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FINAL VERSION 3 RECORD OF DECISION OPERABLE UNITS 6 AND 7 (OU 6) (OU 7) SITE 9 PLANT 1 EXPLOSIVES CONTAMINATED WASTEWATER DISCHARGE AREA AND SITE 19 CONVEYOR BELT SOIL BUILDING 10 NWS YORKTOWN VA
3/1/1998
NAVFAC MIDLANT

*Final* v.3

# Record of Decision

## Operable Unit Nos. VI and VII
## Site 9 - Plant 1 Explosives-Contaminated Wastewater Discharge Area
## and
## Site 19 - Conveyor Belt Soil at Building 10

**Naval Weapons Station Yorktown**
**Yorktown, Virginia**

**March 1998**

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AOC | Area of Concern |
| ARAR | applicable or relevant and appropriate requirement |
| bgs | below ground surface |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CRP | Community Relations Program |
| CT | Central Tendency |
| DoD | Department of Defense |
| DoN | Department of the Navy |
| ESQD | Explosive Safety Quantity Distance |
| FFA | Federal Facility Agreement |
| FS | Feasibility Study |
| HI | hazard index |
| HQ | hazard quotient |
| HMX | Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine |
| HRSD | Hampton Roads Sanitation District |
| IAS | Initial Assessment Study |
| ILCR | incremental lifetime cancer risk |
| IDW | Investigation Derived Waste |
| IR | Installation Restoration |
| LANTDIV | Atlantic Division, Naval Facilities Engineering Command |
| LOAEL | Lowest Observed Adverse Effect Level |
| mg/kg | milligrams per kilogram |
| µg/L | micrograms per liter |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NOAEL | No Observable Adverse Effect Level |
| NPDES | National Pollutant Discharge Elimination System |
| NPL | National Priorities List |
| NPW | net present worth |
| O&M | operation and maintenance |
| OU | Operable Unit |
| PAH | Polynuclear Aromatic Hydrocarbon |
| PRAP | Proposed Remedial Action Plan |

## LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

| | |
|---|---|
| RA | risk assessment |
| RAA | remedial action alternative |
| RAB | Restoration Advisory Board |
| RCRA | Resource Conservation and Recovery Act |
| RDX | Hexahydro-1,3,5-trinitro-1,3,5-triazine |
| RI | Remedial Investigation |
| RME | Reasonable Maximum Exposure |
| RL | Remediation Level |
| ROD | Record of Decision |
| SARA | Superfund Amendments and Reauthorization Act |
| SMCL | Secondary Maximum Contaminant Level |
| SWMU | Solid Waste Management Unit |
| TAL | Target Analyte List |
| TCL | Target Compound List |
| TBC | to-bumsidered criterion |
| TNT | 2,4,6-trinitrotoluene |
| UCL | Upper Confidence Limit |
| USEPA | United States Environmental Protection Agency |
| WPNSTA Yorktown | Naval Weapons Station Yorktown |

# 1.0 DECLARATION OF THE RECORD OF DECISION

## 1.1 Site Name and Location

Naval Weapons Station (WPNSTA) Yorktown, Yorktown, Virginia
Sites 9 and 19; Operable Units (OUs) VI and VII

## 1.2 Statement of Basis and Purpose

This Record of Decision (ROD) documents the selected remedial action to reduce the risks posed by soil, surface water and sediment at Site 9 and soil at Site 19 located at WPNSTA Yorktown, Yorktown, Virginia. Soil contaminated by 2,4,6-trinitrotoluene (2,4,6-TNT) and RDX (explosives) at Site 19 is designated as OU VI and soil, surface water, and sediment at Site 9 are designated as OU VII. The remedial action is chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and, to the extent practicable., with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The information supporting the decisions on the selected remedy is contained in the administrative record. Section 222 lists major documents contained in the administrative record.

The Commonwealth of Virginia concurs with the selected remedy.

