlain by unconsolidated sediment of Quaternary, Tertiary, and Cretaceous ages. These sediments dip to the southeast, with a combined thickness of 1,900 feet in the WPNSTA Yorktown region and overlay a pre-Cretaceous basement-rock complex of crystalline rock and scattered Triassic sedimentary rocks. The surface features on the York-James Peninsula are marked by a series of scarps and terraces that have resulted from erosion and deposition during periods of low and high sea levels.

Most of WPNSTA Yorktown, including the MWR Skeet Range, lies on the Lackey Plain terrace. Although no environmental soil borings have been completed within or nearby the boundaries of the skeet range, the U.S. Geological Survey (USGS) performed a water resources investigation in 1997 which involved completion of several borings drilled to various depths in the proximity of the range. Based on the information included in , *Geohydrology of the Shallow Aquifer System, Naval Weapons Station Yorktown, Yorktown, Virginia* (USGS, 1997), much of the unconsolidated sediment in the area around the range consists of the Windsor, Chuckatuck and Lower Shirley formations. The Windsor formation consists of sand, clay, and silt with some glauconite. The Chuckatuck is formed from light grey, yellowish-orange, and red-brown sandy silt and clay with small amounts of peat. The Shirley Formation includes fluvial deposits of sand and silty-clays.

Within the area of the range, the Yorktown and Eastover formations underlie the surficial sediments. These formations are characterized by shells and shell fragments cemented with calcite. Although the USGS investigation did not include the formations beneath the Yorktown and Eastover formations, based on other data collected on Lackey Plain, it is believed that the St. Mary's and Calvert formations, formed from Miocene deposits, underlie the Eastover formation beneath the MWR Skeet Range. The uppermost portion of these units is characterized by increasing sand and decreasing shell content. The Miocene deposits are positioned at approximately 200 feet below sea level at WPNSTA Yorktown. The bottom-most layer of the deposits consists of marl or coquina.

Beneath the Miocene deposits lie the Eocene deposits, comprising the Chickahominy and Nanjemoy formations. These formations are made of fine- to medium-grained sands and varying amounts of glauconite. In the area of WPNSTA Yorktown, the Eocene deposits are approximately 70 feet thick. Underlying the Eocene deposits are the Paleocene deposits, consisting of the Nanjemoy, Aquia, and Mattaponi formations formed from fine- to medium- grained sands, including dark silts and clays. These formations are approximately 100 feet thick. Cretaceous deposits of the Lower Member, Mattaponi Formation and the basal Potomac Group Formations are located 450 to 1800 feet below sea level and are the bottom layer of the unconsolidated sediments. They are characterized by silts and clays of fluvial and deltaic origin. The Cretaceous deposits are approximately 1,450 feet in thickness. The bedrock in the area of WPNSTA Yorktown is pre-Cretaceous in age and comprises Triassic sandstones, shales, and crystalline rocks.

The soil at the MWR Skeet Range is of the Dogue, Pamunkey, and Uchee Association. The soils of this classification are deep, moderately to well-drained, sandy loams with subsoils that are clayey, loamy, and sandy loams. Permeability is moderate in the upper subsoils and moderately slow in the lower subsoils. These soils fall within soil association 2 in Baker Environmental's 1995 background investigation of WPNSTA.

Hydrogeology

WPNSTA Yorktown overlies a shallow aquifer system containing five individual units: the Columbia aquifer, the Cornwallis Cave confining unit, the Cornwallis Cave aquifer, the Yorktown confining unit, and the Yorktown-Eastover aquifer. These units comprise the York County shallow aquifer system. Based on the USGS All of these units are present in the proximity of the skeet range (USGS, 1997).

The Yorktown-Eastover aquifer is the principal source of water for most of the domestic wells in York County. The thickness of the aquifer is approximately 50 feet in the vicinity of the MWR Skeet Range. The aquifer is confined in the area of the MWR Skeet Range, but is unconfined northwest of the range beyond the Camp Peary Scarp within Croaker Flat (USGS, 1997). The Eastover-Calvert confining unit lies beneath the Yorktown-Eastover aquifer.

At WPNSTA Yorktown, the depth to groundwater ranges from 1 foot below ground surface (bgs) at low-lying areas to 30 feet bgs at upland areas. The depth to water in the proximity of the MWR Skeet Range is approximately 20 feet (USGS, 1997). The predominant source of domestic water supply for WPNSTA Yorktown and surrounding communities is from surface water reservoirs in Newport News. Individual homes are able to obtain water from

private wells installed into the Yorktown-Eastover shallow aquifer. On WPNSTA Yorktown, there are no drinking water wells, and the shallow aquifer system is not used for any domestic water supply. There are no wells on the MWR Skeet Range. There were four water supply wells on WPNSTA Yorktown; three have been abandoned and the fourth has been destroyed. The two closest wells are approximately 2.5 km southwest of the site at Buildings 304 and 352; both are abandoned.

The groundwater flow on WPNSTA Yorktown is generally in the direction of the groundwater discharge zone consistent with surface drainages and streams. Water level elevations reflect the surface topography of the area, so groundwater at the MWR Skeet Range is expected to flow to the northeast in the direction of the York River.

2.1.4 Previous Investigations at the MWR Skeet Range

A PA was conducted for the MWR Skeet Range to identify possible munitions and explosives of concern (MEC) and any sources of munitions constituents (MC) related contamination at the site. Consistent with expected results for a small caliber munitions site, the PA did not identify any MEC at the MWR Skeet Range. However, the PA identified potential "MC-related" contamination from metals (antimony, arsenic, copper, lead, and zinc) associated with bullets and bullet casings present at the site (Malcolm Pirnie, 2005).

2.2 CAX Marine Pistol and Rifle Range

This section provides a brief description of CAX, the site-specific history and physical setting of the CAX Marine Pistol and Rifle Range, and a summary of previous investigations conducted at the range.

2.2.1 CAX Location and History

CAX consists of 1,578 acres of land on the York-James Peninsula, northwest of WPNSTA Yorktown. CAX is divided into two parcels, with the larger parcel along the banks of the York River and the smaller parcel south of the Colonial National Historic Parkway (Figure 2-3). Almost all of the activities at CAX (administration, training, maintenance, support, and housing) take place within the larger parcel of land. The smaller parcel contains Jones Mill Pond and is used mainly as a watershed protection area. The properties are bordered by Colonial National Historical Park on the northwest and east, Queens Lake subdivision to the west, and the city of Williamsburg to the south and southwest.

CAX was established in June 1943 as a satellite unit of the Naval Supply Depot to provide bulk storage facilities. CAX had been the location of the Penniman Shell Loading Plant, a large powder and shell loading facility operated by Dupont during World War I. The facility closed in 1918. Between 1918 and 1943, the property was used for farming or left idle until CAX was commissioned in 1943. From 1943 to the present, CAX has performed services in support of Naval ordnance missions that include packing and shipping materials, warehousing, inventory management, local delivery, fuel management and distribution, technical support, customer service, and care of sponsor-owned material.

In July 1987, CAX was designated the Hampton Roads Navy Recreational Complex. Today, the mission of CAX includes supplying the Atlantic Fleet ships and supplying recreational

opportunities to military and civilian personnel. Fifty-five percent of CAX is undeveloped. Outdoor recreational facilities include cabins, camp sites, an 18-hole golf course, swimming pool, ball fields, freshwater and saltwater fishing areas, boating, wildlife watching, and hunting.

2.2.2 CAX Marine Pistol and Rifle Range Location and History

The Marine Pistol and Rifle Range is located in the northwest portion of CAX, directly southeast of Cheatham Pond (Figure 2-3), and at the end of B Street just north of Building 14. Figure 2-4 shows the current site features and locations of the targets and backstop at the range.

The range is rectangular and approximately 7 acres in area. Firing took place from the southern end of the range toward a wooden backstop and wooden targets in the north; the firing zone is approximately 750 feet long, stretching along the north-south axis.

The range is primarily wooded along the west, north and east borders, with pines being the dominant tree type. Approximately 15 years ago, the range itself was replanted with cedar trees, which now dominate the once-open area of the range. The remaining open areas of the range are vegetated with grasses and vines. To the west, along the Cheatham Pond, wetland vegetation dominates. Many soils at CAX are poorly drained, and ponding is likely, especially as the range is slightly sloping toward Cheatham Pond.

The Marine Pistol and Rifle Range was a training ground for small arms of various calibers. From historical reports, the munitions used at the range were all small caliber ammunitions (i.e., less than .50-caliber). Aerial photographs show that the range was in use by 1939. According to Navy personnel, the range was no longer in use by the 1970s, consistent with a total life span of approximately 30 years. Currently, the southernmost portion of the range is used for vehicle storage.

2.2.3 Geology

Consistent with its location adjacent to WPNSTA Yorktown, CAX also lies within the Atlantic Coastal Plain physiographic province. Most of CAX, including the Marine Pistol and Rifle Range, lies on the Croaker Flat terrace at a lower elevation than Lackey Plain, and is separated from Lackey Plain by the Camp Peary Scarp.

No environmental soil borings have been completed within or near the boundaries of the Pistol and Rifle Range; however, it is likely that geology of Croaker Flat within CAX is similar to Croaker Flat geology within WPNSTA. Based on data collected within the Croaker Flat area of WPNSTA, the subsurface of the Marine Pistol and Rifle Range is most likely very similar to that at the MWR Skeet Range with a few units absent. On Croaker Flat, the Bacons Castle and Sedley Formations and the Moore House Member of the Yorktown Formation are generally missing and the Shirley Formation and Holocene undifferentiated sediments occur at the surface.

The soil at the Marine Pistol and Rifle Range is of the Dogue, Pamunkey, and Uchee Association. The soils of this classification are deep, moderately to well-drained, sandy loams with subsoils that are clayey, loamy, and sandy loams. Permeability is moderate in

the upper subsoils and moderately slow in the lower subsoils. These soils fall within soil association 2 in Baker Environmental's 1995 background investigation of WPNSTA.

2.2.4 Hydrogeology

The site-specific hydrogeology of the range is also unknown; there are no pumping, monitoring or injection wells located at or near the range. However, it is likely that the hydrogeology of Croaker Flat within CAX is similar to the hydrogeology of Croaker Flat within the WPNSTA boundaries. Based on investigations completed within WPNSTA, the Camp Peary Scarp truncates the Columbia aquifer, the Cornwallis Cave confining unit, the Cornwallis Cave aquifer, and some to all of the Yorktown confining unit on Croaker Flat; hence, the upper units are missing and either the Yorktown aquifer or a thin portion of the Yorktown confining unit, occurs at the surface.

2.2.5 Previous Investigations at the CAX Marine Pistol and Rifle Range

A PA was conducted for the Marine Pistol and Rifle Range to identify possible MEC and possible sources of MC-related contamination. Consistent with expected results for a small arms site, the PA did not identify any MEC at the site. However, the PA indicated that potential "MC-related" contamination may exist at the site. Indications of expended small caliber ammunition (bullet holes) were found in the old timber targets near the wooden backstop.

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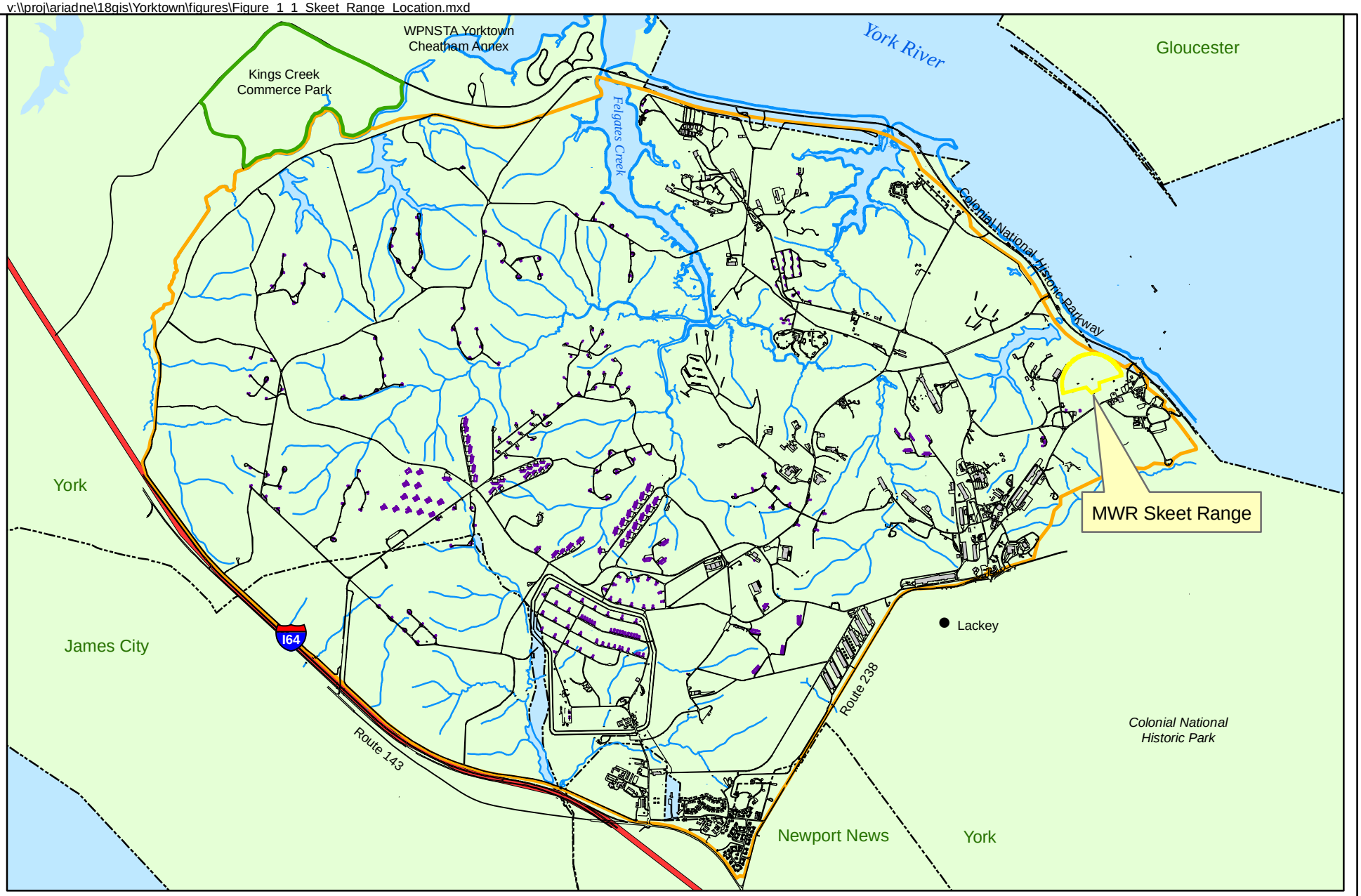

LEGEND

- Yorktown Naval Weapons Station Base Boundary
- Magazines
- Buildings and Structures
- MWR Skeet Range
- VA I-64
- Kings Creek Commerce Center
- County Lines

N

0 2,000 4,000 Feet

Figure 2-1
MWR Skeet Range Location Map
WPNSTA Yorktown
Yorktown, Virginia

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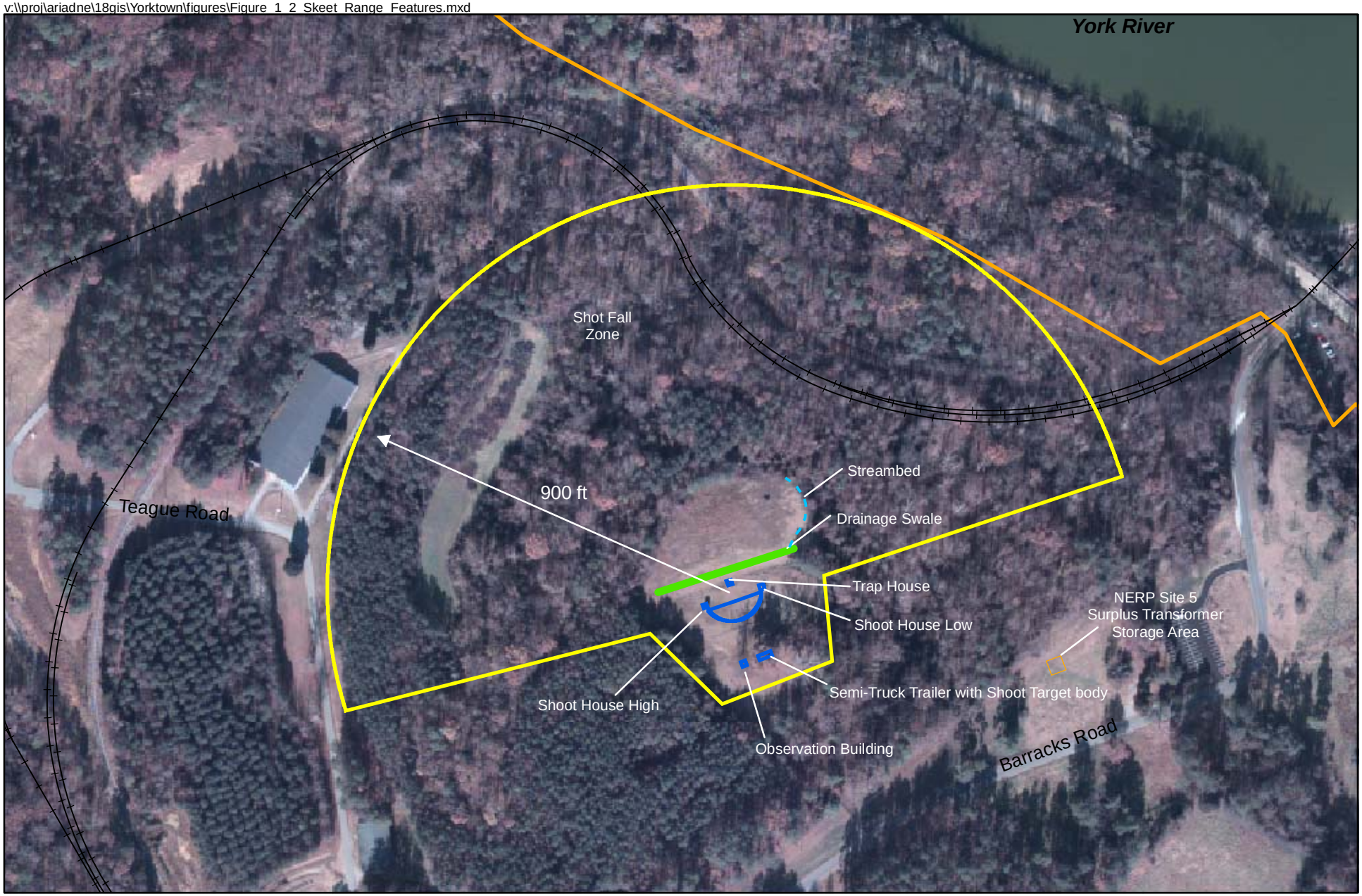

LEGEND

- Yorktown Naval Weapons Station Base Boundary
- Drainage Swale
- MWR Skeet Range
- Skeet Range Site Features
- Railroad

Note:
All structures associated with the Skeet Range have been demolished.

N

0 150 300 Feet

Figure 2-2
MWR Skeet Range Features
WPNSTA Yorktown
Yorktown, Virginia

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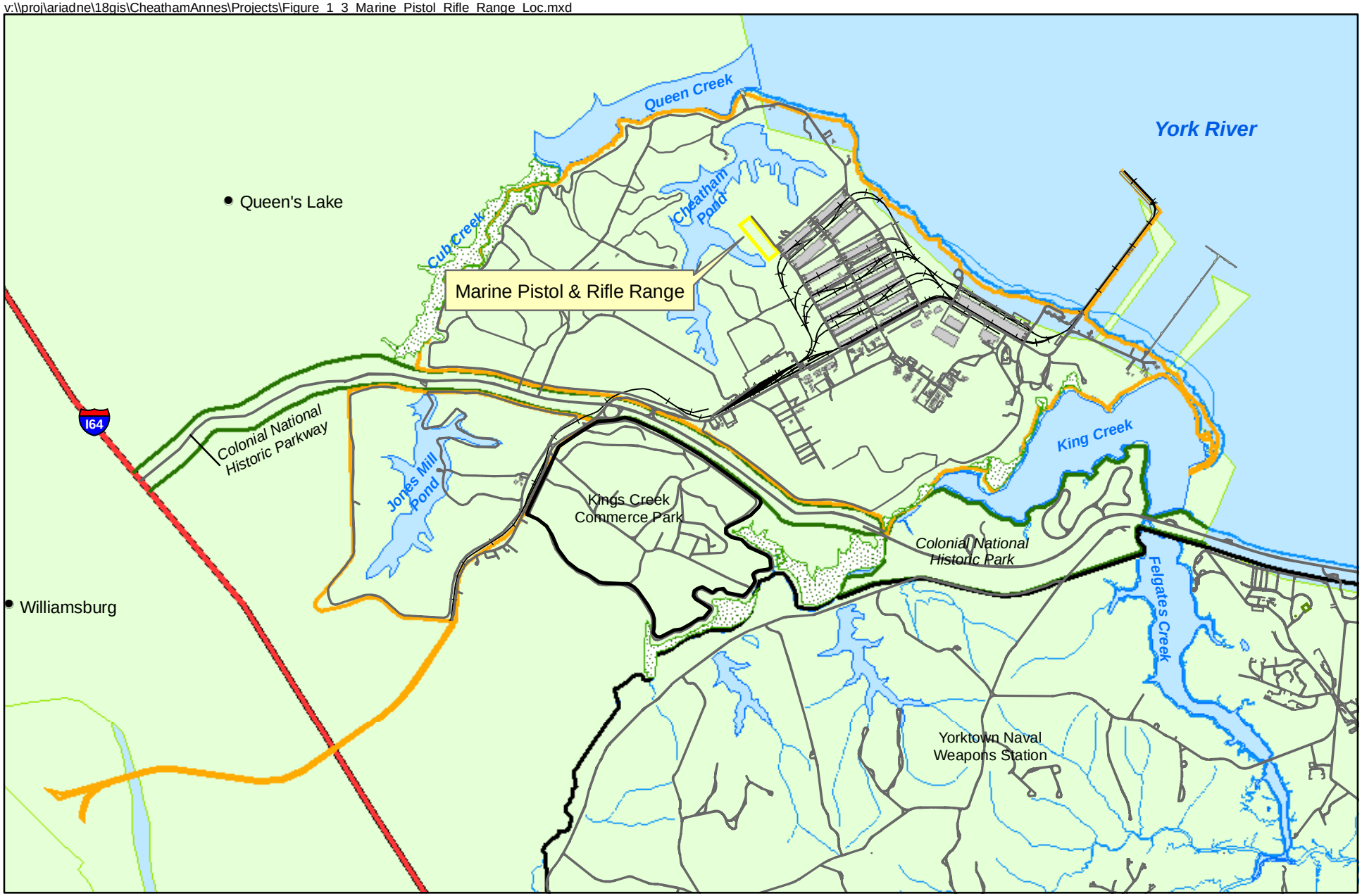

LEGEND

- Cheatham Annex Base Boundary
- Buildings and Structures
- Marine Pistol and Rifle Range
- Mooring Facilities
- Wetlands
- Colonial National Historic Park Boundary
- Road Line
- Railroad
- Shoreline and Water Bodies
- VA I-64

N

0 1,500 3,000 Feet

Figure 2-3
Marine Pistol and Rifle Range Location Map
FISC Cheatham Annex
Williamsburg, Virginia

CH2MHILL

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LEGEND

Marine Pistol and Rifle Range

N

0 100 200 Feet

Figure 2-4
Marine Pistol and Rifle Range Features
FISC Cheatham Annex
Williamsburg, Virginia

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SECTION 3

Field Investigation Plan

This section summarizes the field methodology for the field ESI activities to be completed at the MWR Skeet Range and Marine Pistol and Rifle Range.

The following activities will be conducted as part of the field investigations:

- Mobilization and demobilization
- A visual survey of the ranges, aided by a handheld all-metal detector, to identify areas with more expended rounds, casings and shot
- Collection of surface and subsurface soil samples at 80 locations at the MWR Skeet Range
- Laboratory lead analysis of 20 surface and 20 subsurface samples from the Skeet Range and possible additional analysis based on initial analytical results. Of these samples, 4 surface and 4 subsurface samples will be initially analyzed for PAHs.
- Collection of surface and subsurface soil samples from 65 locations at the CAX Marine Pistol and Rifle Range
- Laboratory select metals analysis of 20 surface and 20 subsurface samples from the Marine Pistol and Rifle Range and possible additional analysis based on initial analytical results.

All activities will be conducted in accordance with Navy CLEAN Standard Operating Procedures (SOPs), CH2M HILL SOPs, and the Master Plans (Baker, 2005a).

3.1 Mobilization/Demobilization

Following approval of the final Work Plan, CH2M HILL will begin mobilization activities. Prior to mobilization, all field team members will review the appropriate master planning documents (including the Master Field Sampling Plan (FSP) (Baker, 2005b) and the Master Quality Assurance Plan (QAP) (Baker, 2005c), along with the final Work Plan and site-specific Health and Safety Plan (HASP). In addition, a field team kickoff meeting will be held prior to mobilization to ensure that personnel are familiar with the scope of field activities, MEC awareness procedures, and safety issues.

Mobilization activities specific to the inactive range inspections include coordination with base personnel and subcontractors, and preparation of field equipment. Demobilization activities will include reseeding any vegetation damaged by field vehicles, review of chains of custody to ensure that all analytical samples were collected as planned and submitted for the appropriate analysis, and packaging and shipment of rental equipment for return to the appropriate vendors. These activities will be conducted in accordance with the FSP referenced above.

3.2 MEC Awareness

Based on CH2M HILL's ordnance risk evaluation (ORE) for this project, no MEC is expected to be encountered at these ranges. MEC is not generally encountered at small arms ranges. However, given prior WPNSTA Yorktown use as a munitions loading facility, and the installation's presence within a historical Civil War battle trail, all personnel will be briefed prior to the start of field activities by a qualified Unexploded Ordnance (UXO) Technician regarding MEC recognition and procedures to be followed in the unlikely event of discovery of a suspect item. The UXO awareness briefing is provided in Appendix A as part of the HASP.

3.3 MEC Management and Contingency Plan

The MEC Management and Contingency Plan is presented in Section 2.1.3 of the HASP (Appendix A). In the unlikely event that MEC is discovered, the Navy Remedial Project Manager (RPM) will be notified and the field sampling will be suspended. The MEC item will be fully described (if known or able to be determined) by a UXO Technician by noting the geographic coordinates using Global Positioning System (GPS), item group, item class, item category, filler type, fuze condition, whether the item requires demolition/ demilitarization, the date and time found, and any comments that will assist in making a decision about how to move forward. The handling and/or management of the MEC will be conducted by an explosive ordnance disposal (EOD) team from WPNSTA Yorktown.

3.4 Field Sampling Plan

3.4.1 Field Operations

Visual and Metal Detector-Aided Surveys of Ranges

The field investigations of the subject ranges will include collection of soil samples from the locations described in the sections that follow in order to identify if a release has occurred at the subject ranges. Prior to collection of these samples, a visual survey of the areas of both ranges will be performed with the aid of an all-metals detector. Based on this survey, sample locations may be modified to better reflect areas with more expended casings, rounds, and shot detected during the surveys.

Additionally, a buffer of 50 ft will be included outside of the delineated boundaries of the ranges to account for stray shot. If the visual and metal detector survey indicates the likely presence of shot or expended rounds outside of the range boundaries, the sampling strategy will be modified in the field to allow for sampling of these areas by extending the existing grid to encompass these additional areas, as appropriate.

Prior to the start of the day's activities, the metal detector will undergo a functionality test as described in the owner's manual provided by the manufacturer of the instrument. Additional representative items will be buried and marked to determine if the unit is functioning properly and can detect metal to the desired sampling depth; one item will be at the ground surface, one item will be at 6 inches below ground surface (bgs), one item will be at 12 inches bgs, and one item will be at 24 inches bgs. The buried items will be placed in a 3

mil bag and the locations of the items will be marked with a pin flag and with a GPS unit. Once the sampling at the site is complete, the test items will be retrieved from the ground.

MWR Skeet Range Sampling Strategy

Because the primary objective of an SI is to identify whether a contaminant release has occurred, sampling is purposely biased toward area(s) where release(s), if present, most likely occurred. In general, skeet ranges produce a wide, fan-shaped shotfall distribution (National Shooting Sports Foundation, 1997; Figure 3-1). Based on the configuration of the concrete still located at the site, it is assumed that there was one location from which users of the skeet range could shoot. Figure 3-2 shows the proposed sampling strategy. The fan shape is consistent with skeet shooting. The spokes of the fan extend outward from the shooting station arc to a distance of 900 feet. For skeet shooting, the area of expected maximum shotfall of lead shot is between 375 and 600 feet from the shooting station arc (Figure 3-1).

The two potential sources of contamination at the MWR Skeet Range are the lead shot fired at the clay targets and the clay targets. Since the lead shot may be distributed over the entire site, all samples collected will be analyzed for lead. The clay targets, however, will be concentrated to the cleared area between the shooting station and the tree line. Therefore, the samples collected within the cleared area up to the tree line will also be analyzed for PAHs.

If no areas of expended shot or weathered clay targets are identified during the visual and metal detector aided survey, samples will be collected at the intersections of transects (i.e., spokes) and arcs which overlay the expected shotfall zone for skeet shooting. Samples will be biased toward the center of the fan and around suspected maximum shotfall boundaries. Additional samples will be collected within the drainage swale that conveys water northeast and off the site because water flowing through the range may move site-related contaminants, if present, to downgradient locations. The drainage swale is vegetated with grasses and is dry except during periods of heavy rain. Therefore samples collected will be considered soil samples rather than sediment. In the event that one or more areas with more expended shot are identified during the visual and metal detector aided survey, samples locations will be moved based on professional judgment to bias the areas of the suspected release. The total number of sample locations will not exceed 80. Prior to sample collection, sample locations will be marked using a handheld GPS.

Surface (0 to 6 inches bgs) and subsurface (6 to 24 inches bgs) samples will be collected using a stainless steel trowel or hand auger. Of the 80 surface and 80 subsurface samples to be collected, 20 surface and 20 subsurface samples will be submitted for laboratory analysis for lead using trace inductively coupled plasma (ICP) Method 6010B (Tables 3-1 through 3-3). Default sample locations for initial analysis are shown in purple on Figure 3-2; circles represent the samples that will only be analyzed for lead, triangles represent the sample that will be analyzed for lead and PAHs. However, if the visual and metal detector aided survey indicates that a release may have occurred in an area in which no sample location exists or an area in which no analytical samples are planned, professional judgment will be used to move or change analytical sample locations. The total number of samples to be sent for initial analysis will remain at 40 (20 surface and 20 subsurface). The original sampling grid (Figure 3-2) and any selection of sampling locations based on the metal detector aided

survey will result in sample results that are biased to locations that most likely represent the source of the potential release. This non-random approach will ensure that the sampling conducted at the site during the SI is located in areas with the highest potential to be impacted from past site use.

Following receipt of the analytical results from the contract laboratory, the results will be screened to ascertain whether a release posing a possible risk has occurred, as described in Section 3.6.4. If it is determined that a release posing a risk has likely occurred at a particular sample location, the additional samples collected but not analyzed from the locations immediately adjacent to that location on the spokes or semicircles of the shooting station arc will be analyzed by the contract laboratory for lead to assist in a determination of the extent of the release (Figure 3-2). With the exception of the sample locations on the perimeter of the grid, this will usually consist of four additional sample locations. In the event that it is determined that a release has occurred within the open portion of the range not within the grid, all samples collected within that open portion will be analyzed.

In an effort to measure shot density across the site, 20 samples will be collected from the site and sieved for lead shot (shown in purple on Figure 3-2). The samples will be collected from a 12 inch by 12 inch area to a depth of 3 inches (0.25 ft^3) and wet sieved in order to expedite the shot count process in the field. Since shot size is generally limited to a maximum of 0.95 in for trap and sporting clay use and a maximum of 0.08 in for skeet shooting, a #10 sieve (0.08 inch openings) will be used to screen for shot.

CAX Marine Pistol and Rifle Range Sampling Strategy

Unlike a skeet range, a pistol and rifle range will not produce a fan-shaped shot distribution. Rather, the impacted area will tend to be located in the vicinity of the targets and the backstop. At the CAX Marine Pistol and Rifle Range, 130 collocated surface and subsurface soil samples will be collected from 65 sample locations (shown on Figure 3-3). The default sampling strategy proposed biases sample locations toward the locations of the targets and the backstop of the range (i.e., the most likely areas of releases, if present). If areas are identified during the visual and metal detector aided survey that may contain more expended rounds and casings, sample locations may be moved based on professional judgment to bias samples to the areas in which a release was most likely to have occurred. The original sampling grid (Figure 3-3) and any selection of sampling locations based on the metal detector aided survey will result in sample results that are biased to locations that most likely represent the source of the potential release. This non-random approach will ensure that the sampling conducted at the site during the SI is located in areas with the highest potential to be impacted from past site use.

Sample locations will be marked prior to sample collection using a hand-held GPS. Surface (0 to 6 inches bgs) and subsurface (6 to 24 inches bgs) samples will be collected using a stainless steel trowel or hand auger. The samples will be immediately packed on ice for shipment to an offsite laboratory.

Initially, 20 surface and 20 subsurface samples will be analyzed for select metals by trace ICP (Method 6010B). Proposed sample locations for initial analysis are shown in purple on Figure 3-3. However, if the visual and metal detector aided survey indicates that a release may have occurred in an area in which no sample location exists or an area in which no

analytical samples are planned, professional judgment will be used to move or change analytical sample locations. The total number of samples to be sent for initial analysis will remain at 40 (20 surface and 20 subsurface). The following analytes will be required from the laboratory (refer to Tables 3-1, 3-2, and 3-4), based on the contaminants likely to result from releases from small arms rounds:

- Antimony
- Arsenic
- Copper
- Iron
- Lead
- Tin
- Zinc

Following receipt of the analytical results from the contract laboratory, the results will be screened to evaluate whether a release has occurred, as described in Section 3.6.4. If it is determined that a release posing a potential risk has occurred, the contract laboratory will be asked to analyze additional samples from the area surrounding the release to assist in assessing its extent. Additional sample locations will consist of those locations not analyzed that are immediately adjacent to the sample location at which the release potentially posing a risk was identified (Figure 3-3).

3.4.2 Quality Assurance/Quality Control and Sample Handling

Quality Assurance and Quality Control

Quality assurance/quality control (QA/QC) requirements for environmental sampling, handling, and management are detailed in Appendix B and in the Master Plans (Baker, 2005a). Field quality control (QC) samples (consisting of trip blanks, field blanks, equipment blanks, duplicate samples, and matrix spike/matrix spike duplicate (MS/MSD) samples) will be collected during the investigation and submitted for laboratory analysis. Required QA/QC samples and the required frequency of collection are as follows:

Sample Type	Description	Frequency	Analytes
Field Blank	Designed to detect contamination in the decontamination water. A field blank is decontamination water collected directly in the sample bottle. It shall be handled like a sample and transported to the laboratory for analysis.	One field blank from each source of decontamination water for each sampling event, where a sampling event is defined as one week	All laboratory analyses requested for the environmental samples collected at the site for that week
Equipment Blank	Designed to detect contamination of environmental samples caused by contamination of sampling equipment. An equipment blank is analyte-free water that is poured into or pumped through the sampling device, transferred to a sample bottle, and transported to the laboratory for analysis.	One each day of sampling	All laboratory analyses requested for environmental samples collected at the site on that day

Sample Type	Description	Frequency	Analytes
Field Duplicate	Designed to check precision of data in the laboratory. A field duplicate is a sample collected in addition to the native sample at the same sampling location during the same sampling event.	10%; One every 10 samples	Same parameters as parent sample
MS/MSD	Designed to evaluate potential matrix interferences, accuracy, and precision. Three aliquots of a single sample—one native and two spiked with the same concentration of matrix spike compounds—are analyzed.	5%; One every 20 samples	Same parameters as parent sample

Tables 3-3 and 3-4 present the anticipated number of field samples and their associated QA/QC samples for the initial round of analysis.

Station Identification System

Field station data are information assigned to a physical location in the field at which some sort of sample is collected. For example, a monitoring well that has been installed will require a name that will uniquely identify it with respect to other monitoring wells or other types of sample locations. The station name provides a key in a database to which any samples collected from that location can be linked to form a relational database structure.

Each station will be uniquely identified by an alphanumeric code that will describe the station's attributes. These attributes are Facility, Area of Concern (AOC)/Site/Operable Unit (OU) number, Location type, sequential Location number, and possibly an additional qualifier. The naming scheme that will be used to identify a sampling location is documented in Table 3-5.

Sample Identification System

Field sample data are information assigned to a physical piece of material collected in the field for which some sort of analysis will be run. Before collecting samples, the Field Team Leader (FTL) will review the proposed level of effort and create a list of unique sample identification names, or sample IDs.

A standardized numbering system will be used to identify all samples collected during sampling activities. The numbering system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. A list of the sample identification numbers will be maintained by the FTL, who will be responsible for enforcing the use of the standardized numbering system during all sampling activities. Sample identification for all samples collected during the investigations will use the format described below.

Each normal and duplicate sample will be uniquely identified by an alphanumeric code that will describe the sample's attributes. These attributes are Facility, AOC/Site/OU number, Location type, sequential Location number with possibly an additional qualifier, depth (as applicable) and date. Each field QC sample will also be uniquely identified by an alphanumeric code that will describe the sample's attributes. These attributes are Qualifier Code, Qualifier Number, and Date. Each unique set of sample attributes will be assigned a

unique sample name. The naming scheme that will be used to identify a field sample is documented in Table 3-6.

This sample designation format will be followed throughout the field activities conducted at WPNSTA Yorktown and CAX. Required deviations to this format in response to field conditions will be documented in the field logbook.

Sample Packaging and Shipping

Samples will be tightly packed in a cooler with bubble wrap packaging material and ice as a preservative. The samples will be either picked up at the site by the analytical laboratory or shipped to the laboratory via overnight courier. The FTL will be responsible for completion of the following forms:

- Sample labels and chain-of-custody (COC) seals
- COC forms
- Appropriate labels and forms required for shipment

Custody of the samples will be maintained and documented at all times. Chain of custody will begin with the collection of the samples in the field and will continue through the analysis of the sample at the analytical laboratory.

3.4.3 Decontamination

Unless disposable, all equipment involved in field investigation activities will be decontaminated upon arrival at the site, between sampling locations, and at the conclusion of investigation activities. Stainless steel sample equipment will be rinsed with distilled water and thoroughly scrubbed with Liquinox™ detergent. Equipment will then be rinsed again with distilled water. Following the distilled water rinse, a final rinse will be completed using laboratory grade deionized water. Details on procedures for decontamination can be found in Section 3.23, Final Master Field Sampling and Analysis Plan, of the Master Plans.

3.4.4 Investigation-Derived Waste Management

All investigation-derived waste (IDW) generated will be managed during the investigation in accordance with the Master Plans (Baker, 2005e). IDW includes water from the decontamination of sampling equipment generated during sampling activities. Samples to be collected for the purposes of IDW characterization are included on Tables 3-1 through 3-4.

Lead shot collected during the field investigation at the WPNSTA Yorktown MWR Skeet Range will be collected and placed in a sealed container. The lead shot will be transported to a lead recycling facility for disposal.

3.5 Health and Safety Plan

The Master HASP in the Master Plans will be utilized along with the project-specific HASP in Appendix A.

3.6 Data and Reporting

During the ESI, three types of data will be generated: field, laboratory, and investigation interpretive. This subsection presents documentation and processing procedures for the data.

3.6.1 Field Data

The field team will document all field activities, including any visits to the site by regulatory personnel or their contractors, in a bound field logbook. The logbook will also be used to document, explain, and justify all deviations from the approved work plan and Master Plans (Baker, 2005e). Its pages will have water-resistant sizing and will be consecutively numbered. Waterproof ink, preferably black, will be used to record entries in the field logbook. Each page will be dated and signed by the individual making the entry. The field logbook should provide a summary of the field activities.

The sampling team will record in the field logbook sampling information, physical and geological information, and any field measurements taken during sampling. A copy of all field logbook entries and COC records will be made available upon request.

3.6.2 Laboratory Data

Upon their arrival at the laboratory, the samples will be cross-referenced against the COC records. All sample labels will be checked against the COC, and any mislabeling will be identified, investigated, and corrected. The samples will be logged in at every storage area and work station required by the designated analyses. Individual analysts will verify the completeness and accuracy of the data recorded on the forms.

Raw data will be entered by the analysts in bound laboratory notebooks. All calculations will be entered into designated laboratory notebooks with a sufficient amount of data to compute without reference to other documents. A tracking form will be used to show that at least 10 percent of all calculations have been checked by the analyst and the laboratory quality assurance (QA) supervisor from the raw data to the final value stages prior to reporting the results of a group of samples. This tracking form, as well as all logs and calculations, will be made available for any QA audit conducted during the investigation.

Instrument calibration logs and internal QC procedures will be documented in accordance with the analytical method in use. All proposed analytical methods have been documented in detail in the Master Plans and in Section 3.5. Documentation of these activities will be made available during QA audits.

The reporting requirements will be in accordance with the ICP 6010B analytical method for inorganics analysis, or other specified analytical method.

Copies of all the analytical data reports, including the QC data, will be maintained by CH2M HILL in the project files.

3.6.3 Data Validation

Following receipt from the contract laboratory and screening as described in Section 3.6.4, data will be sent to an independent data validation subcontractor for validation.

3.6.4 Inspection Results Interpretation and Reporting

Immediately following receipt of the analytical data from the laboratory and prior to submittal to the data validator, a population to population comparison will be conducted comparing site results and the results from the background sample set for soil association 2 surface and subsurface soil as defined in Baker Environmental's 1995 background study. Tin was not analyzed during Baker's background study. Because tin was used for plating other metals or as an alloy for other metals, it is unlikely that it would be found in elevated concentrations if other metals are not found at elevated concentrations. Consequently, the background population to population comparison for the other metals will be used to determine the likelihood of a release relative to background. If the site and background populations are statistically comparable, it will be concluded that a release has not occurred, no additional samples will be analyzed, existing data will be sent for validation to confirm the analytical results, and an ESI report will be prepared summarizing the results and recommending no further action.

If the population to population comparison indicates that the site population is not statistically comparable to the background population, individual results will be screened against the corresponding unadjusted residential risk-based concentration (RBC) and Biological Technical Assistance Group (BTAG) flora and fauna screening values (Table 3-7). Although there are no plans to use the range land for residential purposes, this land may be used for camping cabins or for other recreational purposes. Residential RBCs are used for screening to address this possible land use.

There is no RBC for lead in soil. Lead is regulated by the U.S. Environmental Protection Agency (USEPA) based on blood-lead uptake using a physiologically based pharmakokinetic model referred to as the IEUBK model. The lead soil-screening level of 400 milligrams per kilogram (mg/kg) is typically used to screen soil. In the event of a lead concentration in excess of 400 mg/kg at a site, the IEUBK model is used to determine if the concentrations are adequately protective of human health. Concentrations of less than 400 mg/kg in soil are considered adequately protective of human health under residential land-use conditions. Therefore, lead concentrations above background will be screened against 400 mg/kg for human health, while other constituents will be screened against corresponding residential RBCs (Table 3-7).

If the site data set is found to be elevated relative to the background data set, but individual results do not exceed the health-based screening criteria, it will be concluded that the possible release does not represent an unacceptable risk to human health and/or the environment, no additional samples will be analyzed, existing data will be sent for validation to confirm the analytical results, and an ESI report will be prepared summarizing the results and recommending no further action.

If one or more analytical results exceeds the health-based screening values described above, individual samples results will be compared against the background UTLs. The contract laboratory will then be asked to analyze any additional samples surrounding the sample location(s) exceeding UTLs and the screening values as described in Section 3.4.1 so that the aerial extent of the release can be estimated and a path forward for additional investigation, quantitative risk assessment, or removal action can be evaluated.

TABLE 3-1
Summary of Sampling Program
WPNSTA Yorktown MWR Skeet Range, Yorktown, Virginia
CAX Marine Pistol and Rifle Range, Williamsburg, Virginia
Site Investigation Work Plan

Sample Media	Sample Depth/Location and Rationale	Laboratory Analysis			
		TAL Metals or Lead by Trace ICP (6010B)	Reactivity (Cyanide)	Corrosivity (to steel)	Ignitability (Pensky Martens)
Surface Soil	Collected the first six inches (6") of soil from each location shown in Figure 3-2. Will allow for characterization of surface soil across the site. Co-located with subsurface soil samples.	X			
Subsurface Soil	Collected from the six to eighteen inch (6"-18") interval of soil from each location shown in Figure 3-2. Will allow for characterization of surface soil across the site. Co-located with surface soil samples.	X			
Water	Equipment blank Field Blank	X			
Water	IDW characterization of decon water		X	X	X

Notes and Abbreviations
TAL = Target Analyte List

TABLE 3-2
Analyses, Bottleware, Preservation, and Holding Time Requirements
WPNSTA Yorktown MWR Skeet Range, Yorktown, Virginia
CAX Marine Pistol and Rifle Range, Williamsburg, Virginia
Site Investigation Work Plan

Media	Analysis	Method	Container	Preservation / Storage	Holding Times
Soil	TAL Metals or Lead by Trace ICP	6010B	1x4-oz bottle, Teflon cap	4ºC	6 months
Water	TAL Metals or Lead by Trace ICP	6010B	1x1-L Poly bottle	HNO_3 to pH <2 and cool to 4ºC	6 months

Notes
TAL = Target Analyte List (TAL) metals
HNO_3 = nitric acid

TABLE 3-3
Sample Collection Frequencies
MWR Skeet Range, Site Investigation Work Plan
WPNSTA Yorktown
Yorktown, Virginia

Analysis/Test	Sample Matrix	Field Samples for initial analysis	Field Duplicates for initial analysis	Equipment Blanks	Field Blanks	MS/MSDs
Soil Samples						
Lead by trace ICP	Soil	40	4	4	1	2
IDW Sampling						
Full TCLP	Aqueous	1				
RCI		1				

Notes
MS/MSD = Matrix Spike and Matrix Spike Duplicate pair
TAL = Target Analyte List
Field duplicates are collected at the rate of 1 for every 10 environmental samples
Equipment rinsate blanks are typically collected at the rate of 1 per day per media
Field blanks are typically collected at the rate of 1 per week during sampling
MS/MSDs are collected at the rate of 1 for every 20 samples
TCLP = Toxicity Characteristic Leaching Procedure
RCI = Reactivity, Corrosivity, and Ignitability Characteristics

TABLE 3-4
Sample Collection Frequencies
Marine Pistol and Rifle Range, Site Investigation Work Plan
FISC Cheatham Annex
Williiamsburg, Virginia

Analysis/Test	Sample Matrix	Field Samples for initial analysis	Field Duplicates for initial analysis	Equipment Blanks	Field Blanks	MS/MSDs
Soil Samples						
Select TAL Metals by trace ICP	Soil	40	4	4	1	2
IDW Sampling						
Full TCLP	Aqueous	1				
RCI		1				

Notes
MS/MSD = Matrix Spike and Matrix Spike Duplicate pair
TAL = Target Analyte List
Field duplicates are collected at the rate of 1 for every 10 environmental samples
Equipment rinsate blanks are typically collected at the rate of 1 per day per media
Field blanks are typically collected at the rate of 1 per week during sampling
MS/MSDs are collected at the rate of 1 for every 20 samples
TCLP = Toxicity Characteristic Leaching Procedure
RCI = Reactivity, Corrosivity, and Ignitability Characteristics

TABLE 3-5
Station ID Scheme
Naval Weapons Station Yorktown

First Segment	**Second Segment**	
Facility, AOC Number	Station Type	Station Number, Modifier
AANN	AA	NNN_A
Notes: "A"= alphabetic "N"= numeric		

Facility: Y = Yorktown Naval Weapons Station C = Cheatham Annex Site Number - Sequential Site Number S01 = Site 1 S03 = Site 3 S06 = Site 6 S07 = Site 7 S11 = Site 11 S17 = Site 17 S24 = Site 24 S25 = Site 25 R01 = MWR Skeet Range M01 = Marine Pistol and Rifle Range BKL = Background locations outside of the facility YNWS = Yorktown Naval Weapons Station QC Samples Only CHAX = Cheatham Annex QC Samples Only	Station Type: DS = direct push—soil DW = direct push—groundwater MW = monitoring well groundwater SB = soil boring soil SS = Surface Soil SD = Sediment sample SL = storm sewer line sediment SW = surface water TS = trench sediment WP = wipe sample TI = tissue sample WS = Waste Characterization – Soil WW = Waste Characterization - Water IDW = Investigation Derived Waste QC = For QA/QC blanks only Station Number: Sequential Station Number (i.e., 001, 002, 003…) Modifier (used selectively): D = Deep monitoring well S = Shallow monitoring well

Example Station IDs:

YR01-SS002 = Surface soil station #2 at the Yorktown Naval Weapons Station MWR Skeet Range
YR01-MW002S = Shallow monitoring well station 2, located the Yorktown Naval Weapons Station MWR Skeet Range.
YBKL-SD002 = the Yorktown Naval Weapons Station MWR Skeet Range Background sediment location #2
CM01-SB005 = Soil boring station #5, located at the Cheatham Annex marine Pistol and Rifle Range
CHAX-QC = QC sample collected at the Cheatham Annex
***Note:* Station ID for any QA/QC blank samples (trip blanks, field blanks, equipment rinse blanks) will be Facility, AOC Number-QC and Facility, AOC Number–IDW for any IDW samples.