## 13 Assessment of the Sites

Actual or threatened releases of hazardous substances from OU VI, if not addressed by implementing the remedial action selected in this ROD, may present an imminent and substantial endangerment to human health and the environment. No action is proposed for OU VII because risks posed to human health and the environment fall within acceptable or manageable ranges, and remediation will cause greater harm to the environment than leaving contaminants in place.

## 1.4 Description of the Selected Remedy

The cleanup of OU VI and *the* selection of the no-action alternative for OU VII are part of a comprehensive environmental remediation currently being performed at WPNSTA Yorktown under the Department of Defense (DoD) Installation Restoration (IR) Program.

The removal and treatment of soil at Site 19 addresses the principal threat to human health and the environment at OU VI by eliminating source materials (2,4,6-TNT and RDX) and eliminating the potential release of these contaminants to the environment. Major components of the selected remedy for OUs VI and VII include:

*OU VI*

- Dismantling and disposal of the Site 19 conveyor belt.
- Excavation of soil beneath the belt to a depth of approximately 4 feet.
- Excavation of aluminum contaminated soil (above Station-wide background) to approximately 6 inches around Building 527 and disposal in the bottom of the conveyor belt excavation area.
- Backfilling (with clean soil) and regrading the conveyor belt area and the area around Building 527.
- Biological treatment of excavated explosives-contaminated soil at the WPNSTA Yorktown biocell and placement of treated soil at Site 22 (Former Burn Pad) now occupied by the WPNSTA Yorktown biocell.

*OU VII*

- No action at OU VII.

## 1.5 Statutory Determination

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate requirements (ARARs) to the remedial action, and is cost-effective. The remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable. The selected remedy meets the statutory preference for treatment. Because the remedies discussed will result in hazardous substances remaining on-site above conservative risk-based levels, a review will be conducted within five years after commencement of remedial actions to ensure adequate long-term protection of human health and the environment is maintained.

Captain S.A. Denham, Commanding Officer
Naval Weapons Station Yorktown, Yorktown, Virginia

2/26/98
Date

Abraham Ferdas, Acting Division Director
Hazardous Waste Management
United States Environmental Protection Agency, Region III

3/23/98
Date

## 2.0 DECISION SUMMARY

### 21 Site Name. Location, And Description

WPNSTA Yorktown is a 10,624 acre installation located on the Virginia Peninsula in York and James City Counties and the City of Newport News (Figure 2-1). The Station is bounded on the northwest by *the* Naval Supply Center Cheatham *Annex*, the Virginia Emergency Fuel Farm, and the future community development of Whittaker's Mill; 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 community of lackey.

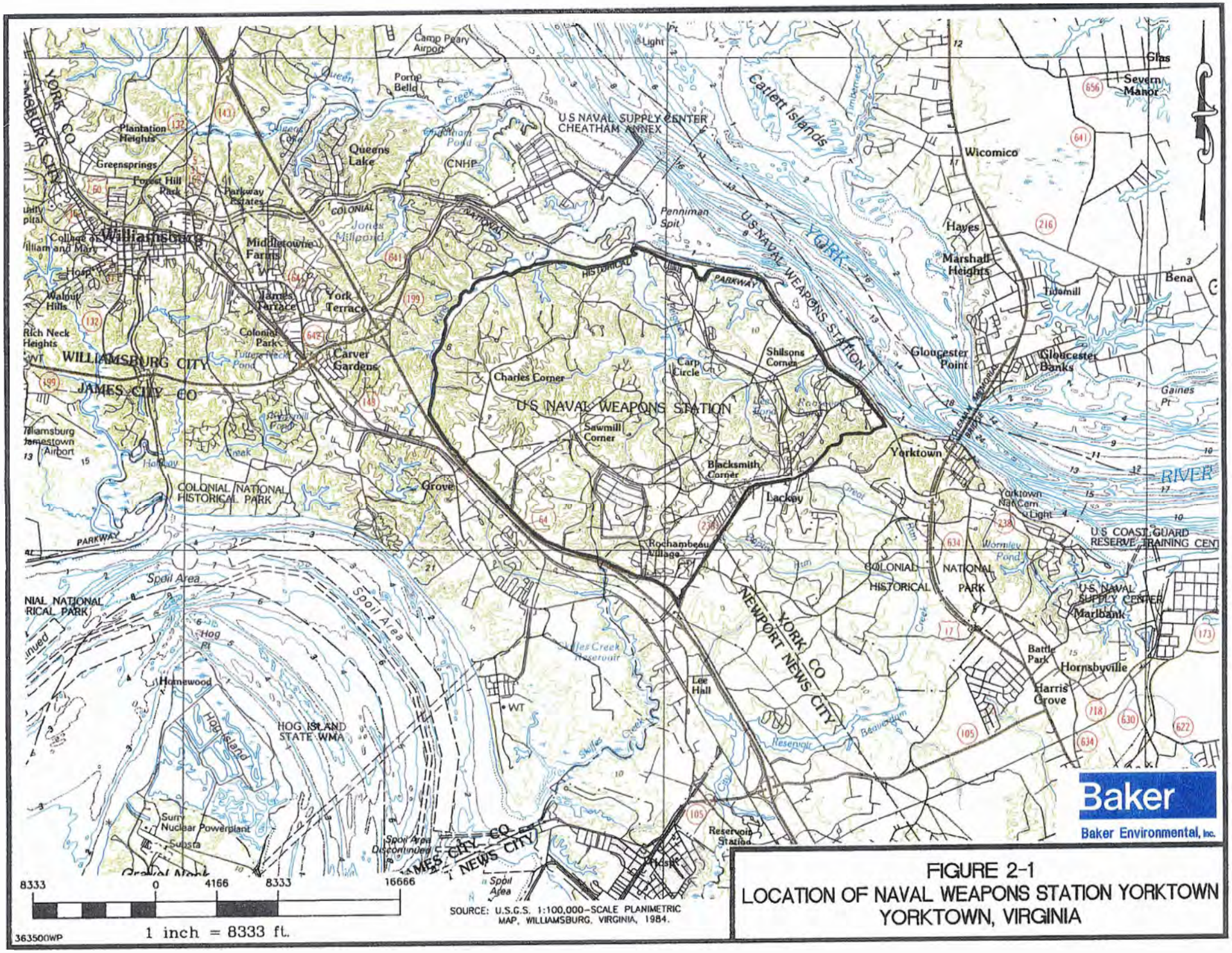
#### 2.1.1 Site *9* - Plant 1 Explosives-Contaminated Wastewater Discharge Area

Site *9* (Figure 2-2) consists primarily of a discharge area that had been used as a drainage way by Plant 1. Explosives-contaminated wastewater and *organic* solvents may have been discharged from Plant 1 into the drainage way. The Site *9* study area is bordered by Bollman Road to the west, an abandoned railroad track to the north, Plant 1 to the *east*, and Site 19 to the south.

The Site *9* drainage ditch runs east to west, away from Plant 1, crossing under Bollman Road through a culvert and ultimately emptying into Lee Pond Lee Pond drains into the eastern branch of Felgates Creek, which in turn flows northward to *the* York River, approximately 1.5 miles from Site 9.

#### 2.13 Site 19 - Conveyor Belt Soil at Plant 1

Site 19 (Figure *2-2)* consists of soil surrounding a conveyor belt, which was formerly used to transport packaged TNT powder from Plant 1 to Building 98. The conveyor belt, which runs northeast to southwest, is located within an earthen trench. Several buildings and sheds are located within the Site 19 study area.




SOURCE: U.S.G.S. 1:100,000-SCALE PLANIMETRIC MAP, WILLIAMSBURG, VIRGINIA, 1984.