TABLE 3-6
Sample ID Scheme
Naval Weapons Station Yorktown

First Segment	Second Segment	Third Segment	Fourth Segment
Facility, AOC Number	Station Type, Station Number, Modifier	Depth (As Applicable)	Date (MMYY) $_A$
AANN	AANNN$_A$	A	NNNN$_A$
Notes: "A"= alphabetic "N"= numeric			

Facility:

Y = Yorktown Naval Weapons Station
C = Cheatham Annex

Site Number - Sequential Site Number

S01 = Site 1
S03 = Site 3
S06 = Site 6
S07 = Site 7
S11 = Site 11
S17 = Site 17
S24 = Site 24
S25 = Site 25
R01 = MWR Skeet Range
M01 = Marine Pistol and Rifle Range

BKL = Background locations outside of the facility

Station Type:

DS = Direct push—soil
DW = Direct push—groundwater
MW = Monitoring well groundwater
SB = Soil boring soil
SS = Surface Soil
SD = Sediment sample
SL = Storm sewer line sediment
SW = Surface water
TS = Trench sediment
WP = Wipe sample
TI = Tissue sample
WS = Waste Characterization – Soil
WW = Waste Characterization - Water
IDW = Investigation Derived Waste
QC = For QA/QC blanks only
EB = Equipment Rinse Blank
FB = Field Blank

Station Number:

Sequential Station Number (e.g., 001, 002, 003)

Modifier (used selectively):

D = Deep monitoring well
S = Shallow monitoring well
P = Duplicate

Depth:

Use only if applicable. A sequential letter is used to reflect varying depths, as actual depths can change in the field after sample planning has occurred. E.g. A, B, C…

Sample Number:

1. Duplicate Samples - Use a 'P' modifier in the second segment of the sample ID, directly after the location number to indicate a duplicate sample. E.g. YS01-MW11P-0506

2. QC Samples (Blank Samples) - Format consists of Qualifier Code, Sequential Qualifier Number-Date (AANN-MMDDYY). E.g. TB02-061106

Qualifier Codes:
TB = Trip Blank
FB = Field Blank
EB = Equipment Blank

3. Multiple samples - Should multiple samples be collected from the same station in a given day/month (affects only samples not differentiated by depth), a sequential letter will be added to the end of the fourth segment (date). E.g. A, B, C…

4. Note – The sample ID for normal samples begins with the station ID (first and second segments).

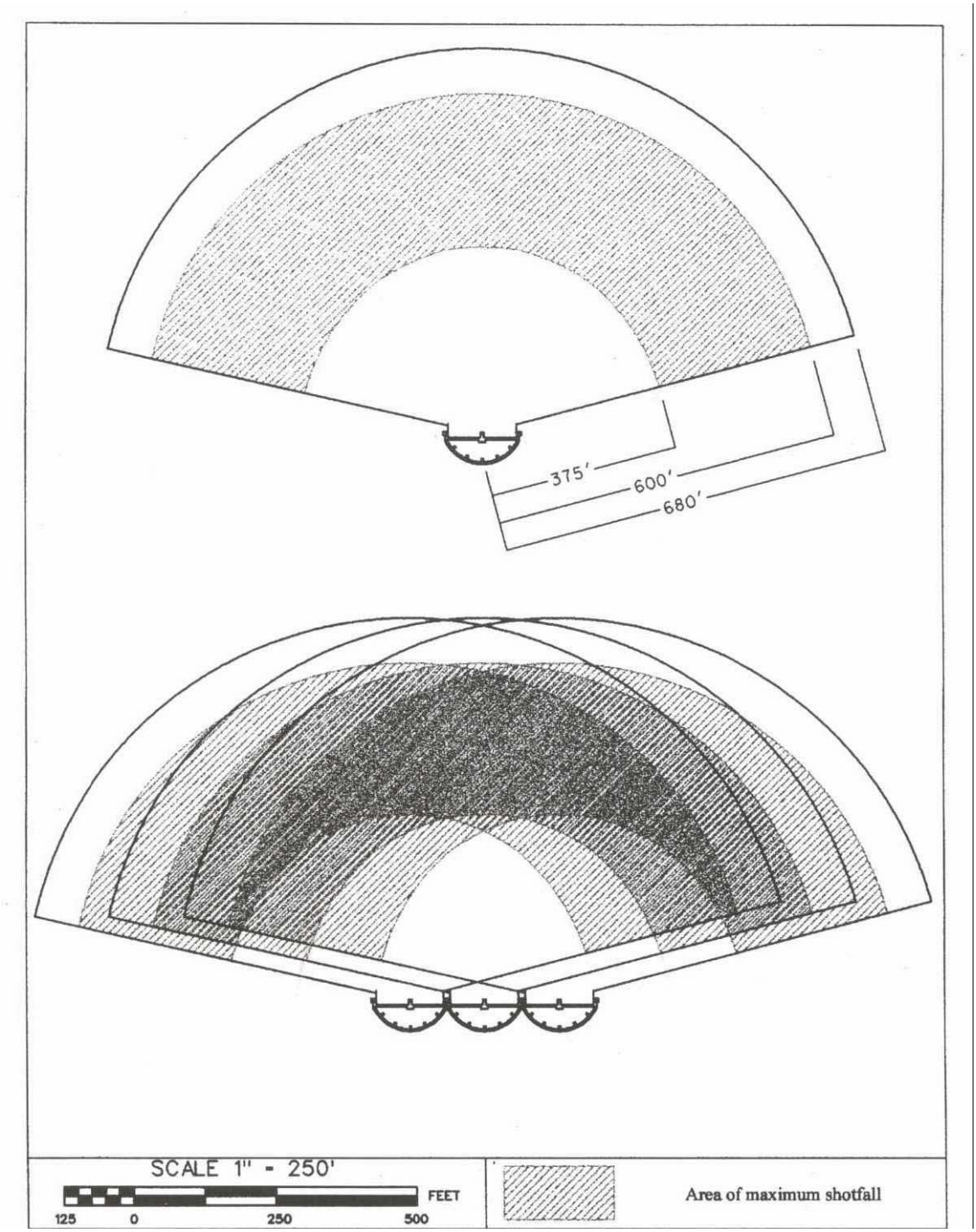
Example Sample IDs:

YS03-DS005-B-0805 = Direct push soil sample collected at station 5, at Site 3 at the Yorktown facility, from the second depth collected below ground surface (BGS) in August 2005.
CBKL-SS011-0403 = Surface soil sample collected at station # 11, in the background location outside of Cheatham Annex in April 2003.
YR01-MW102S-0105A = The first shallow groundwater sample collected at monitoring well station 102 in January 2005 in Site 01 at the Yorktown Naval Weapons Station MWR Skeet Range.
CM01-SW024P-0306 = Cheatham Annex Marine Pistol and Rifle Range duplicate surface water sample collected at station 24 from Site 17 in March 2006.
FB01-061106 = The first field blank collected on June 11, 2006.

TABLE 3-7
Summary of Screening Values
WPNSTA Yorktown MWR Skeet Range, Yorktown, Virginia
CAX Marine Pistol and Rifle Range, Williamsburg, Virginia
Site Investigation Work Plan

	Residential RBC (mg/kg)	Criteria Upper BTAG Flora (mg/kg)	Criteria Upper BTAG Fauna (mg/kg)
Antimony	31	0.48	None Exist
Arsenic	0.43	328	None Exist
Copper	3100	15	None Exist
Iron	23000	3260	12
Lead	400*	2	0.01
Tin	47000	None Exist	None Exist
Zinc	23000	10	None Exist

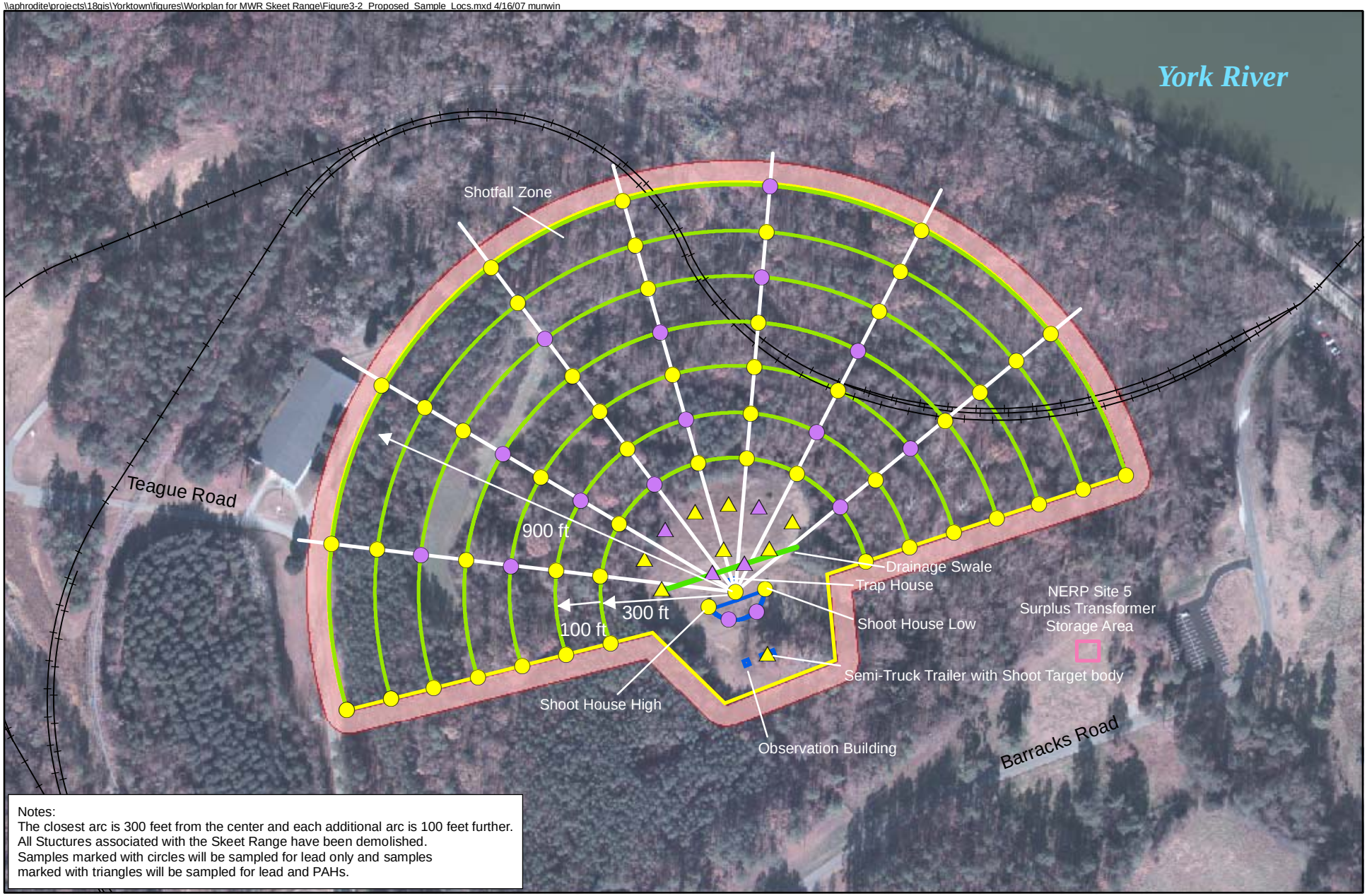
NA: Tin was not evaluated during the background investigation, therefore, no UCLs are available
*This value is not an RBC. The value is the EPA screening value to determine whether risk should be calculated using the IEUBK model



Source: National Shooting Sports Foundation, 1997

FIGURE 3-1 – Skeet Range Shotfall Zone
Theoretical shotfall zone and area of maximum shotfall at skeet fields. A single field is shown at the top of the page, and multiple adjacent fields are shown at the bottom of the page.

\\aphrodite\projects\18gis\Yorktown\figures\Workplan for MWR Skeet Range\Figure3-2_Proposed_Sample_Locs.mxd 4/16/07 munwin



Notes:
The closest arc is 300 feet from the center and each additional arc is 100 feet further.
All Stuctures associated with the Skeet Range have been demolished.
Samples marked with circles will be sampled for lead only and samples marked with triangles will be sampled for lead and PAHs.

LEGEND

- Samples to be Held Pending Initial Analytical Results
- Sample Locations for Initial Submission to the Lab
- Base Boundary
- Range Distance Arcs
- Grid Sample Locations
- Drainage Swale
- MWR Skeet Range
- Skeet Range Site Features
- NERP Site 5 Surplus Transformer Storage Area
- Railroad
- 50 foot buffer

N

0 150 300 Feet

Figure 3-2
Proposed Sample Locations at the
MWR Skeet Range
WPNSTA Yorktown
Yorktown, Virginia

CH2MHILL

\\aphrodite\projects\18gis\CheathamAnnex\Projects\Yorktown MRP\Figure3-3_Proposed_Sample_Locs_Marine_Pistol_Rifle_Range.mxd 3/30/07 munwin

LEGEND

- Sample Locations for Samples to be held Pending Initial Analytical Results
- Sample Locations for Initial Submission to the Lab
- Marine Pistol and Rifle Range
- 50 foot buffer

N

0 100 200 Feet

Figure 3-3
Proposed Sample Locations at the Marine Pistol and Rifle Range
FISC Cheatham Annex
Williamsburg, Virginia

CH2MHILL

SECTION 4

Staffing, Reporting and Deliverables

4.1 Project Personnel, Organization, Reporting, and Schedule

4.1.1 Project Organization

The key organizations involved in this project are NAVFAC Mid-Atlantic, the USEPA, the Virginia Department of Environmental Quality (VDEQ), and CH2M HILL, Inc. Project execution will be conducted by CH2M HILL and its subcontractors.

- CH2M HILL is the primary point of contact with NAVFAC Mid-Atlantic. CH2M HILL will manage the overall project, providing day-to-day oversight and related program management support to execute the project successfully.

4.1.2 Project Personnel

The roles and responsibilities of the key personnel are discussed below.

- Deputy Program Manager—Doug Dronfield will provide program management support of this CTO and will ensure that all contract requirements are met during execution of this project
- Activity Manager—Laura Cook will coordinate the implementation of all CTOs at WPNSTA Yorktown/CAX. Mrs. Cook will ensure that information is shared between CTO project teams and will communicate with the Navy RPM concerning the overall activity
- Project Manager—Tim Wenk will have overall CH2M HILL responsibility for technical support and oversight, budget and schedule review and tracking, invoice review, personnel resources planning and allocation, and project coordination. Mr. Wenk will also coordinate field activities with project field personnel.
- Corporate Munitions Response Safety Officer—Dan Young, will oversee the implementation of the MEC awareness information to ensure that it meets all specific needs of the project and that appropriate health and safety requirements relative to MEC are defined.
- Program Health and Safety Manager—Steve Beck will support the implementation of the HASP (refer to Appendix A) to ensure that it meets all specific needs of the project and that appropriate health and safety requirements are defined.

4.1.3 Project Schedule

CTO-122, which authorizes CH2M HILL to perform the ESIs at the WPNSTA Yorktown MWR Skeet Range and the CAX Marine Pistol and Rifle Range, was issued by NAVFAC on

May 4, 2006. The schedule for performing the ESIs is provided as Table 4-1. This schedule may require revision as the project progresses.

4.1.4 Reporting

A Draft ESI report will be prepared to document the findings of the site inspections. The report will summarize all field activities, evaluate the collected data, and identify if a release has occurred at either of the sites based on the data collected. The raw data for all analyzed samples will be included in a tabular format in appendices of the ESI report. The report will present a conceptual site model (CSM) for each range based on the site features and analytical data. If a release is identified at either site, the report will identify release mechanisms, present an evaluation of fate and transport at the site(s), and identify potential receptors. Based on the sample set proposed, it is likely that data collected will be sufficient to provide justification for close-out of the site(s) or to remediate any contaminant source areas identified. However, if data gaps remain following this inspection, the report will provide recommendations for future study.

Following NAVFAC and regulator review, a Draft Final ESI report will be prepared that incorporates review comments. The Draft Final ESI report will be submitted to NAVFAC MIDLANT and the regulators for review. Any additional comments will be addressed and a Final ESI report will be submitted.

TABLE 4-1
Schedule of Deliverables
Yorktown Naval Weapon Station/Cheatham Annex Site Investigation
CTO-122

Item	**Date**
Award	Thursday, May 4, 2006
Project Schedule	Thursday, May 18, 2006
Draft Work Plan to Navy	Friday, July 7, 2006
Receive navy Comments	Friday, July 21, 2006
Draft Work Plan to Regulators	Friday July 28, 2006
Receive Regulator Comments	Thursday, March 22, 2007
Final Work Plan	Monday, April 23, 2007
Field Investigation	Monday, April 30, 2007
Draft SI Report to Navy	Monday, July 30, 2007
Receive Navy Comments	Monday, August 13, 2007
Draft SI Report to regulators	Monday, August 20, 2007
Receive regulator comments	Friday, October 19, 2007
Draft Final SI Report	Friday, November 2, 2007
Final SI Report	Monday, December 3, 2007

SECTION 5

References

Baker Environmental. 1995. *Final Summary of Background Constituent Concentrations and Characterization of Biotic Community from the York River Drainage Basin, Naval Weapons Station Yorktown, Yorktown, Virginia.* July.

Baker Environmental. 2005a. *Final Master Work Plan, Naval Weapons Station Yorktown, Yorktown, Virginia, and Cheatham Annex, Williamsburg, Virginia.* June.

Baker Environmental. 2005b. *Final Master Field Sampling and Analysis Plan, Naval Weapons Station Yorktown, Yorktown, Virginia, and Cheatham Annex, Williamsburg, Virginia.* June.

Baker Environmental. 2005c. *Final Master Quality Assurance Project Plan, Naval Weapons Station Yorktown, Yorktown, Virginia, and Cheatham Annex, Williamsburg, Virginia.* June.

Baker Environmental. 2005d. *Final Health and Safety Plan, Naval Weapons Station Yorktown, Yorktown, Virginia, and Cheatham Annex, Williamsburg, Virginia.* June.

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Malcolm Pirnie. 2005. *Revised Draft Final Preliminary Assessment, Naval Weapons Station, Yorktown, Virginia.* December.

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National Shooting Sports Foundation. 1997. *Environmental Aspects of Construction and Management of Outdoor Shooting Ranges.*

USGS. 1997. *Geohydrology of the Shallow Aquifer System, Naval Weapons Station Yorktown, Yorktown, Virginia.*

Appendix A
Health and Safety Plan

Project-Specific
Health and Safety Plan

Yorktown Naval Weapons Station MWR Skeet Range and Cheatham Annex Marine Pistol Range Site Inspections

Yorktown Naval Weapons Station Yorktown
Yorktown, Virginia
And
Cheatham Annex, Williamsburg, Virginia

Contract Task Order 122

February 2007

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Under the

LANTDIV CLEAN III Program
Contract N62470-02-D-3052

Prepared by

CH2MHILL

Virginia Beach, Virginia

Project-Specific Health and Safety Plan

Introduction

This Project-Specific Health and Safety Plan (HASP) presents the hazards known or anticipated to be present at the at the Naval Weapons Station (WPNSTA) Yorktown during the Yorktown Naval Weapons Station MWR Skeet Range and Cheatham Annex Marine Pistol and Rifle Range Site Inspections. This Project-Specific HASP will be used by CH2M HILL and its subcontractors to identify and mitigate task-specific hazards and to select appropriate health and safety protective measures not otherwise covered in the Master HASP for WPNSTA Yorktown (CH2M HILL, 2007).

The WPNSTA YORKTOWN Master HASP has been previously developed and must accompany/supplement this Project-Specific HASP. The Master HASP contains information pertinent to the general conditions at WPNSTA YORKTOWN, such as general site information, hazard evaluation and control, personnel responsibilities and requirements, a general description of personal protective equipment, customary decontamination procedures, and emergency response procedures. On-site personnel must review both the Master-HASP and the project-specific HASP and sign an agreement to comply with its provisions prior to commencing on-site work. The Master-HASP and project-specific HASP are considered operational documents that are subject to revisions in response to various project-specific conditions that may be encountered. However, these documents may be modified or updated only with the approval of the Project Health and Safety Officer (PHSO) and Project Manager.

Policy

CH2M HILL's policy is that on-site hazardous waste management activities be performed in conformance with both the Master HASP and a Project-Specific HASPs. The documents are written based on the anticipated hazards and expected work conditions, and apply to field activities to be performed under the Work Plan. Applicability of this Master-HASP and the Project-Specific HASPs extends to all CH2M HILL employees, CH2M HILL's subcontractors, and visitors entering the site. CH2M HILL subcontractors must follow an established health and safety plan; in most cases, either adopting this master plan with appropriate project-specific HASP (e.g., surveyor), or adopting same and amending both with safety and/or health requirements specific to their work (e.g., driller). HASPs authored by a subcontractor must be reviewed by CH2M HILL's PHSO before commencing on-site work. After being reviewed, this information will become part of the appropriate project-specific HASP.

This Project-Specific HASP in combination with the Master HASP will, at a minimum, meet the requirements under Occupational Safety and Health Administration (OSHA) Standard *29 Code of Federal Regulations* (CFR) 1910.120 (Hazardous Waste Operations and Emergency Response).

PRE-ENTRY REQUIREMENTS

During site mobilization, the Site Health and Safety Officer (SHSO) will perform a reconnaissance of each site as identified in the project-specific Work Plan (WP) to evaluate and determine the chemical, physical, and environmental hazards; establish or confirm emergency points of contact and procedures; and review any other issues deemed necessary to address site safety and health. The SHSO will then conduct a health and safety briefing with the site personnel to discuss data obtained from the previous site reconnaissance, provisions outlined in this Master HASP and project-specific HASP, and appropriate safety and health procedures and protocols.

CH2M HILL HEALTH AND SAFETY PLAN

This Health and Safety Plan (HASP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Safety Coordinator Haz-Waste (SC-HW) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 1.

Project Information and Description

PROJECT NO: 345217

CLIENT: US Navy

PROJECT/SITE NAME: Yorktown Naval Weapons Station MWR Skeet Range and Cheatham Annex Marine Pistol and Rifle Range Site Inspections

SITE ADDRESS: Yorktown Naval Weapons Station, Yorktown, Virginia
Cheatham Annex, Williamsburg, Virginia

CH2M HILL PROJECT MANAGER: Tim Wenk

CH2M HILL OFFICE: Herndon

DATE HEALTH AND SAFETY PLAN PREPARED: 5/26/2006

DATE(S) OF SITE WORK: March 2007 – August 2007

SITE ACCESS: Must be accompanied by UXO sub if doing subsurface work

SITE SIZE: WPNSTA Yorktown MWR Skeet Range – approximately 30 acres
CAX Marine Pistol and Rifle Range – approximately 7 acres

SITE TOPOGRAPHY: Flat with slight depressions; mostly forested

PREVAILING WEATHER: Mid-Atlantic, temperate

SITE DESCRIPTION AND HISTORY:

WPNSTA Yorktown MWR Skeet Range –

The MWR Skeet Range is approximately 2000 feet south and southeast of Roosevelt Pond and close to 1500 feet southwest of the York River. There are no wetlands located on the former range. There is a small, intermittent streambed along the eastern edge of the cleared area on-site. There is also a drainage swale located along the center of the site north of the concrete firing pad. The vegetation on the MWR Skeet Range includes cleared, open grasslands surrounded by a mix of hardwood and pine forests. The edge of the cleared land is mainly brush and small shrubs that transition into dense, mature forest.

The range was used on the weekends by facility personnel from 1980 to 1982 and then used sporadically until 1994, when the range was closed. The MWR Skeet Range was used exclusively for recreational purposes. The activities on the range site were limited to skeet shooting with shotguns, firing from a launching pad near the access road in the south toward the northern tree line.

CAX Marine Pistol and Rifle Range -

The Marine Pistol and Rifle Range was a training ground for small arms of various calibers. From historical reports, the munitions used at the range were all small caliber ammunitions (i.e., less than .50-caliber). Although the dates for construction of the range are not available, aerial photographs show that the range was in use by 1939. According to Navy personnel, the range was no longer is use by the 1970s, giving a total lifespan of approximately 30 years. Currently, the southern-most portion of the range is used for vehicle storage. The range is primarily wooded along the west, north and east borders, with pines being the dominant tree type.

The range is rectangular and approximately seven acres in area. Firing took place from the southern end of the range toward a wooden backstop and wooden targets in the north; the firing zone is approximately 750 feet long, stretching along the north-south axis. The open portion of the range is now lightly wooded due to planting of cedar trees about 15 years ago.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED:

The specific objective of CTO 122 is to perform a ESIs to determine impacts by munitions constituents (MC) and collect additional information to verify the findings of previous investigations with regards to past MEC use or disposal at the site. Specifically, CH2M HILL will:

- Conduct the fieldwork, including the sampling of soil using a hand auger and handheld magnetometer survey of the surface.
- Procure qualified subcontractors to perform laboratory analysis and data validation of sample results.

1 Tasks to be Performed Under this Plan

1.1 Description of Tasks

(Work Plan for Expanded Site Inspections for MWR Skeet Range , Naval Weapons Station Yorktown, Yorktown, Virginia, and Marine Pistol and Rifle Range, Cheatham Annex, Williamsburg, Virginia).

The specific objective of CTO 122 is to perform a ESIs to determine impacts by munitions constituents (MC) and collect additional information to verify the findings of previous investigations with regards to past MEC use or disposal at the site. Specifically, CH2M HILL will:

- Conduct the fieldwork, including the sampling of soil using a hand auger and handheld magnetometer survey of the surface.
- Procure qualified subcontractors to perform laboratory analysis and data validation of sample results.

1.1.1 Hazwoper-Regulated Tasks for MWR Skeet Range and Cheatham Annex Marin Pistol and Rifle Range Site Inspections

- Surface and sub-surface soil sampling
- Hand Augering
- Magnotometer Surveying
- Investigation derived waste management

1.2 Project HS&E Change Management Form

*This evaluation form should be reviewed on a **continual basis** to determine if the current project-specific HASP adequately addresses ongoing project work, and it should be modified whenever new tasks are contemplated or changed conditions are encountered.*

Project Task: Soil Sampling	Activity Manager: Donna Caldwell/WDC
Project Number: 345217	Project Name: **WPNSTA Yorktown/Cheatham Annex Marine Range Site Inspections**

Evaluation Checklist		Yes	No
1.	Has CH2M HILL staff changed?		
2.	Has a new subcontractor been added to the project?		
3.	Is any chemical or product to be used that is not listed in **Attachment 7** of the plan?		
4.	Are all tasks addressed in Section 1.1 of the project-specific HASP?		
5.	Have new contaminants or higher than anticipated levels of original contaminants been encountered?		
6.	Have other safety, equipment, activity, or environmental hazards been encountered that are not addressed in Section 2.1 of the plan?		

If the answer is "YES" to Questions 1-3, a HASP revision is NOT needed. Please take the following actions:

- Confirm that the staff's medical and training status is current—check training records at: http://www.int.ch2m.com/hands (or contact your regional SPA) and confirm subcontractor qualifications.
- Confirm with the project KA that subcontractor safety performance has been reviewed and is acceptable.
- Confirm with H&S that subcontractor safety procedures have been reviewed and are acceptable.

If the answer is "YES" to Questions 4-6, a HASP revision MAY BE NEEDED. To determine if a revision is needed, please contact HS&E directly or complete the field project start-up form at: http://www.int.ch2m.com/hsdocgen/fppricing.asp**.**

POTENTIAL HAZARDS	Hand Augering	Magnorometer	Soil Sampling	IDW Management
Flying debris/objects	X	X	X	X
Electrical		X		
Buried utilities, drums, tanks	X		X	
Slip, trip, fall	X	X	X	X
Back injury	X	X	X	X
Biological Hazards	X	X	X	X
Visible lightning	X	X	X	X
Heat/Cold Stress	X	X	X	X

2 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the Site Safety Coordinator (SSC) for clarification.

In addition to the controls specified in this section, "Project-Activity Self-Assessment Checklists" are contained in **Attachment 11**. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor project-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Project-specific frequency for completing self-assessments: **Initially and if conditions change (as determined by the SSC).**

2.1 Project-Specific Hazards

2.1.1 Procedures for Locating Buried Utilities

- Refer to the Master HASP for WPNSTA YORKTOWN for specific utility locating procedures.
- Call Miss Utility of Virginia: 1-800-257-7777

2.1.2 Lead

The following requirements pertain to lead contaminated soils:

- Work shall progress in a sequence from less contaminated to more contaminated areas.
- Water should be added to soils prior to and during excavation, air rotary drilling, and other activities that create or have the potential to create airborne lead contaminated dust. For air rotary drilling operations, water can be added to the boring to reduce dust generation from the cyclone. Depending upon soil type, watering of soil may be required several days prior to commencing ground intrusive activities.
- Personnel working in the vicinity of lead contaminated soil shall wear disposable coveralls or equal and exercise enhanced personal hygiene (i.e., frequent hand washing prior to eating, drinking, and smoking; separation of work and street clothing/footwear; etc.).

2.1.3 MEC/MPPEH

Though no encounter with any MPPEH or MEC is anticipated (see attachment 5, Risk Assessment for Presence of MPPEH/MEC), procedures followed by field personnel in view of the slight possibility of encounter are the following:

- A visual sweep will be made of the areas to be sampled, prior to the commencement of any field operations by a CH2M HILL UXO qualified individual, to validate the assumptions regarding MEC/MPPEH, based on the site historical backgrounds and partial observations made during site Preliminary Assessments. If any suspicious items or debris (fragmentation, rocket fins, cartridges other than those associated with small arms, etc.) are encountered, work will not commence until the potential presence of MEC/MPPEH is resolved.

- All personnel will receive an ordnance safety brief (see Attachment 6) from a CH2M HILL qualified UXO supervisor. Visual and verbal descriptions will enable all personnel to readily identify any objects of suspicion encountered during the performance of sampling tasks

- The actions of field personnel, upon encountering an object that cannot be dismissed as non-MEC with certainty or is identified as potential MEC, will be to
  1) immediately cease any sampling activity
  2) avoid any contact with the encountered item(s)
  3) do not attempt to move the item in order to further identify, and avoid any movement of the suspected object through accidental physical disturbance of the area surrounding it,
  4) mark, either with GPS, tape or flag, the area for ease of relocation,
  5) immediately retreat from the area to a location at least 1250 feet from the discovered item
  6) immediately report the find to appropriate personnel (site manager or supervisor, who will in turn notify the activity manager and client, and ensure the information is relayed to the base EOD team (EODMU TWO Detachment Yorktown) for appropriate response (see Emergency Contacts-Attachment 4). Contact/notification with the base EOD team will always be mediated by the client and activity manager, unless neither can be reached at the time of discovery.

- Nothing may be removed from the sites designated by this sampling study, unless identified and specified by the sampling plan.

- If an item cannot be positively identified as non-MEC-related debris, it must be assumed that it is until positively identified by UXO-qualified individuals. DON'T TOUCH IT, MOVE IT or OTHERWISE DISTURB IT UNTIL POSITIVELY IDENTIFIED. FOLLOW ACTIONS AS DESCRIBED ABOVE.

2.1.4 Inclement Weather

- Work may proceed in light rain- wear rain gear.
- Exposure to slips, trips and falls is increased during rainy and snowing conditions.
- Take cover in field vehicle during adverse weather conditions (High winds, heavy rain).
  - Work shall cease and cover sought in the event of lightning or tornado warnings.
  - Identify "Take Shelter" areas before starting project.
  - Work may proceed in light rain- wear rain gear.
- Notify the Project Manager and Client Representative after shelter has been sought.

Adverse weather conditions requiring immediate suspension of field work activities are defined as the following:

- Thunder or lightning. Thunderstorm watches or warning, as the situation warrants, will be used as an alert to potential electric activity. Typically, a 30-minute stand-down occurs to allow the storm cell to pass the area. If lightning or thunder is observed within the stand down period, the 30-minute time frame is extended until electrical activity ceases.
- Sustained wind speeds of 20 miles per hour (mph) or wind gusts of 25 mph for boating activities.
- Sustained wind speeds of 25 mph or wind gusts of 35 mph for high profile work where wind chill is not a factor, i.e., greater than 60°F.
- Sustained wind speeds of 40 mph or wind gusts of 45 mph for non-high profile work.
- Moderate rain and/or snow fall of 0.11 to 0.3 inch per hour during hoisting activities. Freezing rain is also cause for suspension of hoist use.
- An equivalent wind chill factor of -24°F on the wind chill factor chart (below) will trigger systematic shut down of all non-emergency work activities.
- A tornado/hurricane warning for the general area or county will suffice in requiring a general work stoppage.
- If you are inadvertently caught outside in a thunder/lightning storm, take the following precautions:
  - Seek shelter among densely wooded areas.
  - Avoid lone trees as shelter.
  - Avoid open, bare areas.
  - Do not cross water bodies.

2.1.5 Field Vehicle (Driving)

- Familiarize yourself with vehicle features.
  - Mirror adjustments, seat adjustments, cruise control features, etc.
  - Pre-program radio stations.
- Ensure snow, ice and fog are completely removed from windows prior to driving.
- Review driving directions prior to departing
- Inspect vehicle prior to departure (tire pressure, tread, signals, horn, lights).
- Adjust headrest to proper position.
- Always wear seatbelt while operating vehicle.
- Inquire; and obtain, a vehicle pass from the client if required.
- Observe warning signs, yield to traffic, and observe all posted traffic signs.
- Pull off the road, put the car in park and turn on flashers before talking on a mobile phone.
- Maintain both a First Aid kit, Bloodborne Pathogens kit and Fire Extinguisher in the field vehicle at all times.
- Close car doors slowly and carefully. Fingers can get pinched in doors or in the trunk.
- Use a spotter when backing up near monitoring wells.
- Turn off vehicle when leaving it. Leave keys in vehicle.
- Maintain valuables in the trunk.

2.1.6 Wireless Phone Restrictions

- Wireless phones are only to be used in areas where work is not in progress (only in office buildings or parked cars).
- The use of pagers in the work area is allowed (Treat wireless phone like a pager i.e. check caller ID and call back in proper location).

2.1.7 Soil Sampling

- Tie down loose items if utilizing a van or truck with an open bed.
- Utilize a spotter if backing vehicles or equipment towards sampling location.
- Inspect the sampling area for obstructions and Poison Ivy and Poison Oak, or other physical hazards.
- If sample locations are located in dense tall grassy areas consider utilizing a “Bug-Out” suit or Tyvek to mitigate the potential for tick bites.
- If lifting heavy equipment from vehicle, move items to the rear and get assistance when lifting.
- Be alert for bees, wasps and other insects when sampling.
- Ensure only personnel with current 40-hour Hazwoper and 8 hour refresher training perform task.
- Log calibration of Direct Reading Instrument in either a field log book or on attached form.
- Notify others in area that task is going to be performed, delineate an exclusion zone as applicable.
- Don personal protective equipment (PPE) as specified in **Section 4** of this site-specific HASP.
- Position yourself upwind prior to sampling, if possible.
- Review Material Safety Data Sheets for chemical preservatives, decontamination agents and calibration gas.
- Do not handle sample jars without **Nitrile** gloves.

2.1.8 Slips, Trips, and Falls

- Institute and maintain good housekeeping practices.
- Pick up tools and debris in the work area.
- Walk or climb only on equipment and/or surfaces designed for personnel access.
- Be aware of poor footing and potential slipping and tripping hazards in the work area.

2.2 General Hazards

2.2.1 General Practices and Housekeeping

(Reference CH2M HILL SOP HS-20, *General Practices*)

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness require enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

2.2.2 Hazard Communication

(Reference CH2M HILL SOP HS-05, *Hazard Communication)*

The SC-HW is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using Attachment 2.
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive on site, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 3.
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

2.2.3 Lifting

(Reference CH2M HILL SOP HS-29, *Lifting*)

- Proper lifting techniques must be used when lifting any object.
  - Split heavy loads into smaller loads.
  - Use mechanical lifting aids whenever possible.
  - Have someone assist with the lift -- especially for heavy or awkward loads.
  - Make sure the path of travel is clear prior to the lift.

2.2.5 Fire Prevention

(Reference CH2M HILL SOP HS-22, *Fire Prevention*)

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must:
  - be maintained in a fully charged and operable condition,
  - be visually inspected each month, and
  - undergo a maintenance check each year.
- The area in front of extinguishers must be kept clear.
- Combustible materials stored outside should be at least 10 feet from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

2.2.6 Electrical

(Reference CH2M HILL SOP HS-23, *Electrical*)

- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service.
- All temporary wiring, including extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
  - equipped with third-wire grounding.
  - covered, elevated, or protected from damage when passing through work areas.
  - protected from pinching if routed through doorways.
  - not fastened with staples, hung from nails, or suspended with wire.
- Electrical power tools and equipment must be effectively grounded or double-insulated UL approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

2.2.7 Heat Stress

(Reference CH2M HILL SOP HS-09, *Heat and Cold Stress*)

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SC-HW to avoid progression of heat-related illness.

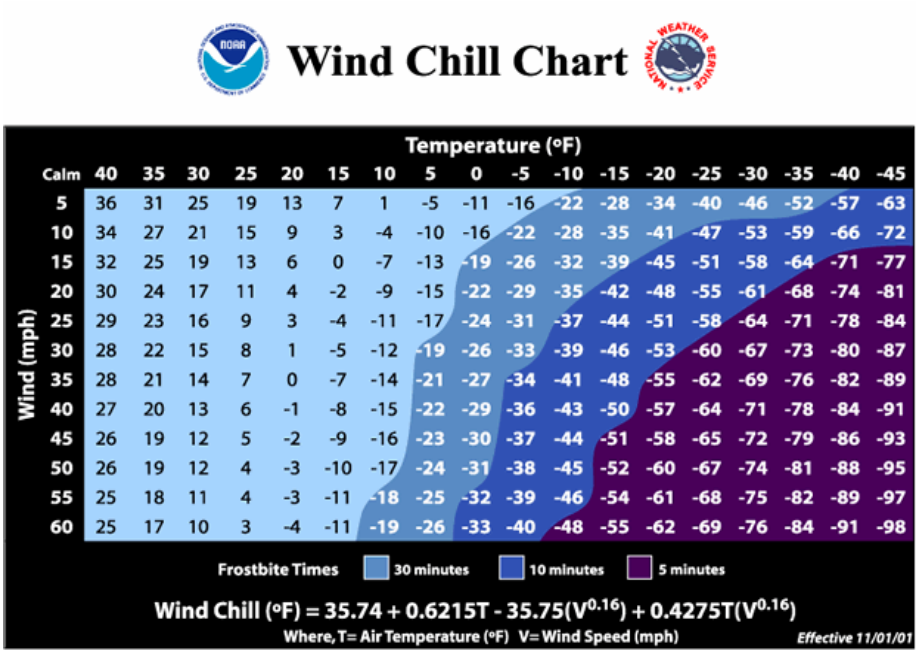
SYMPTOMS AND TREATMENT OF HEAT STRESS					
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!

2.2.8 Cold Stress

(Reference CH2M HILL SOP HS-09, *Heat and Cold Stress*)

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in cool weather.

SYMPTOMS AND TREATMENT OF COLD STRESS			
	Immersion (Trench) Foot	**Frostbite**	**Hypothermia**
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm–but **not** hot–water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.



2.2.9 Compressed Gas Cylinders

- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured in an upright position at all times.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.

2.2.10 Procedures for Locating Buried Utilities

Local Utility Mark-Out Service

Name: Miss Utility
Phone: 1-800-552-7001

Prior to conducting any intrusive activities, Miss Utility must be contacted even though hand auger and trowel collection of soils does not typically present a risk of breaching utility lines.

2.3 Biological Hazards and Controls

2.3.1 Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

2.3.2 Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

2.3.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

2.3.5 Chiggers

Chiggers are active from spring to late fall but are most numerous in early summer when weeds, grasses and undergrowth are the heaviest. Several commercially available repellents are effective against chigger infestations. These repellents usually contain one or more of the following compounds: permethrin, diethyl toluamide, dimethyl phthalate, dimethyl carbate, ethyl hexanediol and benzyl benzoate. Most repellents are also effective against mosquitoes and other insects and are formulated as liquids, aerosol sprays, solid sticks and ointments. Common dusting sulfur, although somewhat messy and odorous, is also a very effective repellent. For further prevention, wear loose-fitting clothing and avoid sitting or reclining on the ground.

Immediately after exposure to chigger-infested areas, take a hot bath to kill and remove chigger larvae. Then apply an antiseptic solution to any welts that have appeared to kill trapped chiggers and to prevent infection. Destroying the chigger usually does not stop the itching completely because the itching is caused by tissue reaction to the fluid injected by the chigger. Normally, two to three days pass before the itching stops. Temporary relief can be obtained by applying a commercial product that contains a mild, local anesthetic. Your pharmacist can suggest an appropriate product for your needs. Any unusual allergic reaction, fever or infection should be treated by a physician.

2.3.5 Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SC-HW and/or buddy. If a stinger is present, remove it carefully

with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.3.6 Bloodborne Pathogens

(Reference CH2M HILL SOP HS-36, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and personal protective equipment (PPE) are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.4 Radiological Hazards and Controls

Refer to CH2M HILL's *Corporate Health and Safety Program, Program and Training Manual,* and *Corporate Health and Safety Program, Radiation Protection Program Manual,* for standards of practice in contaminated areas.

Hazards	Controls
None Known	None Required

2.5 Contaminants of Concern

(Note: Site is uncharacterized. Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration (ppm)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Lead	Expected only if visible dust generation	0.05 mg/m^3	100	Weakness lassitude, facial pallor, pal eye, weight loss, malnutrition, abdominal pain, constipation, anemia, gingival lead line, tremors, paralysis of wrist and ankles, encephalopathy, kidney disease, irritated eyes, hypertension	NA

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water).

[b] Appropriate value of PEL, REL, or TLV listed.

[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.

[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown.

2.6 Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.	**Other:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HS-01, *Medical Surveillance*, and HS-02, *Health and Safety Training)*

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SC-HW" have completed a 12-hour Safety Coordinator Haz-Waste course, and have documented requisite field experience. An SC-HW with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP HS-04, *Reproduction Protection*, including obtaining a physician's statement of the employee's ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SC-HW/FA-CPR
Tim Wenk	WDC	Project Manager/Field Team Leader/SSC	Level ___ SC-HW; FA-CPR
Shaun Whitworth	VBO	Field Team Member	

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Contact Name: Linda Cole
Phone: 757-444-3826
Facility Contact Name: Sean Heaney
Phone: 757-887-4086.

3.2.2 CH2M HILL

Project Manager: Tim Wenk/WDC
Health and Safety Manager: Steve Beck/MKE
Field Team Leader/SC-HW: Tim Wenk/WDC
The SC-HW is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The Health and Safety Manager should be contacted as appropriate.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-07, *Personal Protective Equipment*, HS-08, *Respiratory Protection*)

PPE Specifications [a]

Task	Level	Body	Head	Respirator [b]
• Hand augering • Soil sampling • Magnotometer surveying • Investigation-derived waste management	Modified D	**Coveralls:** Cotton coveralls; uncoated Tyvek® if cotton cannot be kept clean. **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile or butyl gloves.	Hardhat [c] Safety glasses Ear protection [d]	None required

Reasons for Upgrading or Downgrading Level of Protection

Upgrade [f]	Downgrade
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

[b] No facial hair that would interfere with respirator fit is permitted.

[c] Hardhat and splash-shield areas are to be determined by the SC-HW.

[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.

[e] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SC-HW qualified at that level is present.

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HS-06, *Air Monitoring)*

5.1 Air Monitoring Specifications

Instrument	Tasks	Action Levels[a]	PPE	Frequency [b]	Calibration
Dust Monitor: **Visual**	• Hand Augering • Soil Sampling • Magnotometer surveying	No Dust →	Level D	Continuous during task	NA
		Visible Dust→	Level D. Practice dust suppression techniques/engineering controls. Apply water mist and/or wet soil prior to sampling		

[a] Action levels apply to sustained breathing-zone measurements above background for more than 5 minutes.

[b] The exact frequency of monitoring depends on field conditions and is to be determined by the SC-HW; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3", "at surface/SB-2", etc.).

5.2 Calibration Specifications

(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method

Not Applicable

5.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds. Contact the HSM immediately if these contaminants are encountered.

Method Description

Due to engineering controls designed to reduce exposure to dust (keep soils moist to wet), air sampling not required at this time.

6 Decontamination

(Reference CH2M HILL SOP HS-13, *Decontamination*)

The SC-HW must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SC-HW. The SC-HW must ensure that procedures are established for disposing of materials generated on the site.

6.1 Decontamination Specifications

Personnel

- Boot wash/rinse
- Glove wash/rinse
- Outer-glove removal
- Body-suit removal
- Inner-glove removal
- Respirator removal
- Hand wash/rinse
- Face wash/rinse
- Shower ASAP
- Dispose of PPE in municipal trash, or contain for disposal
- Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal

Sample Equipment

- Wash/rinse equipment
- Solvent-rinse equipment
- Contain solvent waste for offsite disposal

Heavy Equipment

- Power wash
- Steam clean
- Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

6.2 Diagram of Personnel-Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SC-HW should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure 6-1 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SC-HW to accommodate task-specific requirements.

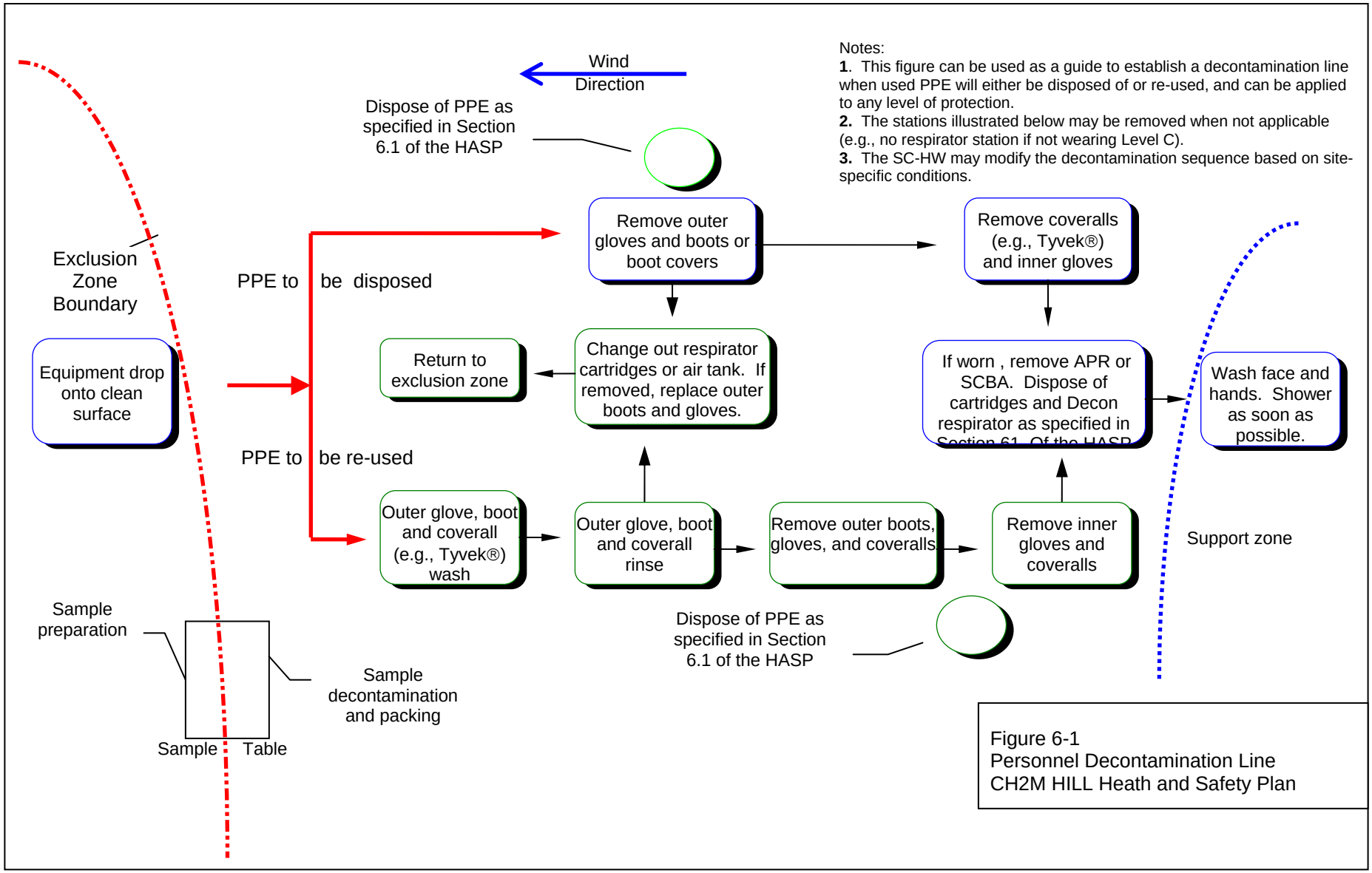


Figure 6-1
Personnel Decontamination Line
CH2M HILL Heath and Safety Plan

7 Spill-Containment Procedures

Sorbent material will be maintained in the support zone. Incidental spills will be contained with sorbent and disposed of properly.

8 Site-Control Plan

8.1 Site-Control Procedures

(Reference CH2M HILL SOP HS-11, *Site Control)*

- The SC-HW will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of Health and Safety Plan, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SC-HW records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HS-71, *OSHA Postings*.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the "buddy system."
- Initial air monitoring is conducted by the SC-HW in appropriate level of protection.
- The SCC is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2 and 3. Deficiencies are to be noted, reported to the HSM, and corrected.

8.2 Hazwoper Compliance Plan

(Reference CH2M HILL SOP HS-19, *Site-Specific Written Safety Plans)*

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in Section 1.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed on the site, or while non-Hazwoper-trained staff are working in proximity to Hazwoper activities. Other data (e.g., soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 2.5 and 5.3 for contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SC-HW must post the exclusion zone and inform non-Hazwoper-trained personnel of the:
  - nature of the existing contamination and its locations
  - limitations of their access
  - emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.
- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is, for the purposes of applying the Hazwoper standard, considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hour of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

9 Emergency Response Plan

(Reference CH2M HILL, SOP HS-12, *Emergency Response*)

9.1 Pre-Emergency Planning

The SC-HW performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate.

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The SC-HW will evaluate emergency response actions and initiate appropriate follow-up actions.

9.2 Emergency Equipment and Supplies

The SC-HW should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
First aid kit	Support Zone/Field Vehicle
Bloodborne-pathogen kit	Support Zone/Field Vehicle
Eye Wash	Support Zone/Field Vehicle
Potable water	Support Zone/Field Vehicle
Additional equipment (specify): Cellular phone	Support Zone/Field Vehicle

9.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

9.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical

treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 9.8 (e.g., 911).
- The SC-HW will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 9.7.

9.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the SC-HW before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SC-HW and a "buddy" will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The SC-HW will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The SC-HW will write up the incident as soon as possible after it occurs and submit a report to the Corporate Director of Health and Safety.