FIGURE 2-1
LOCATION OF NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

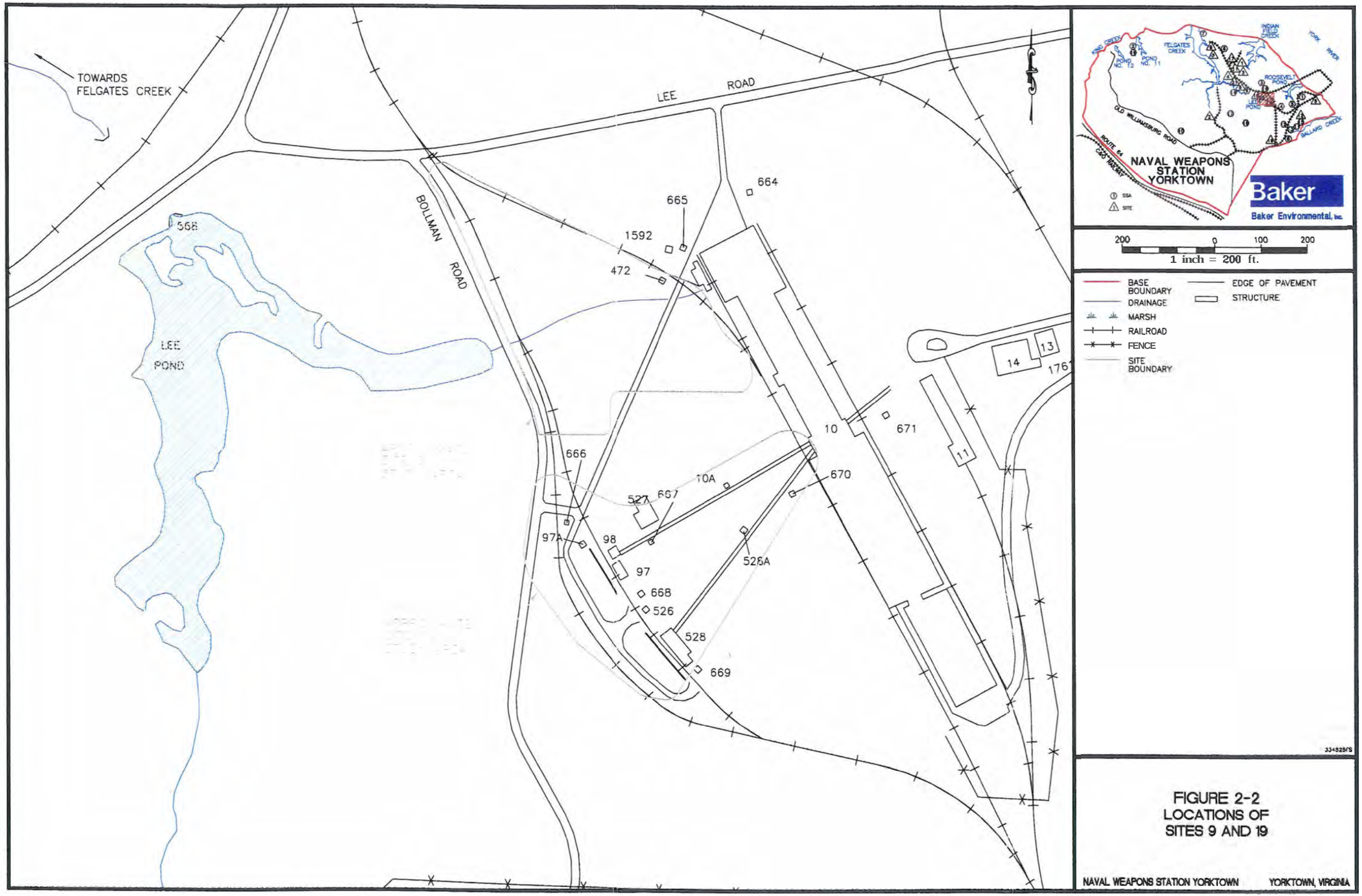



FIGURE 2-2
LOCATIONS OF
SITES 9 AND 19

NAVAL WEAPONS STATION YORKTOWN YORKTOWN, VIRGINIA

## 2.2 Site History and Enforcement Activities

### 2.1 Site History

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 received, reclaimed, stored, and issued mines, depth charges, and related materials. During World War II, the facility was expanded to include three additional 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, which included the design and development of depth charges and advanced underwater weapons. On August 7, 1959, the depot was redesignated the U.S. Naval Weapons Station. 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.