9.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

9.7 Incident Notification and Reporting

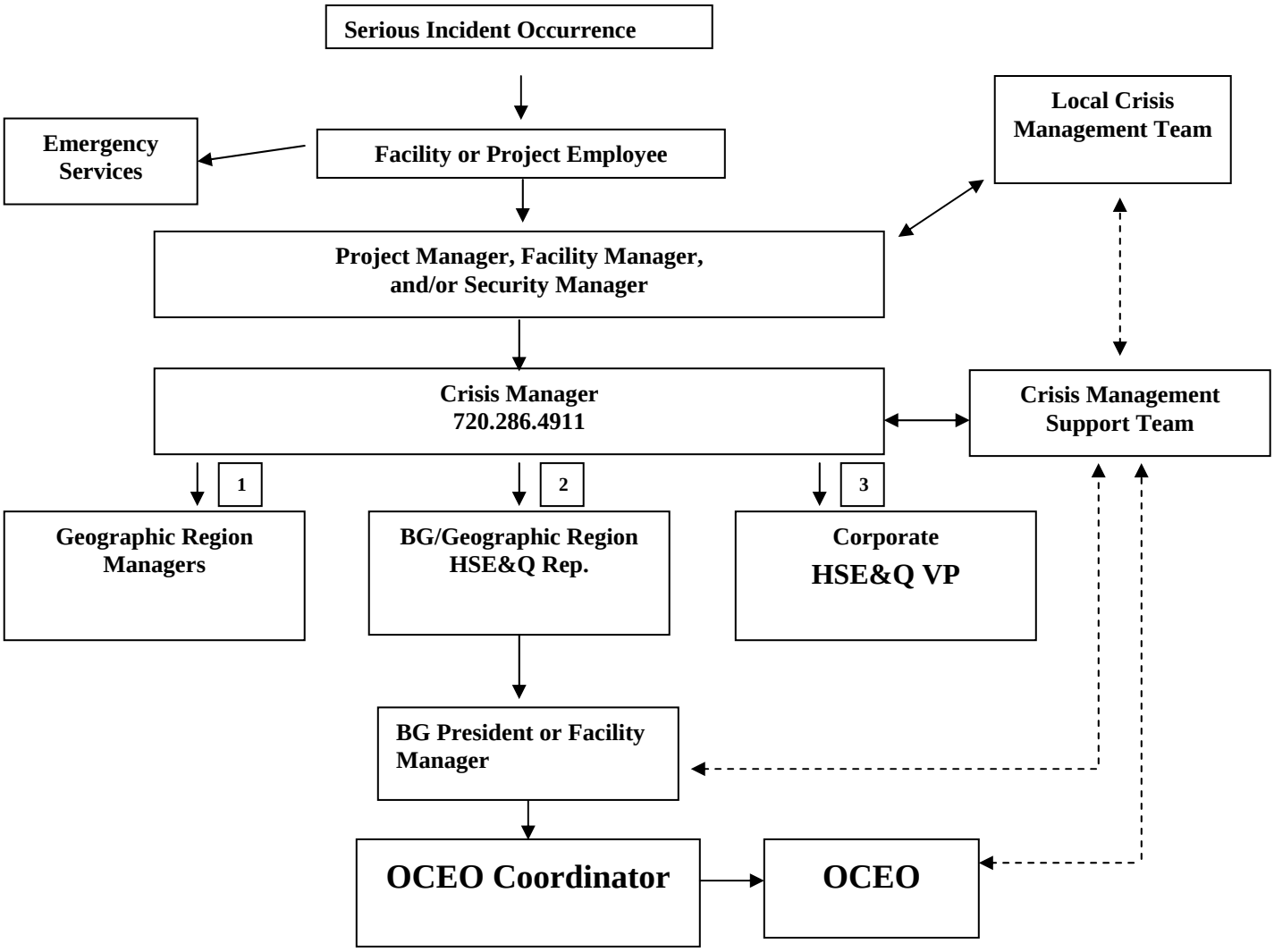
- Upon any project incident (fire, spill, injury, near miss, death, identification of potential MEC, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to client as required in contract.

9.8 Incident Notification and Reporting

- Serious Incidents must be reported in accordance with CH2M HILL Standard of Practice, *Serious Incident Reporting Process,* immediately. Serious incidents are those that involve any of the following:
  - Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or member of the public
  - Kidnap/missing person
  - Acts or threats of terrorism

- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage.
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment

Serious Incident Notification Chart



Legend:

Direct line of communication

Indirect line of communication

10.0 Behavioral Based Loss Prevention

10.1 Job Hazard Analysis (JHA)

- **Refer to Attachment 4**

10.2 Pre-Task Safety Plans (PTSP)

- **Refer to Attachment 5**
- **Complete either a PTSP from or a STAC card for each day for the project**

10.3 Safe Work Observations

- **Refer to Attachment 6**

10.4 Loss/Near-Loss Investigations

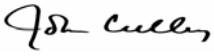
- **Refer to Master HASP – Attachment 7**

11 Approval

This site-specific Health and Safety Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

11.1 Original Plan

Written By: Tim Wenk/WDC **Date: May 26, 2006**

Approved By:  **Date: May 30, 2006**

John Culley/SPK

10.2 Revisions

Revisions Made By: Tim Wenk/WDC **Date: March 1, 2007**

Revisions to Plan:Incorporated changes suggested by Cindy Collins/PHL, changed dates, added field staff names, corrected routes to hospitals using client suggestion and Master HASP

Revisions Approved By: **Date:**

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12 Attachments

Attachment 1: **Employee Signoff Sheet**
Attachment 2: **Emergency Contacts**
Attachment 3: **Job Hazard Analysis - Drilling and Groundwater Sampling**
Attachment 4: **Pre-Task Safety Plan / Stac Card**
Attachment 5: **Safe Work Observation Form**
Attachment 6: **Project-Specific Chemical Product Hazard Communication Form**
Attachment 7: **Chemical-Specific Training Form**
Attachment 8: **Self-Assessment Checklist (Respiratory Protection, Drilling, and Waste Characterization, Sampling and Analysis)**
Attachment 9: **Material Safety Data Sheets/Fact Sheets**

CH2MHILL

HEALTH AND SAFETY PLAN
ATTACHMENT 1

EMPLOYEE SIGN-OFF SHEET

CH2MHILL

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

- The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: Yorktown Naval Weapons Station Skeet Range & Cheatham Annex Rifle Range Inspections **Project Number:** 345217

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

Project Contact List

&

Emergency Contact Sheet

CH2MHILL

PROJECT CONTACTS LIST

This form shall be completed and updated as necessary by the Safety Coordinator. A copy of the completed form shall be posted in a prominent location onsite and/or attached to the CH2M HILL HSE plan.

Client: Department of Navy – Atlantic Division

Project/Site Name: Yorktown Naval Weapons Station MWR Skeet Range and Cheatham Annex Marine Rifle Range Site Inspctions Project Number: 345217

Project Contacts	Name	Phone Number	Cell Number
Client ***Contact to client shall only be made after contacting Project Manager**	Linda Cole	(757) 444-3826	
CH2M Hill Project Manager	Tim Wenk/WDC	(703) 376-5283	(757) 371-3723
CH2M HILL Safety Coordinator	Tim Wenk/WDC	(703) 376-5283	(757) 371-3723
CH2M Hill HS&E Manager	Steve Beck/MKE	(414) 847-0277	(414) 526-4517
CH2M HILL Environmental Compliance Coordinator (ECC)	Linda Hickok/SYR	(315) 422-8495 Ext. 229	(315) 751-3903

CH2M HILL Subcontractors Contact List

Subcontractor	Primary Task	Site Manager	Phone	Safety Rep.	Phone
	Analyze Samples				

Client Contractors Contact List

Contractor Name	Primary Task	Contact	Phone

Emergency Contacts

24-hour CH2M HILL Emergency Beeper – 888/444-1226	Occupational Injury Nurse 1-800-756-1130
Medical Emergency – 911 Facility Medical Response #: 4911 Local Ambulance #: 911 Poison Control Center: 1-800-222-1222	**CH2M HILL Medical Consultant** Health Resources Dr. Jerry H. Berke, M.D., M.P.H. 600 West Cummings Park Suite 3400 Woburn, MA 01801 1-781-938-4653 or 1-800-350-4511 (After hours calls will be returned within 20 minutes)
Fire/Spill Emergency -- 911 Facility Fire Response #: 4911 – from a Base land-line Local Fire Dept #: 911	**Local Occupational Physician** Dr. Laura Staton 46440 Benedict Drive Suite 108 Sterling, Virginia 22170 Phone: (703)444-5656
Security & Police – 911 Facility Security #: 4911 – from a Base land-line Local Police #: 911	**Corporate Director Health and Safety** Name: Jerry Lyle/BOI Phone: 208/345-5314 **24-hour emergency beeper: 888-444-1226**
Utilities Emergency Water: Water Emergency: Gas: Electric:	**Health and Safety Manager (HSM)** Name: Steve Beck/MKE Phone: (414)272-2426 ext. 277 **Radiation Health Manager** Name: David McCormack/SEA Phone: (206)453-5005
Safety Program Administrator (SPA) Name: Lynn Bong/MKE Phone: (414)272-2426 ext. 384	**Regional Human Resources Department** Name: Cindy Bauder/WDC Phone: (703)47106405 ext. 4243
Activity Manager Name: Donna Caldwell/HRO Phone: (757) 873-1442 Ex. 28	**Corporate Human Resources Department** Name: John Monark/COR Phone: 303/771-0900
Federal Express Dangerous Goods Shipping Phone: 800/238-5355 **CH2M HILL Emergency Number for Shipping Dangerous Goods** Phone: 800/255-3924	**Worker's Compensation** Contact the regional Human Resources Department to have an Incident Report Form (IRF) completed, or contact Julie Zimmerman after hours: 303/664-3304 **Auto Claims** Rental: Carol Dietz/COR (303)713-2757 CH2M HILL Owned: Zurich Insurance Company 1-800-987-3373

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies

Federal Agency (CERCLA): USEPA Robert Stroud (215)814-3366	**State Agency:** District of Colombia Henry Cobo (202)535-1910

Hospital

Hospital Name/Address: Mary Immaculate Hospital
2 Bernardine Drive
Newport News, Virginia 23602

Hospital Phone #: (757) 886-6000
(General Information)

Directions to Hospital from WPNSTA Yorktown

From Gate 1:

- From Gate 1 proceed south (turn right) on State Route 238 until intersecting with State Route 143 (approximately 2.4 miles).
- Turn left, following State Route 143 south for approximately 5.3 miles until intersecting with Denbigh Boulevard.
- Turn left onto Denbigh Boulevard and proceed east until intersecting with McManis Boulevard, following signs for emergency room entrance.

From Gate 3:

- From Gate 3 turn left and proceed south on Route 143 for approximately 5.5 miles until intersecting with Denbigh Boulevard.
- Turn left onto Denbigh Boulevard and proceed left until intersecting with McManis Boulevard, following signs for the Emergency Room entrance.

Emergency Contacts – Cheatham Annex

24-hour CH2M HILL Emergency Beeper – 888/444-1226

Medical Emergency – 911
Facility Medical Response #: 757-887-7333
Local Ambulance #: 911

Fire/Spill Emergency -- 911
Facility Fire Response #: 757-887-7333
Local Fire Dept #: 911

Security & Police – 911
Facility Security #: 757-887-7333
Local Police #: 911

Utilities Emergency
Water:
Gas:
Electric:

Safety Program Administrator (SPA)
Name: Lynn Bong/MKE
Phone: (414)272-2426 ext. 384

Project Manager
Name: Timothy Wenk
Phone: 703-471-1441

Federal Express Dangerous Goods Shipping
Phone: 800/238-5355

CH2M HILL Emergency Number for Shipping Dangerous Goods
Phone: 800/255-3924

CH2M HILL Medical Consultant
Health Resources
Dr. Jerry H. Berke, M.D., M.P.H.
600 West Cummings Park
Suite 3400
Woburn, MA 01801
1-781-938-4653 or 1-800-350-4511
(After hours calls will be returned within 20 minutes)

Local Occupational Physician
Dr. Laura Staton
46440 Benedict Drive
Suite 108
Sterling, Virginia 22170
Phone: (703)444-5656

Corporate Director Health and Safety
Name: Jerry Lyle/BOI
Phone: 208/345-5314
24-hour emergency beeper: 888-444-1226

Health and Safety Manager (HSM)
Name: Steve Beck/MKE
Phone: 414-272-2426 ext. 277
Cell: 414-526-4517

Regional Human Resources Department
Name: Cynthia Bauder
Phone: 703/471-4605 ext. 4243

Corporate Human Resources Department
Name: John Monark/COR
Phone: 303/771-0900

Worker's Compensation
Contact the regional Human Resources Department to have an Incident Report Form (IRF) completed, or contact Julie Zimmerman after hours: 303/664-3304

Auto Claims
Rental: Carol Dietz/COR (303)713-2757
CH2M HILL Owned: Zurich Insurance Company 1-800-987-3373

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Facility Alarms: TBD by Safety Coordinator

Evacuation Assembly Area(s): TBD by Safety Coordinator

Facility/Site Evacuation Route(s): TBD by Safety Coordinator

Hospital Name/Address:
Williamsburg Community Hospital
301 Monticello Ave
Williamsburg, Virginia

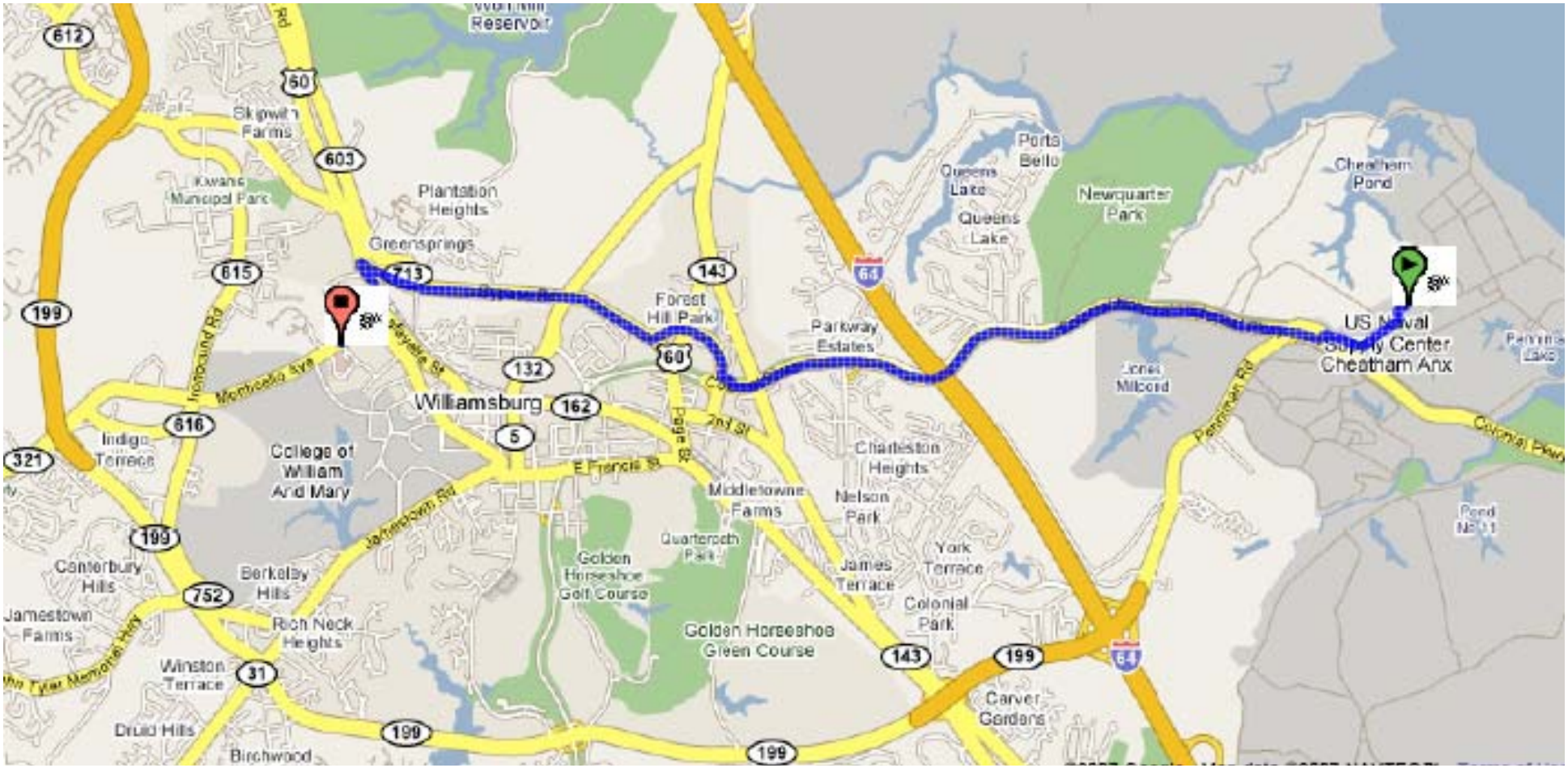
Hospital Phone #:
(757) 253-6030 (General Information)

Directions to Hospital

- From the CAX entrance gate, turn right on **Colonial Historical Parkway**
- Proceed west to Williamsburg for approximately 3.5 miles.
- Take the **Parkway Drive** ramp (0.1 mi)
- Turn **right** at **Parkway Drive/VA-163** (0.6 mi)
- Turn **right** at **Bypass Rd/US-60** (1.7 mi)
- Turn **left** at **Richmond Rd/US-162** (0.3 mi)
- Turn **right** on **Monticello Ave** (0.3 mi)

Alternative Route

- From the CAX entrance gate, stay straight on **Sanda Ave**
- Turn **Sanda Ave** becomes **Penniman Rd**
- Stay **straight** on **Route 199** (Penniman Rd becomes Route 199)
- Turn **right** at **Monticello Avenue**


Reservoir
612
50
Skiffwich Farms
603
Kiwanis Municipal Park
Plantation Heights
Greensprings
615
713
143
199
Forest Hill Park
64
Parkway Estates
Ironbound Rd
Merrimac Trl
Page St
132
60
Williamsburg
162
5
616
Indigo Terrace
College of William And Mary
321
E Francis St
Jamestown Rd
Middletowne Farms
Charleston Heights
Nelson Park
199
Quarterpath Park
Golden Horseshoe Golf Course
James Terrace
York Terrace
Colonial Park
Canterbury Hills
Berkeley Hills
752
Jamestown Farms
Rich Neck Heights
Golden Horseshoe Green Course
143
199
64
Winston Terrace
31
Carver Gardens
Druid Hills
199
Birchwood
199
Porta Bello
Queens Lake
Queens Lake
Newquarter Park
Cheatham Pond
US Naval Supply Center Cheatham Anx
Penniman Rd
Colonial Pkwy
Pond No 31

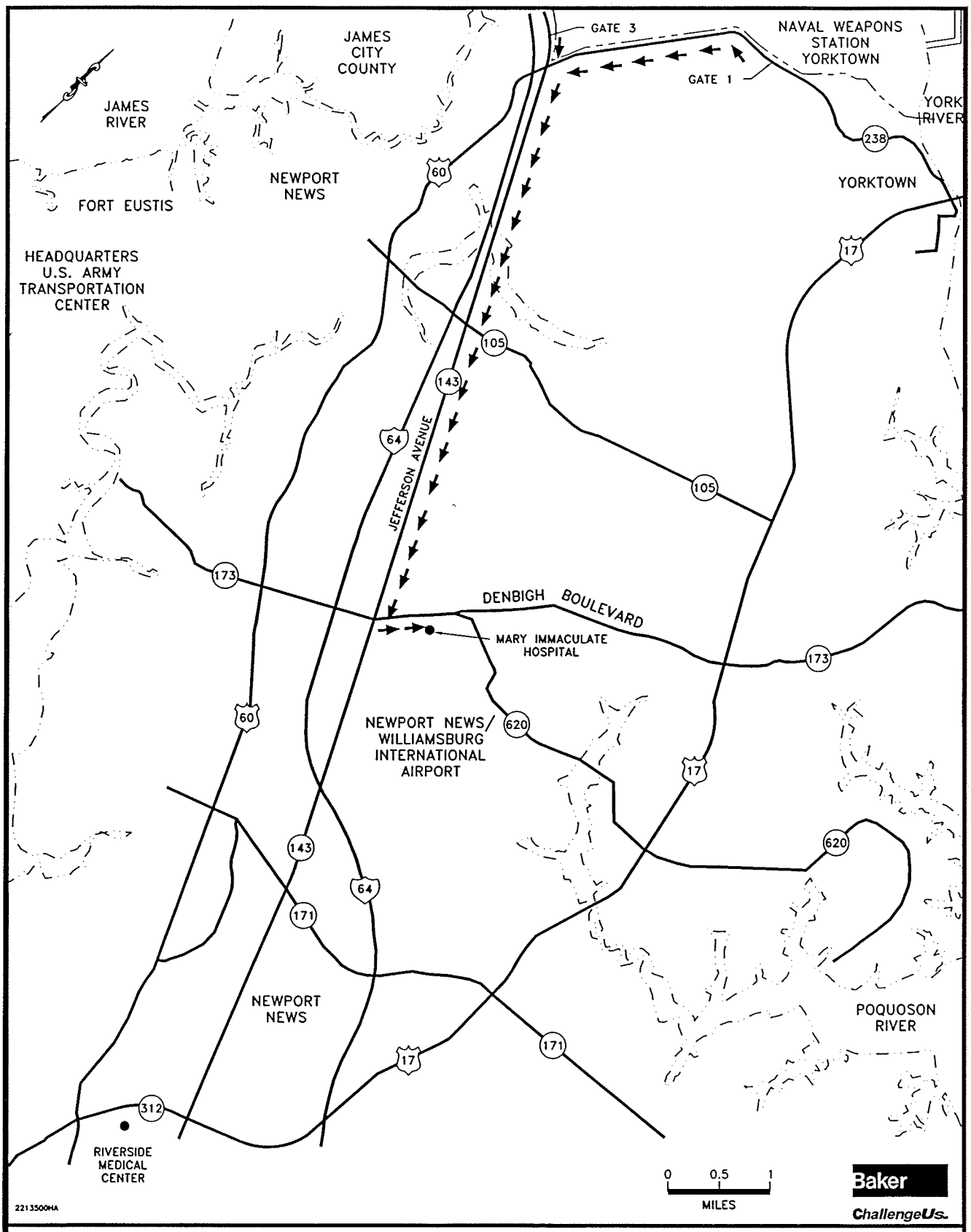


FIGURE 4-1
EMERGENCY HOSPITAL ROUTE
NON-CHEMICAL EXPOSURE INCIDENTS
MARY IMMACULATE HOSPITAL

NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

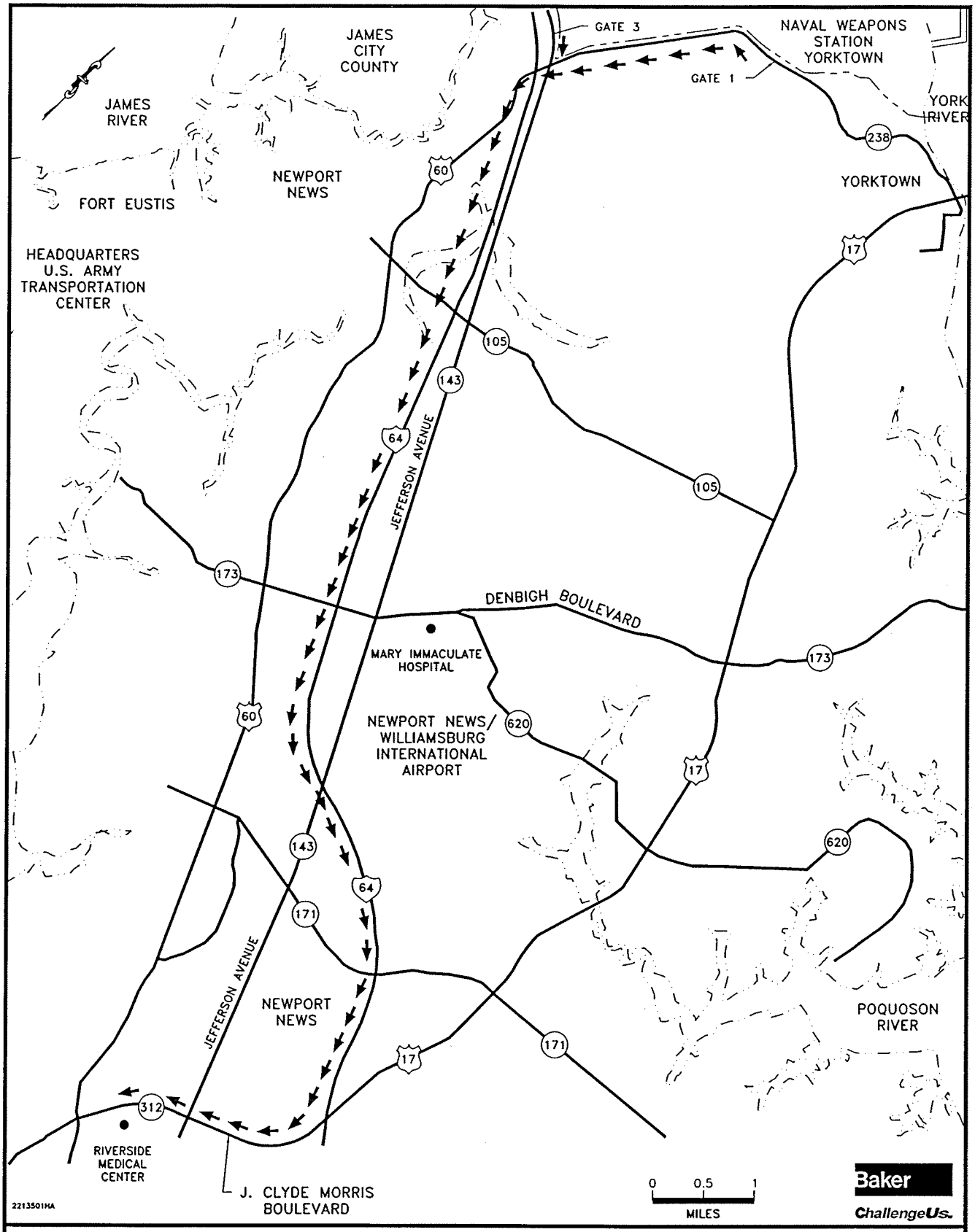


FIGURE 4-2
EMERGENCY HOSPITAL ROUTE
CHEMICAL EXPOSURE INCIDENTS
RIVERSIDE MEDICAL CENTER

NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

WRITTEN DIRECTIONS TO PUBLIC HOSPITALS

NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA

Non-Chemical Exposure Incidents: Mary Immaculate Hospital (refer to Figure 8-1):

From Gate 1:

1A From Gate 1 proceed south (turn right) on State Route 238 until intersecting with State Route 143 (approximately 2.4 miles).

2A Turn left, following State Route 143 south for approximately 5.3 miles until intersecting with Denbigh Boulevard.

3A Turn left onto Denbigh Boulevard and proceed east until intersecting with McManis Boulevard, following signs for emergency room entrance.

From Gate 3:

1B From Gate 3 turn left and proceed south on Route 143 for approximately 5.5 miles until intersecting with Denbigh Boulevard.

2B Turn left onto Denbigh Boulevard and proceed left until intersecting with McManis Boulevard, following signs for the Emergency Room entrance.

Chemical Exposure Incidents: Riverside Medical Center (refer to Figure 8-2):

1A From Gates 1 and 3 proceed south (turn right) on State Route 238 until intersecting with Interstate 64 (approximately 2.5 miles from Gate 1).

2A Follow Interstate 64 east (southeast) for approximately 11.0 miles until intersecting with J. Clyde Morris Boulevard (State Route 312) at Exit 258A.

3A Proceed west-southwest for approximately 2.3 miles, Riverside Medical Center will be on the left-hand side.

4A Follow signs for Emergency Room Entrance.

UPON ARRIVING AT RIVERSIDE MEDICAL CENTER, FOLLOW THE PROCEDURES OUTLINED IN ATTACHMENT A ENTITLED "EMERGENCY PROCEDURES FOR EXPOSURE TO HAZARDOUS CHEMICALS/WASTE."

EMERGENCY PROCEDURES FOR EXPOSURE TO HAZARDOUS MATERIALS/WASTE

NAVAL WEAPONS STATION YORKTOWN, YORKTOWN, VIRGINIA

1. Call ambulance or transport individual to hospital/clinic immediately.

2. Fill in Potential Exposure Report, answering each of the questions to the best of your ability.

3. Contact your physician at EMR as soon as possible. The procedure is as follows:
   a. Call EMR at 1-800-229-3674
   b. Ask to speak with:
      Dr. David L. Barnes;
      Dr. Elaine Theriault; or
      Ms. T.J. Wolff, R.N.

   Note: During nonbusiness hours (i.e., after 6:00 pm) call 1-800-229-3674 and follow directions for paging the aforementioned individuals.

4. Once in contact with any of these individuals, explain what has happened. They will review the information on the form with you and may ask you to fax the form to them, if possible, and allow either of them to speak with the attending physician.

5. When asked about payment, inform the Hospital/Clinic/Physician that this is a "work related injury" and have them contact the Benefits Coordinator at (412) 269-4655. Have invoices sent to:
   Michael Baker Jr. Inc.
   Attn: Benefits Coordinator
   Airport Office Park, Bldg. 3
   Coraopolis, PA 15108

6. Contact the Project Manager and the PHSO as soon as it is feasible, but wait no longer than 24 hours.

Note: For non-emergency work related injuries, follow steps 5 and 6.

JOB HAZARD ANALYSIS (JHA)

FOR

Drilling &
Groundwater Sampling

Activity: Soil Sampling	**Date: March 1, 2007**
	Project: ESI at the WPNSTA YORKTOWN MWR Skeet Range and the CAX Pistol and Rifle Range
Description of the work: Sample preparation, collection, packaging, shipment, and water level surveys	**Project Manager: Tim Wenk**
	Field Services Manager: Tim Wenk
	Health & Safety Manager: Steve Beck

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Soil Sampling (early spring to early summer)		
Load Vehicle	1. Ice/snow in CSA/slippery surfaces 2. Ice/snow/condensation covering vehicle windows/ poor visibility 3. Cold weather/exposure 4. Heat stress 5. Loading heavy equipment/pinch points, backstrain 6. Shifting loads/pinch points, equipment and vehicle damage	1. Be mindful of slippery surfaces. Use ice melt or sand to improve traction. 2. Remove all snow and ice from vehicle before moving vehicle (snow brush, ice scraper) 3. Clear all condensation from windows and mirrors before moving vehicle 4. Dress appropriately for weather; dress in layers to account for both cold and warm conditions 5. Use partner to assist in lift, be aware of pinch points when using truck lift gates, lift with legs not your back. 6. Tie down all loads securely (rope, bungee cords, load bars)
Driving vehicle from site to site	1. Traffic/unmindful drivers. 2. Road conditions/ruts, snow, ice, puddles/poor traction 3. Maneuvering in tight areas/potential vehicle or personnel damage	1. Drive defensively. 2. Slow vehicle speeds to match road conditions. 3. Use a spotter to maneuver into tight areas
Accessing site	1. Rusty locks/chains, slipping causing cuts/abrasions to hands.	1. Know the limitations of all hand tools. Use socket wrenches and, if necessary, bolt cutters to remove old, rusty locks 2. Wear work gloves

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Setting up Site/Exclusion Zone	1. Uneven ground, holes, stumps, extension cords/slips, trips and falls 2. Site visitors/ unauthorized site entrants	1. Recon site, flag potential trip hazards (flags, cones), organize site to minimize walking areas 2. Establish suitable exclusion zone (tape, rope)
Sample Collection	1. Placing or removing pump from well/pinch points, muscle strain 2. Sampler preservatives/vapors released once water is added or splashing of preservative on skin 3. Tape gun – sharp edge	1. Be aware of hands as pump is lowered and recoiled, don't allow pump-head to fly out of well. 2. Hold sample containers away from face when filling and wear proper PPE 3. To extent possible, prepare tape strips separately and apply to sample bottles by hand; break tape by pushing tape gun away from you; ensure hands and legs are not in the path of the tape gun
Site Breakdown	1. Moving drums of purge water/pinch points, muscle strain	1. Use partner and lift gate to move drums from ground to truck bed
Sample Preparation & Packaging		
Managing Prep and Pack in a heavy traffic area.	1. Weather Conditions: Rainy, snowy days 2. Spilled DI water / slipping causing bodily injury 3. Debris on floor/slip, trip and fall.	1. Mop floor, keep slip preventive rugs in area. 2. Keep doorway and walkway clean.
Preparation of sample containers	1. Handling of chemicals/spilling of chemicals on skin, clothes or eyes.	1. Never leave open chemicals unattended. 2. Know location of nearest eyewash station. 3. Wear proper PPE. (nitrile gloves, safety glasses, acid apron) 4. Keep prep and pack area well ventilated 5. Know location of MSDS, absorbent spill cloth, Hazmat spill kit 6. Make sure all caps are secure 7. Know location of MSDS forms
Receiving pre-preserved bottles	1. Glass containers/broken glass, cuts to hands 2. Packaging material / acid leak	1. Use caution when opening package 2. Wear proper PPE (nitrile gloves, safety glasses)

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	Potential Health and Safety Hazards (Analyze each principal step for potential hazards)	Hazard Controls/Resources (Develop specific controls for each potential hazard)
Receiving coolers from the field	1. Heavy coolers/back injury 2. Ticks, insects/Lyme Disease, spider bites and stings 3. Poison Ivy, Sumac/ rash	1. Bend at knees, ask for assistance 2. Use handtruck when necessary 3. Use caution when taking contents out of cooler. Inspect coolers for ticks/spiders 4. Apply ivy block
Preparing coolers for delivery	1. Strapping machine/ tripping over unrolled tape. 2. Tape gun/cuts to hands 3. Heavy coolers/back injury	1. Make sure strapping machine is properly rolled. 2. Use caution, be aware of cutting edge; To extent possible, break tape by pushing tape gun away from you; ensure hands and legs are not in the path of the tape gun 3. Bend at knees, ask for assistance 4. Use handtruck as necessary
Neutralizing sampling containers	1. Handling of chemicals/spilling of chemicals on skin, clothes, and eyes. 2. Disposal of glass containers/cuts, broken glass.	1. Wear proper PPE (nitrile gloves, glasses, acid apron, absorbent cloth) 2. Dispose of glass waste in IDM box. 3. Follow proper procedures for neutralizing samples in Tech procedure 028.
Equipment to be used (List equipment to be used in the work activity)	**Inspection Requirements** (List inspection requirements for the work activity)	**Training Requirements** (List training requirements including hazard communication)
Hand auger	Prior to use (daily) inspect auger extensions to ensure they are tightened appropriately	Equipment usage training
PPE (glasses with side shields, nitrile gloves, hard hats, leather gloves, etc.)	Prior to use/daily	PPE training

	PRINT NAME	SIGNATURE
Manager Name:		
Date/Time:		
HSM Name:		
Date/Time:		
Employee Name(s):		
Date/Time:		
Date/Time:		
Date/Time:		
Date/Time:		
Date/Time:		
Date/Time:		
Date/Time:		
Date/Time:		
Date/Time:		

PRE-TASK SAFETY PLAN (PTSP)
OR
STAC CARD

CH2MHILL

Pre-Task Safety Plan (PTSP)

Project: _____ Location: _____Date:_____

Supervisor: _____ Job Activity:_____

_____

Task Personnel:

_____

List Tasks:

_____

__

Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools):

_____

__

Potential H&S Hazards, including chemical, physical, safety, biological and environmental (check all that apply):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__ Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__ Heights/fall > 6 feet	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__ Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__ Welding/cutting	__ Demolition
Other Potential Hazards (Describe):		

CH2MHILL

Hazard Control Measures (Check All That Apply):			
PPE __ Thermal/lined __ Eye __ Dermal/hand __ Hearing __ Respiratory __ Reflective vests __ Flotation device	Protective Systems __ Sloping __ Shoring __ Trench box __ Barricades __ Competent person __ Locate buried utilities __ Daily inspections	Fire Protection __ Fire extinguishers __ Fire watch __ Non-spark tools __ Grounding/bonding __ Intrinsically safe equipment	Electrical __ Lockout/tagout __ Grounded __ Panels covered __ GFCI/extension cords __ Power tools/cord inspected
Fall Protection __ Harness/lanyards __ Adequate anchorage __ Guardrail system __ Covered opening __ Fixed barricades __ Warning system	Air Monitoring __ PID/FID __ Detector tubes __ Radiation __ Personnel sampling __ LEL/O2 __ Other	Proper Equipment __ Aerial lift/ladders/scaffolds __ Forklift/heavy equipment __ Backup alarms __ Hand/power tools __ Crane with current inspection __ Proper rigging __ Operator qualified	Welding & Cutting __ Cylinders secured/capped __ Cylinders separated/upright __ Flash-back arrestors __ No cylinders in CSE __ Flame retardant clothing __ Appropriate goggles
Confined Space Entry __ Isolation __ Air monitoring __ Trained personnel __ Permit completed __ Rescue	Medical/ER __ First-aid kit __ Eye wash __ FA-CPR trained personnel __ Route to hospital	Heat/Cold Stress __ Work/rest regime __ Rest area __ Liquids available __ Monitoring __ Training	Vehicle/Traffic __ Traffic control __ Barricades __ Flags __ Signs
Permits __ Hot work __ Confined space __ Lockout/tagout __ Excavation __ Demolition __ Energized work	Demolition __ Pre-demolition survey __ Structure condition __ Isolate area/utilities __ Competent person __ Hazmat present	Inspections: __ Ladders/aerial lifts __ Lanyards/harness __ Scaffolds __ Heavy equipment __ Cranes and rigging	Training: __ Hazwaste __ Construction __ Competent person __ Task-specific (THA) __ Hazcom
Field Notes:_____ _____			

Name (Print): _____
Signature:_____ Date:_____

CH2MHILL

SAFETY HAZARD ANALYSIS CARD

Name/Company: _____

Date/Time: _____

Job Description: _____

Daily Safety Goal: _____

PRE-TASK CHECKLIST

SAFETY EQUIPMENT (Check all that apply)

- ❑ PPE
- ❑ Equipment in HSP/FSI available

List: _____

_____

_____

- ❑ Inspected/in good condition
- ❑ Trained in use
- ❑ Fall protection
- ❑ Inspect before use
- ❑ Trained in use
- ❑ Monitoring Equipment
- ❑ Equipment in HSP/FSI available
- ❑ Inspected/maintained
- ❑ Within calibration range

PERMITS

- ❑ Confined space
- ❑ Lock-out/Tagout
- ❑ Hot work/welding
- ❑ Electrical
- ❑ Excavation/Drilling

EXAMPLE HAZARD AND CONTROL MEASURES

(Use to help you complete the reverse side)

OVERHEAD WORK (People/equipment above workers)

- ❑ Barricades
- ❑ Signage
- ❑ Flaggers

WORKING FROM HEIGHTS

- ❑ Personnel trained
- ❑ Fall protection equipment available
- ❑ Guardrails and/or railings
- ❑ Safety net
- ❑ Ladder
- ❑ Inspect before use
- ❑ Proper placement

SPILLS

- ❑ Spill Prevention Plan
- ❑ Secondary containment available
- ❑ Spill kit available

HEAVY EQUIPMENT (Drill rigs, backhoes, excavators, etc)

- ❑ Personnel trained
- ❑ Site-specific plan in place
- ❑ Maintenance/inspection checklist available
- ❑ Equipment on firm, level surface
- ❑ Competent person onsite (excavation)
- ❑ Dig permit obtained
- ❑ Underground utilities identified
- ❑ Overhead utilities identified
- ❑ Safety equipment identified in HSP/FSI available
- ❑ Able to work outside of operating radius (People/equipment above workers)

TOOLS

- ❑ Correct tool for job
- ❑ Inspected and maintained
- ❑ Proper explosion rating
- ❑ Guards in place

ELECTRICAL

- ❑ Power tools & extension cord inspection
- ❑ Qualified personnel work on/near energized equipment
- ❑ Lockout/tagout equipment available
- ❑ Equipment grounded
- ❑ GCIFs in use
- ❑ Safe clearances maintained

LIFTING

- ❑ Assistance required
- ❑ Mechanical lift (dolley, crane, chain fall, etc)**CHEMICAL**
- ❑ Trained
- ❑ MSDS available and reviewed
- ❑ Medically monitored
- ❑ PPE available per the HSP/FSI
- ❑ Air sampling/equipment available per the HSP/FSI

GENERAL

- ❑ Heat stress management planned (rest-work schedules, liquid available, work hours shifted to cooler hours, etc)
- ❑ Aisle-ways clear
- ❑ Fire extinguishers available
- ❑ Good housekeeping maintained
- ❑ Trash containers used and emptied
- ❑ Containers labeled
- ❑ Safety glasses/goggles used when flying objects/particulars present

OFFICE/ERGONOMICS

- ❑ Neutral position when working on a computer
- ❑ Slip, trip, and fall hazards removed
- ❑ Drawers closed when not in use
- ❑ Top drawers closed before bottom drawers opened

DRIVING

- ❑ Seat belt fastened
- ❑ Mirrors and headsets adjusted
- ❑ Valid drivers license for vehicle type

OTHER

- ❑ _____
- ❑ _____
- ❑ _____

WHAT AM I DOING? (List Tasks)	WHAT ARE THE POSSIBLE HAZARDS OF THE TASK I'M DOING? (List Potential Hazards)	WHAT WILL I DO TO REDUCE THE LIKELIHOOD OR SEVERITY OF THE HAZARD? (List Control Measures)

SAFE WORK OBSERVATION FORM

CH2MHILL

Safe Work Observation Form		
Project:	Observer:	Date:
Position/Title of worker observed:	Background Information/ comments:	
Task/Observation Observed:		

- ❖ Identify and reinforce safe work practices/behaviors
- ❖ Identify and improve on at-risk practices/acts
- ❖ Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
- ❖ Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
- ❖ Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's Corrective Actions/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's Corrective Actions/Comments:**
Other…			

PROJECT-SPECIFIC CHEMICAL PRODUCT HAZARD COMMUNICATION FORM

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: WPNSTA YORKTOWN-MWR Skeet Range and Cheatham Annex Marine Pistol and Rifle Range Site Inspections

Project Number: 345217

MSDSs will be maintained at the following location(s):

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard
Nitric acid	< 500 ml	Support Zone / sample bottles			
Methanol	< 1 Gallon	Support/Decon Zones			
Alconox/Liquinox	< 1liter	Support/Decon Zones			

Refer to SOP HSE-107 *Hazard Communication* for more detailed information.

CH2MHILL

HEALTH AND SAFETY PLAN
ATTACHMENT 7

CHEMICAL-SPECIFIC TRAINING FORM

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project #: 345217
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

HEALTH AND SAFETY PLAN
ATTACHMENT 8

HS&E SELF ASSESSMENT CHECKLISTS

- ***Waste Characterization, Sampling and Analysis***

Appendix A: Waste Characterization, Sampling and Analysis – USA

1.0 Introduction

This appendix provides federal requirements for projects conducted within the U.S. and its territories. Contact the regional ECC for specific state and local requirements.

2.0 Regulatory Review

The Resource Conservation and Recovery Act (RCRA, 40 CFR 258-279) regulates the generation, storage, transportation, treatment and disposal of solid and hazardous waste. States or local agencies may have hazardous waste requirements more restrictive than the Federal standard.

The Toxic Substances Control Act (TSCA, 40 CFR 761) regulates the manufacture, use, storage, treatment, and disposal of toxic substances, including PCBs. States or local agencies may have requirements more restrictive than the Federal standard.

The Clean Air Act (CAA, 40 CFR 61) regulates the emission of hazardous air pollutants, including asbestos and provides management standards to control emissions. States or local agencies may have requirements more restrictive than the Federal standard.

3.0 Responsibilities

3.1 Environmental Compliance Coordinator (ECC)

The ECC is responsible for providing resources to assist Project Managers to interpret environmental requirements and implement the policies and procedures in this appendix.

4.0 CH2M HILL Policy

It is CH2M HILL policy to manage wastes in compliance with applicable regulations. Since waste characterization is the client's legal responsibility, **CH2M HILL will not sign documentation (e.g., manifests) that suggests CH2M HILL is assuming the client's waste characterization responsibility.** If a client requests this service, the approval process described in the Hazardous Waste Policy for U.S. Projects (Attachment A-1) must be followed.

5.0 Definitions

5.1 Acute Hazardous Waste

Acute hazardous waste is designated with an "H" in the *Hazard Code* column in Tables 40 CFR 261.31 (F-list) and 261.33 (P-list).

5.2 Asbestos Containing Material (ACM)

ACM contains greater than 1 percent asbestos determined by polarized light microscopy.

5.3 Container

A container is any portable device in which a material is stored, transported, treated, disposed of, or otherwise handled. Containers include roll-off boxes, drums, and portable tanks.

5.4 Debris

Debris is any solid material exceeding a 60 mm particle size that is intended for disposal and that is a manufactured object, plant or animal matter, or natural geologic material.

5.5 EPA Identification Number

The EPA Identification Number is a unique number assigned by EPA or a state agency to a generator, transporter, and treatment, storage, or disposal facility that manages hazardous waste.

5.6 Environmental Media

Environmental media includes substances occurring in the natural environment, such as groundwater or soil.

5.7 Facility

A facility is all contiguous land, structures, appurtenances, and improvements on the land used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units (e.g., one or more landfills, surface impoundments, or combinations of them).

5.8 Hazardous Waste

Hazardous waste is a solid waste that is not excluded from regulation and: 1) is listed as a hazardous waste, and/or 2) exhibits any of the characteristics of hazardous waste, i.e., ignitability, corrosivity, reactivity, and TCLP toxicity. States may have additional wastes or criteria for state-specific “hazardous” wastes.

5.9 Hazardous Waste Manifest

The hazardous waste manifest (Environmental Protection Agency (EPA) Form 8700-22) is the shipping document for tracking shipments of hazardous waste from the generator’s facility to the final disposal facility. The manifest is originated and signed by the generator, and must also be signed by transporters and disposal facilities.

5.10 Munitions and Explosives

Munitions and explosives consist of various types of ordnance such as ammunition, ammunition components, chemical or biological warfare materials that have been abandoned, expelled from demolition pits or burning pads, lost, discarded, buried or fired. “Military munitions” are munitions and explosives that are or have been under the control of various federal agencies such as the DOE and DOD.

5.11 Polychlorinated Biphenyls (PCBs)

PCBs are chemicals in which the biphenyl molecule has been chlorinated and are commonly used in electrical equipment. PCBs may be regulated under TSCA, depending upon concentration.

5.12 Solid Waste

Solid waste is any discarded material regardless of physical state (solid, liquid, or containerized gases). Solid wastes are considered discarded if they are abandoned, recycled, or are inherently waste-like.

5.13 State-Regulated/Special/Industrial Wastes

State-regulated/special/industrial wastes are identified by state agencies for regulation separate from wastes identified by EPA.

5.14 Universal Waste

Universal wastes include batteries, agricultural pesticides, thermostats, and mercury-containing lamps. These wastes are subject to less stringent requirements than RCRA hazardous waste if they are managed in a regulation-specified manner.

5.15 Unexploded Ordnance (UXO)

UXO includes military munitions that have been primed, fuzed, armed, or otherwise prepared for action, and have been fired dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause.

6.0 Waste Characterization

This section provides fundamental information on how to characterize wastes in accordance with RCRA, the Toxic Substance Control Act (TSCA), and other applicable laws and regulations. Consult your regional Environmental Compliance Coordinator for specific state and local requirements.

CH2M HILL may assist a client with waste characterization if specified in the project scope of work. The following procedures provide general information to assist with our limited scope. However, **CH2M HILL personnel must not sign documentation (such as manifests) that may indicate that CH2M HILL intends to assume the client's waste characterization responsibilities.** If a client requests this service, the approval process described in the Hazardous Waste Policy for U.S. Projects (Attachment A-1) must be followed.

6.1 Hazardous Waste Determination

Generators must determine if waste is hazardous by using process knowledge (e.g., historical data or information in MSDS) or testing the waste using standard EPA methods. With this information, a waste is characterized by asking the following questions:

1. Is it a solid waste?
2. Is it excluded?
3. Is it a listed hazardous waste?
4. Is it "contained in" environmental media or debris?
5. Does it exhibit a hazardous characteristic?

Regulated wastes will carry a specific "waste code" for identification. Hazardous wastes are subject to strict management standards as discussed in HSE-80 (Hazardous Waste Management). The following sections discuss each question to characterize waste.

6.1.1 Is it a Solid Waste?

Almost everything is considered solid under RCRA, including liquids and compressed gases. Solid material becomes solid waste when it is discarded by being abandoned through accumulation, storage, disposal, or treatment or by being recycled.

6.1.2 Is it Excluded?

Some wastes are excluded from regulation as solid and hazardous waste. Solid waste exclusions are found in 40 CFR 261.4. Common solid waste exclusions include domestic sewage and industrial wastewater. Materials that are not solid waste *cannot* be hazardous waste.

Hazardous waste exclusions are found in 40 CFR 261.4. Common hazardous waste exclusions include mining overburden returned to the mine, and wastes from extraction or production of crude oil or natural gas. Evaluate all waste streams for a solid or hazardous waste exclusion and document all exclusions in the project file.

6.1.3 Is it Listed Hazardous Waste?

A solid waste is hazardous if it is included on one of three lists: F-list (40 CFR 261.31), K-list (261.32), and P- and U-lists (261.33). The lists are based on the source of the waste as shown in Table 6-1. Evaluate the source of all project waste streams to determine if a listed waste code applies. Document all waste code determinations in the project file.

Table 6-1 Listed Wastes

WASTE CODE	SOURCE OF WASTE	DESCRIPTION
F-list	Non-Specific Source	Generic wastes produced by any industrial manufacturing processes. Examples include spent solvents from degreasing.
K-list	Specific Source	Wastes from specifically identified industries. Examples include petroleum refining wastes or wood preserving wastes.
P- list (acutely hazardous) U-list (toxic)	Commercial Chemical Products	Pure chemical products or manufacturing intermediates listed in 40 CFR 261.33 or are the sole active ingredient in a mixture. Examples include MEK or TCE.

6.1.4 Is it "Contained-in" Environmental Media or Debris?

Environmental media and debris can become a hazardous waste if it "contains" (i.e., is contaminated) with a listed waste. Evaluate all project waste streams to determine if one of the following "contained-in" rules cause the waste stream to be regulated as a listed hazardous waste.

The "contained-in policy" regulates environmental media that contains listed hazardous waste. Environmental media is regulated as hazardous waste if it is contaminated with an F-, K-, P- or U-listed waste, regardless of the amount of contamination. The waste code can be removed from soil or groundwater by demonstrating that contamination is below health-based standards (e.g., following treatment) and obtaining a "contained-in decision" (also known as a "contained-out" decision) from the state or EPA. Document all determinations and contained-in decisions in the project file.

The "contained-in rule" (also known as the debris rule) applies to debris. It states that debris such as concrete, asphalt, or wood is regulated as hazardous waste if it contains listed hazardous waste. This determination can be removed through treatment to the alternative treatment standards for hazardous debris in 40 CFR 268.45. Treatment technologies include surface extraction such as pressure washing or spalling, depending upon the type of debris. Contact the regional ECC for assistance with "contained-in" rules.

6.1.5 Does it Exhibit a Hazardous Characteristic?

A solid waste is a hazardous waste if it exhibits the following four characteristics:

- Ignitability (D001)
- Corrosivity (D002)
- Reactivity (D003)
- Toxicity (D004-43)

Ignitable wastes (D001) are generally liquids with a flash point of less than 140 degrees F, such as mineral spirits. Other ignitable wastes are non-liquids that can cause fire under standard temperature and pressure, ignitable compressed gases, and ignitable oxidizers (chlorates).

Corrosive wastes (D002) are liquids with a pH < 2 or > 12.5, such as lead acid batteries, hydrochloric acid or sodium hydroxide. Soil cannot be a corrosive waste because it is not aqueous. Note however, that some states regulate corrosive solids.

Reactive wastes (D003) are wastes that are normally unstable and react violently such as a lithium sulfur dioxide battery, heated aerosol cans, or ordnance.

Toxic wastes are liquids or solids that contain a regulated amount of any one of 39 toxic compounds; the waste codes assigned to these compounds are D004 through D043. This determination is usually made by sampling and analysis using the Toxicity Characteristic Leaching Procedure (TCLP). Waste leachate concentrations exceeding the regulatory limits are assigned the corresponding D004 through D043 waste code(s). Table 6-2 lists the constituents applicable to the toxicity characteristic. Evaluate all project waste streams to determine if a D-code will apply.