Site 9 reportedly received Plant 1 wastewater discharge from the late 1930s to 1975. Wastewater was generated as a part of high explosives loading operations which took place at Plant 1 during this time period. In 1974, a carbon adsorption tower was installed to treat the contaminated wastewater emanating from Plant 1 prior to discharge to the drainage way. A National Pollutant Discharge Elimination System (NPDES) permit was granted by the United States Environmental Protection Agency (USEPA) Region III to allow this discharge. In 1986, treatment tower discharge was diverted to the sanitary sewer and ultimately to the Hampton Roads Sanitation District (HRSD).

The Site 19 conveyor belt is enclosed on top and along its sides. TNT dust was released to the soil below and around the conveyor belt during loading activities as high explosives were moved along the conveyor belt to the kettles at Plant 1. In addition, past operational practices involved the routine spraying of the conveyor walls and floors with water to control the potential buildup of TNT dust. This water likely dripped onto the ground surface below the conveyor. TNT-contaminated soil was previously reported in the vicinity of the conveyor belt and an undocumented quantity of soil beneath and around the belt was voluntarily excavated and removed in 1973-1974 by Station personnel.

### 2.2.2 Enforcement Activities

On October 15, 1992, WPNSTA Yorktown was included on the National Priorities List (NPL) because of the facility's proximity to wetlands and the potential impact on the surrounding environment. A Federal Facility Agreement (FFA) between USEPA Region III, the Commonwealth of Virginia, and the Department of the Navy (DoN) was finalized in August of 1994 for WPNSTA Yorktown. The FFA covers the investigation, development, selection, and implementation of response actions, satisfying WPNSTA Yorktown's Resource Conservation and Recovery Act (RCRA) corrective action obligations as well as appropriate provisions of CERCLA for all sites, RCRA Solid Waste Management Units (SWMUs) and RCRA Areas of Concern (AOCs).

In September 1994, a removal action was conducted at Site 9 to address miscellaneous debris at the lower end of the drainage way before it crosses Bollman Road. Debris and soil were excavated, clean fill was added, and the area was graded and vegetated.

No other documented enforcement activities have been conducted at either Sites 9 or 19 under the FFA.

The following documents provide details of the site investigations and assessments of cleanup actions for OUs VI and VII.

- C.C. Johnson & Associates, Inc. and CH2M Hill. Initial Assessment Study of Naval Weapons Station, Yorktown. July 1984.

- Dames & Moore. Confirmation Study Step IA (Verification). Round One. Naval Weapons Station, Yorktown, Virginia. June 1986.

- Dames & Moore. Confirmation Study Step IA (Verification) Round Two. Naval Weapons Station, Yorktown, Virginia. June 1988.

- Dames & Moore. Draft Remedial Investigation Interim Report, Naval Weapons Station, Yorktown, Virginia. February 1989.

- Baker Environmental, Inc. and Roy F. Weston, Inc. Final Round One Remedial Investigation Report for Sites 1-9. 11. 12, 16-19 and 21. Naval Weapons Station, Yorktown. Virginia. July 1993.

- Baker Environmental, Inc. Final Round Two Remedial Investigation Report for Sites 9 and 19. Naval Weapons Station Yorktown. Yorktown. Virginia. January 1997.

- Baker Environmental, Inc. Final Feasibility Study Report for Sites 9 and 19. Naval Weapons Station — . — Yorktown. Virginia. June 1997.

- Baker Environmental, Inc. Final Explosives Contaminated Soil Pilot Study Report, Naval Weapons Station Yorktown. Yorktown. Virginia. July 1997.

### 2.2.3 History of Previous Investigations

The purpose of the Initial Assessment Study (IAS) (C.C. Johnson & Associates, Inc. and CH2M Hill, July 1984) was to identify and assess sites posing a potential threat to human health and/or the environment due to contamination from past operations. A total of 19 potentially contaminated sites were identified based on information from historical records, aerial photographs, field inspections, and personnel interviews. Each site was evaluated for the type of contamination, migration pathways, and pollutant receptors. The IAS concluded that 15 of the 19 sites, including Sites 9 and 19, were of sufficient threat to human health or the environment to warrant Confirmation Studies.