Table 6-2 Toxicity Characteristic Criteria

Waste Code	Constituent	TCLP Maximum (mg/l)
	Metals	
D004	Arsenic	5.0
D005	Barium	100.0
D006	Cadmium	1.0
D007	Chromium (total)	5.0
D008	Lead	5.0
D009	Mercury	0.2
D010	Selenium	1.0
D011	Silver	5.0
	Insecticides/Herbicides	
D012	Endrin	0.02
D013	Lindane	0.4
D014	Methoxychlor	10.0
D015	Toxaphene	0.5
D016	2,4-D	10.0
D017	2,4,5-TP Silvex	1.0
	Organics	
D018	Benzene	0.5
D019	Carbon tetrachloride	0.5
D020	Chlordane	0.03
D021	Chlorobenzene	100

D022	Chloroform	6.0
Waste Code	**Constituent**	**TCLP Maximum (mg/l)**
D023	o-Cresol*	200.0
D024	m-Cresol*	200.0
D025	p-Cresol*	200.0
D026	Cresols*	200.0
D027	1,4-Dichlorobenzene	7.5
D028	1,2-Dichloroethane	0.5
D029	1,1-Dichloroethylene	0.7
D030	2,4-Dinitrotoluene	0.13
D031	Heptachlor (and epoxide)	0.008
D032	Hexachlorobenzene	0.13
D033	Hexachlorobutadiene	0.5
D034	Hexachloroethane	3.0
D035	Methyl ethyl ketone	200.0
D036	Nitrobenzene	2.0
D037	Pentachlorophenol	100.0
D038	Pyridine	5.0
D039	Tetrachloroethylene	0.7
D040	Trichloroethylene	0.5
D041	2,4,5-Trichlorophenol	400.0
D042	2,4,6-Trichlorophenol	2.0
D043	Vinyl chloride	0.2

6.2 Underlying Hazardous Constituents

Wastes that are determined to be hazardous under Section 6.1 must also be evaluated for the presence of underlying hazardous constituents. These must be evaluated so that the waste can be fully treated to meet the Land Disposal Restrictions (LDRs, 40 CFR 268). The presence of underlying hazardous constituents can be determined through process knowledge, MSDS review, or sampling and analysis. Consult the regional ECC for assistance in determining if your project waste stream contains underlying hazardous constituents.

6.3 State-Specific Wastes

Many states have more stringent requirements than EPA and regulate additional wastes as hazardous or special wastes. Some examples include low-level PCB waste or petroleum-contaminated soil. Contact the regional ECC to evaluate state regulations and guidance to determine if project waste streams are regulated as state-specific wastes.

6.3 TSCA Waste Classification

PCB wastes are regulated under the Toxic Substances Control Act (TSCA, 40 CFR 761). As a general rule, if the concentration of PCBs in the waste is greater than 50 ppm, or if the original PCB source has a concentration greater than 50 ppm, the waste is regulated under TSCA. Refer to the PCB Management SOP (HSE-82) for more information.

6.4 Universal Waste Determination

Universal wastes include batteries, agricultural pesticides, thermostats, and mercury-containing lamps, and are regulated under 40 CFR 273. These wastes are subject to less stringent requirements than RCRA hazardous waste if they are managed in the regulatory specified manner. Refer to the Universal Waste SOP (HSE-83) for these requirements.

6.5 Asbestos

Asbestos is regulated under the Clean Air Act National Emission Standards for Hazardous Air Pollutants (NESHAPs). Waste asbestos or wastes containing asbestos must be removed, packaged, labeled and managed of in accordance with 40 CFR 61, Subpart M. Refer to the Asbestos SOP (HSE- 42).

6.6 UXO/OEW

Unexploded ordnance/ordnance explosive waste (UXO/OEW) is regulated under RCRA. See the UXO/OEW SOP (HSE-91) for more information.

6.7 Radioactive Waste

If radioactive wastes will potentially be generated at a client site, contact the CH2M HILL Radioactive Waste Expert, Dave McCormack/SEA.

7.0 Waste Sampling and Analysis

This section identifies the requirements for sampling and analysis for wastes generated on U.S. projects. The following should be considered for sampling and analysis activities:

- Avoid resampling by evaluating regulatory and treatment, storage, or disposal facility (TSDF) requirements during project planning
- Ensure that test method detection levels meet regulatory limits
- Supplement laboratory testing with field test kits
- Use total constituent data where possible instead of TCLP to reduce costs
- Develop a sampling and analysis plan for the collection of representative samples

7.1 Identifying Analytical Test Methods

Potential analyses include:

- Totals
- TCLP
- Paint filter test
- Ignitability
- Corrosivity
- Reactivity
- PCBs

7.1.1 Waste Nature and Quantity

Under RCRA Land Disposal Restrictions (LDRs), underlying hazardous constituents must also be identified in a hazardous waste. Underlying hazardous constituents must also be treated to meet LDRs prior to land disposal. Therefore, any inquiries into the nature of the waste should identify underlying constituents that may not cause the waste to be hazardous. Also evaluate the waste to determine if listed hazardous waste is “contained-in” environmental media or debris (See Section 6.1.4). This determination can greatly effect the volume of hazardous waste generated.

7.1.2 Legal Requirements

RCRA requires that samples be representative of the waste stream. Representative sampling is easily accomplished in homogenous waste streams such as no-phase liquids. However, determining representative samples in a heterogeneous waste stream such as contaminated soil is more difficult. The following are EPA resources for determining representative sampling:

- Samplers and Sampling Procedures for Hazardous Waste Streams. 1980. U.S. EPA, Municipal Environmental Research Laboratory, Cincinnati, Ohio 45268, EPA-600/2-80-018. 70 pp. Publication is free. Order by calling EPA, Cincinnati Environmental Research Information Center (513) 569-7562.

- Sampling and Sampling Plans. Test Methods for Evaluating Solid Waste, Volume II: Field Manual, Physical/Chemical Methods, 3rd Edition, SW-846, Part III, Chapter 9, pp. 9-1 to 9-79. November 1986. EPA, Office of Solid Waste and Emergency Response, Washington, D.C. 20460.
- Characterization of Hazardous Waste Sites—A Methods Manual: Volume II. Available Sampling Methods, 2nd Edition. December 1984. EPA, Environmental Monitoring Systems Laboratory, Las Vegas, Nevada 89114, EPA 600/4-84-076.
- Characterizing Heterogeneous Wastes: Methods and Recommendations. February 1992. EPA, Office of Research and Development, Washington, D.C. 20460, EPA/600/R-92/033.

Commercial laboratories should be used for waste analyses. Field test kits may be used to minimize the cost of screening waste streams in the field. However, these *test kits should not be used as a sole source for hazardous waste determination*.

In some cases, total concentration analysis may be used to characterize a waste stream for the toxicity characteristic (D004-43) instead of running TCLP analysis. To use totals analysis, the waste must be entirely solid, or must contain less than 0.5 percent liquid. For ***solids*** with no liquid fraction, the TCLP leaches 100 grams of sample with 2,000 grams of leaching solution, providing a maximum of 20 times dilution of constituents in the sample. Therefore the conservative "20-Times" rule is to compare total constituent results to the TCLP regulatory limit times 20 to determine if the waste is hazardous. If less than 20x, the waste is below the regulatory limit, if above 20x, you must assume it is a hazardous waste for that constituent, or perform TCLP to make a final determination. For ***liquid*** wastes which have less than 0.5 percent solids, compare the results directly to the TC regulatory limit, with no multiplier. Note that for both liquids and solids, total constituent data can be more conservative than TCLP, especially for metals.

7.1.3 Detection Limits

Consult with the laboratory to identify the detection limits of the proposed test methods and compare them to the corresponding regulatory level, such as the TCLP limit. Although most detection limits will meet TCLP levels, some test methods cannot meet some regulatory levels, such as PCB concentrations in drinking water.

7.1.4 Disposal Facility Requirements

All facilities require waste characterization whether it be by analyses such as Toxicity Characteristic Leaching Procedure (TCLP) or by generator knowledge. Some facilities will also require additional analyses, such as total organic carbon (TOC) or chemical oxygen demand (COD), while others require testing only to meet certain permit requirements or no testing at all. Contact the proposed treatment/disposal facilities to determine their specific requirements.

HAZARDOUS WASTE POLICY for U.S. PROJECTS

Revision 2.0, January 1996

INTRODUCTION

This document presents the CH2M HILL policy for pursuing and performing projects involving hazardous and toxic wastes, and is effective on the date of issue. It applies to all projects involving the management or remediation of hazardous wastes or toxic substances that are governed by U.S. federal and state laws or regulations. This policy replaces the CH2M HILL, INC. policy issued in May 1993, and presents the prescribed process to follow for screening project opportunities involving hazardous or toxic materials. ***This policy is applicable to all project opportunities pursued or performed in all business groups.***

Properly done, hazardous and toxic waste work is challenging, profitable business and represents an investment in our firm's future success. Because this work can involve higher risks and exposures than most of our other work, we must use great care in marketing our services, screening potential projects, negotiating our contracts, and performing our work. We should accept only project work for which we are qualified and for which we have qualified and available people. We should not accept work for which the risks are too great. Most importantly, we must make sure that the health and safety of our employees is not compromised.

This policy represents a significant departure from its earlier versions. It reflects the competitive forces we encounter in the marketplace on a daily basis, and also considers the current legal and practice environment in which we pursue and perform project work involving hazardous and toxic materials. This hazardous waste policy makes the assignment of stewardship and the decision-making process for projects pursuit, except where special approval is required, similar to the decision-making process for pursuing other types of projects.

The policy requires careful screening of all opportunities involving hazardous or toxic materials. The screening process triggers one of several formal bid/no-bid or go/no-go assessments and assigns stewardship depending on the issues identified in the evaluation of the specific project opportunity.

PROJECTS REQUIRING SPECIAL APPROVAL

As a matter of policy, the following types of projects may not be undertaken without special approval as described below:

1. **Hazardous Waste Generator or Transporter**. We will not accept projects or conduct tasks that will cause us to be classified as a generator or transporter of hazardous wastes. For example, we will not sign hazardous waste manifests.
2. **Environmental Impairment Liability (EIL) Insurance Investigations**. We will not accept projects involving EIL investigations or assessments.
3. **Standard Setting**. We will not accept projects that require us to certify, or to express an opinion regarding "safe" levels of contamination; i.e., we will not become "standard setters."
4. **Asbestos Remediation Work**. We will not accept projects involving "stand-alone" asbestos remediation. We can accept assignments involving asbestos remediation that is performed by qualified subcontractors.

Special approval may be obtained from a team comprising the following people:

1. A lawyer from the Legal & Insurance Department.
2. The Regional Manager from the affected region.
3. The Project Delivery Director or Director of Operations from the appropriate business group.
4. If the project opportunity is from a multi-regional client, then the Operations Manager from the appropriate business group will be added to the special approval team.

If you have questions, or you need additional information, contact Dan Smith in the Legal & Insurance Department/COR ext. 2452, David Miller/COR ext. 2411, or Bill Dehn/FGL/COR ext. 2315.

CH2MHILL

HEALTH AND SAFETY PLAN
ATTACHMENT 9

MATERIALS SAFETY DATA SHEETS

Appendix B
Project Quality Control Plan

APPENDIX B

Quality Control Plan

1.1 Introduction

This QCP describes the QC approach and procedures for the ESI at the WPNSTA Yorktown MWR Skeet Range and CAX Marine Pistol and Rifle Range and references the WPNSTA Yorktown and CAX Master Quality Assurance Project Plan (Baker Environmental, June 2005).

The requirements and systems established in this QCP are relevant and applicable to project work performed by CH2M HILL and its subcontractors.

1.2 Project Organization and Responsibilities

This section identifies key project team members and lists the QA/QC responsibilities associated with each position and describes communication procedures that will be followed throughout the project. Refer to Section 2.6 for the project schedule summary.

1.2.1 Project Team Members

The organizational structure and responsibilities of the project team are designed to provide project QA/QC for the ESIs at WPNSTA Yorktown MWR Skeet Range and the CAX Marine Pistol and Rifle Range. Selected positions are described in the following paragraphs.

Project Manager

The PM for this project is Timothy Wenk. The PM is responsible for overall project activities, including cost control, schedule control, and technical quality. In addition, the PM develops the work plan and monitors task order activities to ensure compliance with project objectives and scope. The PM also communicates with the NTR and other designated parties regarding project progress.

The PM has ultimate responsibility within the project team for producing deliverables that are technically adequate, satisfactory to the client, and cost-effective. To accomplish this, the PM develops an internal project review schedule, provides written instructions and frequent guidance to the project team, and monitors budgets and schedules. The PM will work with the project team to select an internal QA/QC review team, to coordinate review efforts, to address review comments, and to adjudicate technical issues.

Activity Manager

The activity manager (AM) for this project is Donna Caldwell. The primary objectives of the AM are to build and maintain the relationship with the client and to provide continuity across all projects at WPNSTA Yorktown and CAX. The AM will provide overall guidance with regards to NAVFAC LANTDIV, WPNSTA Yorktown, and CAX

and will serve as the alternate CH2M HILL contact. The AM has overall responsibility for client satisfaction.

Senior Consultant

The senior consultant for this project is Brett Doerr. Brett is a company-wide resource with significant experience in the various technical aspects involved with environmental investigations. He responsible for evaluating the technical merit of the work planning documents before field activities begin, and reviewing all deliverables before submittal to the Navy. He will assist in addressing review comments, and resolving technical issues.

Health and Safety Manager (HSM)

The health and safety manager (HSM) for this project is Steve Beck. The HSM reviews and approves the project-specific HASP as well as subcontractor HASPs. The HSM serves as the point of contact for the site safety coordinator (SSC) for any health- or safety-related issues, and may conduct project audits. The HSM is also responsible for investigating accidents should any occur during the course of the project.

Field Team Leader (FTL) and Site Safety Coordinator (SSC)

The field team leader (FTL) for this project is Timothy Wenk. The FTL reports to the PM and is responsible for coordinating field efforts; providing and maintaining sampling equipment and materials; providing shipping and packing materials; and accurately completing the field logbook. The FTL will supervise the completion of all COC records and the proper handling and shipping of samples. As the lead field representative, the FTL is also responsible for consistently implementing program QA/QC measures at the site and for performing field activities in accordance with approved work plans, policies, and field procedures.

The FTL for this project will also serve as the SSC. The SSC develops and implements the project-specific HASP (refer to Appendix A) in the field. The SSC will assist in conducting site briefings and perform all final safety checks. The SSC is responsible for stopping any investigation-related operation that threatens the health and safety of the field team or surrounding populace.

Subcontractors

Subcontractors will be used for the investigation at WPNSTA Yorktown/CAX. The following services will be provided by subcontractors:

- Utility location
- Analytical laboratory services
- Data validation

Procurement of subcontractors will be performed in accordance with the Navy CLEAN Contract Procurement Manual.

1.2.2 Project Communication

One of the most critical elements in performing any type of project is to establish and maintain lines of communication among all project personnel. At the beginning of the

project or at major milestones, the PM will prepare written project instructions that will be distributed to all team members. These instructions will document project and task instructions, and each team member's responsibility in meeting the objectives, as well as a budget and schedule for successfully executing the work.

Before field activity begins, a project team meeting will be held to review the concept, assumptions, objectives of the field approach, and project objectives. Periodic meetings will be held to review data validity, technical evaluations, major decisions, and overall progress toward completing the project. Additionally, a team kickoff meeting will be held before work on each task is started. Senior personnel, including the RTL, will participate in the meetings to help focus the project approach and to define specific issues.

During the field investigation phase of projects, the field teams will meet daily to review the status of the project and to discuss technical and safety issues. When necessary, other meetings will be scheduled or the FTL will meet individually with field personnel or the subcontractors to resolve problems. During the field effort, the FTL will prepare a weekly report detailing project progress.

During the field effort, the FTL will be in regular telephone or face-to-face contact with the project team. When significant problems or decisions requiring additional authority occur, the FTL can immediately contact the PM for assistance. The environmental information scientist (EIS), in consultation with the PM and the project chemist (PC), will coordinate communication with the laboratory during sample collection, sample analysis, and data quality evaluation.

Daily and weekly reports, boring logs, QA reports, and other project information will be shared by the members of the project team as needed.

1.3 Environmental Investigation Quality Assurance Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required from field and laboratory data collection activities to support decisions concerning risk and remediation. DQOs are established prior to data collection and describe what data are needed, why the data are needed, and how the data will be used to address the problems being investigated. DQOs help to ensure that all data collected are legally and scientifically defensible.

1.3.1 Background

The objective of this project is to determine whether a release that has the potential to adversely impact human health or the environment has occurred at either site. CH2M HILL will perform the following tasks to support this objective:

- Perform a visual survey of the ranges aided by a handheld magnetometer in order to identify areas with more expended casings, rounds, and/or shot and therefore potentially more past activity
- Collect surface and subsurface soil samples at both ranges

- Analyze select soil samples for lead (MWR Skeet Range) or select Target Analyte List (TAL) metals (Marine Pistol and Rifle Range)
- Screen the soil analytical data against applicable screening values in order to identify whether a release has occurred at either range, and if so, whether any potential risks to human health and the environment have resulted
- Request laboratory analysis of additional samples to delineate the extent of the release(s) if necessary
- Provide the results of the inspections and recommendations for these sites in an ESI Report

The data collected will be used to assist in determining whether a subsequent response action (RA) is appropriate at either site.

1.3.2 Levels of Data Quality

Three categories of data will be collected as part of the field effort, and each category has a different level of supporting QA/QC documentation. Level 1 includes field monitoring activities. Level 2 includes the analyses associated with the characterization of the IDW samples. All other samples will be submitted to the laboratory for Level 3 analyses. For each QC level, the measures and methods to be used, as well as the applicable data package deliverables, are outlined below.

Level 1—Field Surveys

Level 1 encompasses field monitoring or screening activities and does not require formal data package deliverables. Level 1 activities are focused on easily measured characteristics of a sample. The data generated from field surveys are used to make decisions about the execution of the investigation or to provide general sample screening before laboratory analysis.

Monitoring results, as well as pertinent data concerning the sampling event, will be documented in the field logbook. Level 1 documentation will consist of the following:

- Instrument identification
- Calibration information (standards used and results)
- Date and time of calibration and field measurements
- Field measurement results

The logbooks will be reviewed daily by the FTL for completeness and correctness. No additional documentation or data quality evaluation is required.

Level 2—IDW Analyses

Level 2 includes the samples submitted to the laboratories for IDW characterization. Samples submitted for analysis under Level 2 will require the delivery of an analytical data package. Level 2 documentation will consist of the following:

- Case narrative
- Sample results
- Selected QC information such as surrogate recovery

- Associated blank results
- Completed COC form and sample receipt information

Level 3—Laboratory Analyses

The purposes of Level 3 data include to determine the nature, extent, and potential fate and transport of range-related contamination from past use at the site.

Samples will be analyzed for the analyses presented in Tables 3-1 through 3-3. EPA-approved methods from the current edition of publication SW-846, *Test Methods for Evaluating Solid Waste,*[1] will be used to analyze samples. Data package deliverables are summarized below.

Level 3 Data Package Deliverables (Standard Deliverable Package)
All Analytical Fractions
Case Narrative
Sample ID Cross Reference Sheet (Lab IDs and Client IDs)
Completed COC form and any sample receipt information
Any analytical/procedural changes (copies of "Confirmation of Communication")
Copies of non-conformance memos and corrective actions
Gas Chromatograph/Mass Spectrometer (GC/MS) Organic Analyses
Form 1—Sample Results
Form 2—Surrogate Recovery Summary
Form 3—MS/MSD Accuracy and Precision Summary
Form 4—Method Blank Summary
Form 5—Instrument Tuning Summary
Form 6—Initial Calibration Summary
Form 7—Continuing Calibration Summary
Form 8—Internal Standard Summary
General Chemistry
Includes potentiometric, gravimetric, colorimetric, and titrimetric analytical techniques. TRPH (418.1), project, etc. The following forms must be included (where applicable)
Form 1—Sample Results
Form 2A—Initial and Continuing Calibration Summary
Form 3—Initial and Continuing Calibration Blanks and Method Blanks Summary
Form 5A –MS/MSD Recoveries Summary
Form 6—Native Duplicate and MS/MSD Precision Summary
Form 7—Laboratory Control Sample Recovery Summary
Form 10—Instrument or Method Detection Limit Summary
Form 13—Preparation Log Summary

[1] Available at http://www.epa.gov/epaoswer/hazwaste/test/main.htm#table.

1.3.3 Quality Assurance Objectives for Chemical Data Management

Analytical performance requirements are expressed in terms of precision, accuracy, representativeness, comparability, and completeness (PARCC). Brief definitions for each parameter are presented below.

Precision

Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate analyses made under identical conditions. Precision is estimated from analytical data and cannot be measured directly. The precision of a duplicate determination can be expressed as the relative percent difference (RPD).

Accuracy

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Accuracy is estimated through the use of known reference materials or matrix spikes. It is calculated from analytical data and is not measured directly. Spiking of reference materials into a sample matrix is the preferred technique because it provides a measure of the matrix effects on analytical accuracy. Accuracy is defined as percent recovery.

Representativeness

Representativeness is a qualitative measure of the degree to which sample data accurately and precisely represent a characteristic environmental condition. Representativeness will be assessed by reviewing the presence/absence of contaminants in method blanks, trip blanks, and equipment blanks; sample condition/integrity upon receipt and storage at the laboratory; and laboratory adherence to sample holding times. In addition, the effects of sample matrix interferences, if any, will be evaluated to determine possible data impact.

Comparability

Comparability is another qualitative measure designed to express the confidence with which one data set may be compared to another. Sample collection and handling techniques, sample matrix type, and analytical method all affect comparability. Comparability is limited by the other PARCC parameters because data sets can be compared with confidence only when precision and accuracy are known.

Completeness

Completeness is defined as the percentage of valid measurements compared to the total number of measurements made for a specific sample matrix and analysis. The completeness goal for analytical data is 90 percent. All validated data will be used. During the data validation process, an assessment will be made of whether the valid data are sufficient to meet project objectives. If sufficient valid data are not obtained, corrective action will be initiated by the PM.

1.3.4 Sampling Procedures

Sampling locations and procedures are discussed in Section 3.

1.3.5 Sample Custody

A sample is physical evidence collected from a hazardous waste site, the immediate environment, or another source. Because of the potential evidentiary nature of samples, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence in enforcement proceedings.

COC procedures are used to maintain and document sample possession for enforcement purposes. The principal documents used to identify samples and to document possession are the following:

- Packing lists
- COC records
- Air bills (such as Federal Express, UPS)
- Field logbooks
- Color photographs of the field activities

Sample custody and COC records will be maintained by the field team until delivered to the laboratory. Sample shipping information from each day will be maintained by the FTL and relayed to the laboratory as soon as possible after sample pickup. These documents could be introduced as evidence should a site investigation result in legal action. To document sample possession, COC procedures are followed.

Definition of Custody

A sample is under the field team's custody if one or more of the following criteria are met:

- It is in the field team's possession
- It is in the field team's view after being in the field team's possession
- It was in the field team's possession and then the field team locked it up to prevent tampering
- It is in a designated secure area

Field Custody

In collecting samples, the amount collected should be only enough to provide a good representation of the media being sampled. To the extent possible, the quantity and types of samples and sample locations are determined before the actual field work begins.

The following procedures will be used to document, establish, and maintain custody of field samples:

- Labels will be completed for each sample with waterproof ink, making sure that the labels are legible and affixed firmly on the sample container
- All sample-related information will be recorded in the site logbook
- The field sampler will retain custody of the samples until they are transferred or properly dispatched

- To simplify the COC record and minimize potential problems, as few people as possible will handle the samples or physical evidence. One individual from the field sampling team will be designated as the responsible individual for all sample transfer activities. This field investigator will be responsible for the care and custody of the samples until they are properly transferred to another person or facility
- All samples will be accompanied by a COC record, which documents the transfer of custody of samples from the field investigator to another person, the laboratory, or other organizational elements. Each change of possession must be accompanied by a signature for relinquishment and receipt of the samples
- Completed COC forms will be placed in a plastic cover, which is then placed inside the shipping container used for sample transport from the field to the laboratory
- When samples are relinquished to a shipping company for transport, the tracking number from the shipping bill or receipt will be recorded on the COC form or in the site logbook
- Custody seals will be used on the shipping containers when samples are shipped to the laboratory to inhibit sample tampering during transportation

Sample Labels

The sampling location identification and sample labeling, handling, and shipping must be performed using standardized and well-documented procedures so that a sample can be tracked to its point of origination. Tracking will be performed from the time of sampling until the analytical data are released from the laboratory. The effectiveness of the tracking process will determine the integrity of the samples. Therefore, a sample-numbering system with a tracking mechanism that allows the retrieval of sample information including sampling locations, date, time, and analytical parameters must be used. Procedures for this system are provided in Section 3.5.2. The method of sample identification to be used depends on the type of sample collected and container used, as follows:

- Samples collected for in situ field analysis are those collected for specific field analyses or measurements for which the data are recorded directly in the field logbooks or recorded on field data sheets, along with sample identity information, while in the custody of the sampling team.
- Samples other than those collected for in situ field measurements or analyses are to be identified on a sample label affixed to the sample container by the FTL. The following information must be included on the label:
  - Laboratory
  - Project name (and number where appropriate)
  - Sample ID
  - Station ID
  - Date (for key to sampling round)
  - Preservation
  - Analysis
  - Sampler's initials, date, and military time

Chain-of-Custody Record

Samples are accompanied by a COC record, which will contain the information described in the next section.

Transfer-of-Custody and Shipment

When transferring samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the COC record. This record documents custody transfer from the sampler to the analyst at the laboratory.

Samples will be packaged properly for shipment and dispatched to the appropriate laboratory for analysis, with a separate COC record accompanying each shipping container. Shipping containers will be sealed with custody seals for shipment to the laboratory. Courier name(s), and other pertinent information, will be entered in the '"Received By" section of the COC record.

When samples are split with a facility owner or agency, this information will be noted in the "Sample Remarks" section of the COC record and will be signed by both the sampler and the recipient. If the split is refused, the refusal will be noted and signed by both parties. The "Sample Remarks" section will also indicate if a representative is unavailable or refuses to sign. When appropriate, as in the case of the representative being unavailable, the COC record should contain a statement that the samples were delivered to the designated location at the designated time.

All shipments will be accompanied by the COC record identifying their contents. The original record and yellow copy will accompany the shipment to the laboratory, and the pink copy will be retained by the FTL.

If sent by mail, the package will be registered with return requested. If sent by common carrier, a bill of lading will be used. Freight bills, postal service receipts, and bills of lading will be retained as part of the permanent documentation.

Laboratory Chain-of-Custody Procedures

When samples are shipped to the laboratory, they will be placed in containers that are sealed on each side with at least one custody seal. A designated sample custodian will accept custody of the shipped samples following the procedure outlined below.

When sample analyses and necessary QA checks have been completed in the laboratory, the unused portion of the sample will be disposed of properly. All identifying stickers, data sheets, and laboratory records will be retained as part of the documentation. Sample containers and remaining samples will be disposed in compliance with all federal, state, and local regulatory requirements.

Sample Receipt. A designated sample custodian will accept custody of the shipped samples and verify that the packing list sample numbers match those on the COC record. The custodian will enter pertinent information as to shipment, pickup, and courier in the "Sample Remarks" section of the COC record and enter the sample numbers into a field logbook, which is arranged by project code and station number. Upon receipt of the samples, the custodian will check the original COC and request-for-analysis documents and compare them with the labeled contents of each sample

container for corrections and traceability. The sample custodian will sign the COC and record the date and time received. The sample custodian also will assign a unique laboratory sample number to each sample. Cooler temperature (temperature vial) will be checked and recorded.

Care will be exercised to annotate any labeling or descriptive errors. If discrepancies occur in the documentation, the laboratory will immediately contact the FTL as part of the corrective action process. A qualitative assessment of each sample container will be performed to note anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming COC procedure.

Sample Storage. The laboratory custodian will use the sample identification number and assign a unique laboratory number to each sample, and is responsible for seeing that all samples are transferred to the proper analyst or stored in the appropriate secure area. The laboratory will send a sample acknowledgement letter to the PM or FTL as a record of the shipment's arrival and the condition of the containers. Any discrepancy will be identified by the laboratory custodian, and corrective actions taken. The PC may need to provide guidance concerning additional actions. A copy of the sample acknowledgement letter will be retained with the COC by the PM.

Data Recording. The custodian will distribute samples to the appropriate analysts. Laboratory personnel are responsible for the care and custody of samples from the time they are received until the sample is exhausted or returned to the custodian. The data from sample analyses are recorded on the laboratory report form.

Documentation Procedures

Field documentation for activities at WPNSTA Yorktown/Cheatham Annex will consist of one or more site-specific field logbooks and any necessary field forms as described in Section 3.7. Each logbook will be identified uniquely by project task and consecutively numbered. For extended field activities, logbooks will be maintained onsite until complete, then stored in the project files.

Photographs will be taken during key field activities.

Sample Identification. Sample identification procedures are identified in Section 3.5.2. The sample designation format will be followed throughout the project. Required deviations from this format in response to field conditions will be documented.

Field Logs. Field logs will consist of all associated field logbooks and any necessary field forms.

Site Logbook. The site logbook chronicles field investigation activities, but does not have the same level of detail as the field logbook. The site logbook delineates conditions and activities that occur on a given day and references the appropriate field logbooks and forms for specific information. The site logbook also is used to record field changes, along with supporting rationale.

The person responsible for the field effort will complete the site logbook. Pages will not be removed from the document. Partially used pages will be lined out, dated, and initialed to prevent data entry at a later date.

The front cover or first page of the site logbook must list the project name, the project number, and dates of use. The following items are to be included, as appropriate to the work scope, in the site logbook:

- Date
- Weather conditions
- List of CH2M HILL personnel, subcontractor personnel, and site visitors by name, title, organization, and purpose, who entered the project area during the day
- Brief descriptions of activities conducted
- Field changes or variances with references to the appropriate documentation of these changes
- Specific comments related to peculiar problems that occurred during the day, if any, and their resolution

Field Logbook. Information required on the cover of the site logbook also must be provided on the cover of each field logbook. Entries in the field logbook must be continuous through the day. Pages, as well as the logbooks themselves, are numbered consecutively. The following information should be included in the field logbook:

- Date, time of specific activities, and physical location
- Weather conditions
- Names, titles, and organization of personnel onsite, names and titles of visitors, and times of visits
- Field observations, including specific details on sampling activities (including type of sampling, time of sampling, and sample numbers), a description of any field tests and their results, and references to any field forms used and type of document generated
- A detailed description of samples collected and any splits, duplicates, matrix spikes, or blanks that were prepared. A list of sample identification numbers, packaging numbers, and COC record numbers pertinent to each sample or referenced to the appropriate documentation should be noted
- Specific problems, including equipment malfunctions and their resolutions
- A list of times, equipment types, and variations of decontamination procedures followed or a reference to the appropriate documentation
- Photograph records

Corrections to Documentation. All original handwritten data recorded in field logbooks, sample identification tags, COC records, and receipts-for-sample forms will be written in black, waterproof ink. Corrections must be marked with a single line, dated, and initialed. No accountable control documents (such as site, field, and calibration logbooks) are to be destroyed or discarded, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on an accountable document assigned to one team member, the FTL may make corrections simply by drawing a single line through the error and entering the correct information. The erroneous information should not be obliterated. Any subsequent error discovered on an accountable document should be corrected by the person who made the entry. All subsequent corrections must be initialed and dated.

Final Evidence File Documentation. Documentation, including voided entries, must be maintained within project files.

1.3.6 Calibration Procedures

Field and laboratory equipment must operate satisfactorily within specified operating limits before it can be expected to produce reliable and usable data for a project. Documentation concerning the calibration laboratory equipment should include instrument type, calibration frequency, reference standards used, calibration acceptance criteria, and calibration documentation procedures. Calibration applies to field and laboratory instruments, including balances, refrigerators, and ovens.

Instrument testing is primarily achieved by following the manufacturer's instructions with regard to proper voltages, carrier gas flow rates, temperatures, mass or retention time windows, and certified calibration standards. Practically all instruments come with manufacturer's instructions for initial setup, routine checks, corrective actions, and preventive maintenance.

Field Instruments

Field instruments will be calibrated at the beginning of each day using the method described by the manufacturer's instructions and then checked periodically during the day and at the end of the measurement period. Standards used to calibrate the field survey instruments will be traceable to National Institute of Standards and Testing standards. All instrument calibration activities are documented in the field logbooks.

All field instruments will be set up and operated in strict accordance with the manufacturer's instructions. When the operation of these instruments needs modification because of specific site or sample conditions, such modification will be documented in the instrument logs and field logbooks.

Laboratory Equipment

Laboratory instruments will be calibrated in accordance with the manufacturer's directions and applicable method specifications. Laboratory instrument calibration procedures will be summarized in the laboratory's quality assurance plan, which will be reviewed and approved by the PC or designee before samples are submitted for analysis.

1.3.7 Analytical Procedures

Field Testing and Screening

All field parameters will be analyzed in accordance with SOPs for the individual equipment.

Laboratory Methods

The parameters to be analyzed and the specific analytical methods to be used are discussed in Section 3 of the Work Plan.

1.3.8 Data Reduction, Validation, and Reporting

The data quality evaluation process is used to assess the effect of the overall analytical process on the usability of the data.

Level 1—Field Survey Data

Field instruments used to collect field survey data are direct readings, thus making field calculations and subsequent data reduction unnecessary. Field data will be recorded in the site logbooks by appropriately trained field personnel. Field data will include the following:

- Instrument identification
- Calibration information (standards used and results)
- Date and time of calibration and sample measurement
- Sample results
- Supporting information if appropriate
- Data will be reviewed by the FTL, who is responsible for the collection and verification of all field data while in the field. Data initially will be accepted or rejected by the FTL before leaving the sampling site. Extreme readings (readings that appear significantly different from other readings at the same site) will be accepted only after the instrument has been checked for malfunction and the readings verified by re-testing.

Field documentation, sample data, instrument calibrations, and QC data will be reviewed by the PM (or a designee) before being included in the project files.

Level 2—Screening Analyses

Level 2 data includes the samples submitted to the laboratories for physical parameter testing and IDW characterization. Samples submitted for Level 2 analysis will require the delivery of a limited data package, which includes:

- Case narrative
- Sample results
- Selected QC information, such as surrogate recovery
- Associated blank results
- Completed COC forms and sample receipt information

The PC or designee will review the supporting information and will provide a summary report to the PM at the end of the field effort.

Laboratory Analyses

The PC or designee will perform data quality evaluation. The data quality evaluation process is used to assess the effect of the overall analytical process on the usability of the data. The two major categories of data evaluation are laboratory performance and matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements and identifies whether the laboratory did, or did not, analyze the samples within the limits of the analytical method. Evaluation of the matrix interferences is more subtle and involves analysis of several results including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results.

Before the analytical results are released by the laboratory, both the sample and QC data will be reviewed carefully to verify sample identify, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. Additionally, the QC data will be reduced and spike recoveries will be included in control charts, and the resulting data will be reviewed to ascertain whether they are within the laboratory-defined limits for accuracy and precision. Any non-conforming data will be discussed in the data package cover letter and case narrative. The laboratory will retain all of the analytical and QC documentation associated with each data package.

The data package will be reviewed by the PC or designee using the process outlined by the EPA (1999, 2004).

For non-CLP methods, the validation will be performed in a process analogous to the National Function Guidelines, but will use QC criteria established by the method.

The data review and validation process is independent of the laboratory's checks; it focuses on the usability of the data to support the project data interpretation and decision-making process. Areas of review include data package completeness, holding time compliance, initial and continuing calibration, spiked sample results, method blank results, and duplicate sample results. A data review worksheet will be completed for each data package. Acceptance criteria for each area of review are specified in the analytical method.

Sample results that do not meet the acceptance limit criteria will be indicated with a qualifying flag, which is a one- or two-letter abbreviation that indicates a possible problem with the data. Flags used in the text may include the following:

- U—Undetected. Samples were analyzed for this analyte, but it was not detected above the method detection limit (MDL) or instrument detection limit
- UJ—Detection limit estimated. Samples were analyzed for this analyte, but the results were qualified as not detected. The results are estimated
- J—Estimated. The analyte was present, but the reported value may not be accurate or precise
- R—Rejected. The data are unusable (analyte/compound may or may not be present)

It is important to note that laboratory qualifying flags are included on the data summary forms that are submitted by the laboratory. However, during the data review and validation process, the laboratory qualifying flags are evaluated and replaced with the project-specific validation flags.

Once each of the data packages has been reviewed, and the data review worksheets completed, then the entire data set will be evaluated for overall trends in data quality and usability. Information summarized as part of the data quality evaluation may include chemical compound frequencies of detection, dilution factors that might affect data usability, and patterns of target compound distribution. The data set will also be evaluated to identify potential data limitations or uncertainties in the laboratory. Additional areas of review are listed below.

Field and Laboratory Blank Contamination. The appearance and concentration of target compounds in field and laboratory blanks as well as environmental samples will be reviewed. Common field sampling and laboratory contaminants detected in blanks include acetone, methylene chloride, and phthalates. Acetone and methylene chloride are used to extract samples in the laboratory, and hence, are common laboratory contaminants. Phthalates (such as bis(2-ethylhexyl)phthalate) are used as plasticizers and are often introduced during sample handling.

If these compounds are encountered in a method blank at a concentration greater than the practical quantification limit (PQL), corrective actions will be taken in an attempt to eliminate these compounds. These compounds may also be detected in field blanks above the PQL. In either case, all analytical data above the PQL associated with these compounds will be flagged to indicate possible cross-contamination.

Surrogate Spike Recoveries. Surrogate spike compounds are added to each sample for the organic analytical methods. Surrogate spike compounds are structurally similar (but not identical) to target compounds and should behave in a similar manner during analysis. Surrogate spike recoveries are used to monitor both laboratory performance and matrix interferences. Surrogate spike recoveries from field and laboratory blanks are used to evaluate laboratory performance because these blanks represent an ideal sample matrix. Surrogate spike recoveries for field samples are used to evaluate the potential for matrix interferences.

When surrogate spike recoveries for field samples fall outside the method target acceptance windows, the samples are re-extracted if appropriate, then re-analyzed. If the surrogate spike recovery is still outside the acceptance window for the re-analyzed sample, then the sample results are qualified as affected by matrix interferences.

Matrix Spike Recoveries. For this QC measure, three aliquots of a single sample are analyzed—one normal and two spiked with the same concentration of matrix spike compounds. Unlike the surrogate spike compounds, matrix spike compounds are found on the method target compound list. Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. The duplicate spike results are compared to evaluate precision.

Laboratory Control Samples. An aliquot of American Society for Testing and Materials Type II water or "Ottawa sand" for organic analyses is spiked with target analytes or

compounds at concentrations in the middle of the linear calibration range, and then prepared and analyzed with a batch of samples. The laboratory control sample is used to ensure quality control for each preparation batch.

Duplicate Sample Results. Duplicate samples will be collected and submitted for laboratory analysis. Both the native and duplicate samples will be analyzed for the same parameters. Target compounds that are detected in both the native and duplicate samples will be compared and the precision estimated for the sample results calculated.

Laboratory Data Reporting. Laboratory data will be reported in Level 3 QC and validated for risk assessment. Level 3 reporting includes all QC and calibration summaries for a project-specific batch of samples. Matrix-specific QC is performed relative to project sample delivery groups.

1.3.9 Internal Quality Control

Field Measures

Field sampling QC procedures will include collecting trip blanks, field blanks, equipment blanks, field duplicates, and MS/MSD samples, as discussed in Section 3.5.2. These QC samples will be submitted blind to the laboratory. Field measurement QC procedures will include the calibration requirements discussed in Section 4.3.5.

Samples will be collected by personnel wearing Level D personal protection equipment.

Routine Analytical Services

Laboratory QC procedures will include the following:

- Analytical methodology according to the specific methods identified
- Instrument calibrations and standards as defined in the specific methods
- Laboratory blank measurements at a minimum frequency of 5 percent or one-per-batch
- Accuracy and precision measurements at a minimum frequency of 5 percent or one-per-set
- Data reduction and reporting according to the specific methods and the specifications outlined in Section 4.3.7
- Laboratory documentation according to the specifications outlined in Section 4.3.7

1.3.10 Performance and System Audits

Performance and systems will be audited to verify documentation and implementation of the project-specific QCP, to identify nonconformance, and to verify correction of identified deficiencies.

Assessment activities may include surveillance, inspections, peer review, management system review, readiness review, technical systems audit, performance evaluation, and data quality assessment. The Quality Assurance Control Manager (QACM) will be

responsible for initiating audits, selecting the audit team, and overseeing audit implementation.

The QACM, or designee, in consultation with the PM, will evaluate the need for an independent audit. The client may also perform independent project audits. Performance audits are used to quantitatively assess the accuracy of analytical data through the use of performance evaluation and blind check samples. Laboratory performance will be audited by the QACM or designee

Project Systems Audit

A systems surveillance of operations may be required by the project-specific work plan and would be used to review the total data generation process. This will include onsite review of the field operational system, physical facilities for sampling, and equipment calibrations. Informal document control surveillance will consist of checking each document for completeness, including such items as signatures, dates, and project numbers.

An audit report summarizing the results and corrections will be prepared and entered in the project files.

Technical Performance Audits

The FTL or a designated representative will conduct an informal surveillance of the field activities. Surveillance for completeness will include the following items:

- Sample labels
- COC records
- Field logbooks
- Sampling operations

The first three items above will be checked for completeness. Sampling operations will be reviewed to determine if they are being performed as stated in Section 3 or as directed by the FTL. A performance surveillance may be conducted by the PM and the FTL during the first week of sampling if it is deemed necessary by the PM, FTL, or client. The surveillance may focus on verifying that proper procedures are followed so that subsequent sample data will be valid. Before the surveillance, a checklist will be prepared by the PM and the FTL to serve as a guide for the performance surveillance. The surveillance may verify the following:

- Collection of samples follows the available written procedures
- COC procedures are followed for traceability of sample origin
- Appropriate QC checks are being made in the field and documented in the field logbook
- Specified equipment is available, calibrated, and in proper working order
- Sampling crews are adequately trained
- Record-keeping procedures are being followed and appropriate documentation is maintained

- Corrective action procedures are followed

An audit report summarizing the results and corrections will be prepared and entered in the project files.

Field Audits

Field audits are not currently anticipated during this investigation, but will be performed if necessary.

Laboratory Audits

The analytical laboratory will conduct both internal and external QC checks. External QC checks include participation in EPA's certification and performance evaluation programs. The results of quarterly performance evaluation samples will be made available to the PM upon request. Internal QC checks (duplicates, blanks, and spiked samples) will be performed in accordance with the approved methods.

Laboratory systems are audited annually and as required by specific projects. The laboratories are required to submit a laboratory quality assurance plan and relevant SOPs before the field effort begins. During data evaluation and data use, if any problems are noted, specific corrective actions will be implemented on a case-by-case basis. An additional systems audit may be requested if warranted.

The laboratory will be required to perform the following:

- Monthly project review of 10 percent of all projects done by the QA department
- Audits by the laboratory QA manager at a frequency greater than specified in the laboratory quality assurance plan
- Special audits by the QACM or corporate management when a problem is suspected
- Yearly audits by the corporate QACM

1.3.11 Preventive Maintenance

Field Equipment

The field personnel operating the field equipment and appropriate offsite laboratory chemists are responsible for the maintenance of their respective instruments. Preventive maintenance will be provided on a scheduled basis to minimize down time and the potential interruption of analytical work. All instruments will be maintained in accordance with the manufacturer's recommendations and normal approved laboratory practice.

Scheduled periodic calibration of testing equipment does not relieve field personnel of the responsibility of using properly functioning equipment. If a project team member suspects an equipment malfunction, the device will be removed from service, tagged so that it is not inadvertently used, and the appropriate personnel notified so that a recalibration can be performed or a substitute piece of equipment can be obtained.

Laboratory Equipment

Designated laboratory personnel will be trained in routine maintenance procedures for all major instrumentation. When repairs become necessary, they will be made by either trained staff or trained service engineers/technicians employed by the instrument manufacturer. The laboratory will have multiple instruments that will serve as backup to minimize the potential for downtime.

Preventive maintenance will be performed according to the procedures delineated in the manufacturer's instrument manuals, including lubrication, source cleaning, detector cleaning, and the frequency of such maintenance. Procedures should be listed in greater detail in the laboratory's quality assurance plan.

Chromatographic carrier gas purification traps, injector liners, and injector septa will be cleaned or replaced on a regular basis. Precision and accuracy data will be examined for trends and excursions beyond control limits to identify evidence of instrument malfunction. Maintenance will be performed when an instrument begins to degrade, as evidenced by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or more of the QC criteria.

Instrument downtime will be minimized by keeping adequate supplies of all expendable items (i.e., an expected lifetime of less than 1 year). Selected items include gas tanks, gasoline filters, syringes, septa, GC columns and packing, ferrules, printer paper and ribbons, pump oil, jet separators, open-split interfaces, and MS filaments.

Instrument Maintenance Logbooks

All maintenance will be documented in permanent logs that will be available for review by auditing personnel. Both scheduled and unscheduled maintenance required by operational failures will be recorded. The designated laboratory operations coordinator will review maintenance records regularly to ensure that required maintenance is occurring.

Instrument maintenance logbooks are maintained in laboratories at all times. The logbooks, in general, contain a schedule of maintenance, as well as a complete history of past routine and nonroutine maintenance. Laboratories will be audited by the PC prior to the start of analyses.

1.3.12 Specific Procedures Used to Assess Data

The final activity of the data quality evaluation is an assessment of whether the data meet the DQOs. The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and that the resulting analytical data can be used to support the project decision making process.

Data assessment will follow the data review and validation described in Section 4.3.7. An assessment report will be prepared at the end of the project. The report will summarize the findings of the data review/validation as relevant to project usage. Data accuracy, precision, and completeness values will be summarized in the assessment report. The following subsections describe the quantitative definition of accuracy, precision, and completeness.

Precision

Precision is a measure of the agreement or repeatability of a set of replicate results obtained from duplicate analyses made under identical conditions. Precision is estimated from analytical data and cannot be measured directly. The precision of a duplicate determination can be expressed as the RPD and is calculated as follows:

$$RPD = \{(|X_1 - X_2|)/(X_1 + X_2)/2\} \times 100 = \left\{ \frac{|X_1 - X_2|}{\frac{(X_1 + X_2)}{2}} \right\} \times 100$$

where

X_1 = native sample
X_2 = duplicate sample

Accuracy

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Accuracy is estimated through the use of known reference materials or matrix spikes. It is calculated from analytical data and is not measured directly. Spiking of reference materials into a sample matrix is the preferred technique because it provides a measure of the matrix effects on analytical accuracy. Accuracy, defined as percent recovery (P), is calculated as follows:

$$P = \left[\frac{(SSR - SR)}{SA} \right] \times 100$$

where

SSR=spiked sample result
SR=sample result (native)
SA=the spike concentration added to the spiked sample

Completeness

Completeness is defined as the percentage of measurements judged to be valid compared to the total number of measurements made for a specific sample matrix and analysis. Completeness is calculated using the following formula:

$$\text{Completeness} = \frac{\text{Valid Measurements}}{\text{Total Measurements}} \times 100$$

Experience on similar projects has shown that laboratories typically achieve about 90 percent completeness. All validated data will be used. During the data validation process, an assessment will be made of whether the valid data are sufficient to meet project objectives. If sufficient valid data are not obtained, corrective action will be initiated by the PM.

1.3.13 Corrective Actions

Field Activities

The PM is responsible for initiating corrective actions, which include problem identification, investigation responsibility assignment, investigation, action to eliminate the problem, increased monitoring of the effectiveness of the corrective action, and verification that the problem has been eliminated.

Documentation of the problem is important to the overall management of the study. A corrective action request form for problems associated with sample collection is completed by the person discovering the QA problem. This form identifies the problem, establishes possible causes, and designates the person responsible for action. The responsible person will be either the PM or the FTL.

The corrective action request form includes a description of the corrective action planned and has space for follow-up. The PM verifies that the initial action has been taken and appears to be effective, and at an appropriate later date, checks to see if the problem has been resolved fully. The PM receives a copy of all corrective action request forms and enters them into the corrective action log. This permanent record aids the PM in follow-up and assists in resolving the QA problems.

Examples of corrective action include, but are not limited to, correcting COC forms, analysis reruns (if holding time criteria permit), recalibration with fresh standards, replacement of sources of blank contamination, or additional training in sampling and analysis. Additional approaches may include the following:

- Resampling and reanalyzing
- Evaluating and amending sampling and analytical procedures
- Accepting the data and acknowledging the level of uncertainty or inaccuracy by flagging the validated data and providing an explanation for the qualification

Laboratory Activities

The laboratory department supervisors review the data generated to verify that all QC samples have been run as specified in the protocol. Laboratory personnel will be alerted that corrective actions may be necessary if the following should occur:

- QC data are outside the warning or acceptable windows for precision and accuracy established for laboratory samples.
- Blanks contain contaminants at concentrations above the levels specified in the laboratory QAP for any target compound.
- Undesirable trends are detected in matrix spike recoveries or RPD between matrix spike duplicates.
- There are unusual changes in detection limits.
- Deficiencies are detected by the laboratory QA Director during internal or external audits, or from the results of performance evaluation samples.

If nonconformances including, but not limited to, analytical methodologies or QC sample results are identified by the bench analyst, corrective actions will be implemented immediately. Corrective action procedures will be handled initially at the bench level by the analyst, who will review the preparation or extraction procedure for possible errors and check the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. The analyst will immediately notify his/her supervisor of the problem and the investigation being made. If the problem persists or cannot be identified, the matter will be referred to the laboratory supervisor and QA/QC Officer for further investigation. Once resolved, full documentation of the corrective action procedure will be filed with the laboratory supervisor, and the QA/QC Officer will be provided a corrective action memorandum for inclusion in the project file if data are affected. Corrective actions may include, but are not limited to, the following:

- Re-analyzing suspect samples
- Re-sampling and analyzing new samples
- Evaluating and amending sampling and/or analytical procedures
- Accepting data with an acknowledged level of uncertainty
- Recalibrating analytical instruments
- Qualifying or rejecting the data

Following the implementation of the required corrective action measures, data that are deemed unacceptable may not be accepted by the PM, and follow-up corrective actions may be explored. Details of laboratory corrective actions are provided in the laboratory's quality assurance plan.

1.3.14 Quality Assurance Reports

The purpose of QA reports is to document implementation of the QCP. These reports include periodic assessments of measurement data accuracy, precision, and completeness of the results of performance audits, the results of system audits, and the identification of significant QA problems and recommended solutions.

The analytical laboratory will be responsible for submitting monthly progress reports to the PM. The PM is responsible for submitting these reports to the client, as required.

The final QA report can be attached as an appendix to the ESI report and may include the following:

- Data quality assessment in terms of PARCC, and the method detection limits
- The degree to which DQOs were met
- Limitations of the measurement data and usability of the data
- Applicability of the data to site conditions
- Laboratory QC activities, including a summary of planned versus actual laboratory QC activities, explanations for deviations, and an evaluation of data quality for each analysis for each medium

- Field QC activities, including a summary of planned versus actual field QC activities, explanations for deviations, and evaluations of the data quality of field QC samples/activities and estimated effect on sample data
- Data presentation and evaluation, including an assessment of sampling and analysis techniques, data quality for each analysis and each medium, and data usability

A final report will be submitted to the client after comments from the client and regulatory agencies have been incorporated.