A Confirmation Study was then conducted for the 15 sites identified in the IAS. Two rounds of data were obtained during the Confirmation Study. The first round of data was collected in the winter of 1986. This effort was documented in the "Confirmation Study Step IA (Verification), Round One," (Dames & Moore, June 1986). The second round of sampling was conducted during November and December 1987. The results of the analyses and comparisons with appropriate regulatory standards were presented in the "Confirmation Study Step IA (Verification), R o d Two," (Dames & Moore, June 1988).

The 15 sites, including Sites 9 and 19, were recommended for further study and were evaluated as part of the Round One Remedial Investigation (RI) (July 1993). Soil, surface water, sediment and groundwater were collected and analyzed for Target Compound List (TCL) organics, Target Analyte List (TAL) inorganics and nitramine/nitroaromatic compounds (explosives). Data generated during the Round One RI was compared to standards and/or available criteria and the sites were further recommended for additional investigation, if necessary. Sites 9 and 19 indicated the presence of contamination in soil and groundwater and were, therefore, targeted for more comprehensive investigation and a baseline risk assessment to better evaluate the significance of site related contamination.

The Round Two RI and report for Sites 9 and 19 were completed in January of 1997. Additional soil data indicated that contamination was present at both sites. A subsequent soil investigation conducted as part of a soil pilot scale treatability study indicated higher detected soil concentrations in composite samples taken at Site 19 than in discrete samples taken during both remedial investigations. As such, soil samples were obtained from directly under the conveyor belt at Site 19 and from hot spots at both Sites 9 and 19. These sample data were used as part of the Feasibility Study (FS) Report (June 1997) to determine the extent of soil contamination. FS soil data confirmed that the highest levels of contamination were under the conveyor belt at Site 19. Site 9 exhibited little soil contamination from explosives.

## 23 Highlights of Community Participation

The Proposed Remedial Action Plan (PRAP) for Sites 9 and 19 was released to the public in June 1997 at the four information repositories listed below:

- York County Public Library
  8500 George Washington Highway
  Yorktown, VA 23692
  (757) 890-3377

- Newport News City Public Library
  366 Deshazor Drive
  Newport News, VA 23506
  (757) 247-8506

- Gloucester Public Library
  P.O. Box 367, Main Street
  Gloucester, VA 23601
  (804) 887-4720

- Naval Weapons Station Yorktown
  Environmental Directorate
  Building 31-B, P.O. Drawer 160
  Yorktown, VA 23691-0160
  (757) 887-4775 (ext. 29) (Contact: Mr. Jeff Harlow)

The notice of availability of this document was published June 29,1997 in the *Daily Press*. A public comment period was held from June 30,1997 to August 13,1997. A fact sheet that summarized the Proposed Plan was distributed to attendees of the Public Meeting held at the York County Recreational Services Meeting Room, 301 Godwin Neck Road, Yorktown, Virginia, on July 21,1997. This meeting was held to inform interested members of the community about the preferred remedial alternative under consideration. Responses to comments received during the public comment period and a transcript of the Public Meeting are included in the Responsiveness Summary in Section 3.0 of this document.

## 2.4 Scope and Role of the Remedy

Sites 9 and 19 are part of comprehensive environmental investigations being conducted under the IR Program at WPNSTA Yorktown. OU VI consists of explosives contaminated soil at Site 19. OU VII consists of soil, surface water and sediment at Site 9. Although conservative modeling predicts some potential for ecological risk at Site 9, remediation of the site would generate more harm to the surrounding ecology by destroying habitat and potentially creating erosion problems in the Site 9 drainage ditch. As such, No Action is recommended for OU VII from an ecological perspective. Human health risks at Site 9 fall within the acceptable risk range for current receptors and future potential receptors, supporting the No Action decision for this OU.

To protect human health and the environment, soil beneath the Site 19 conveyor belt will be excavated to a depth of approximately 4 feet. The soil will be treated biologically at the Site 22 biocell. A small area of aluminum-contaminated soil that could potentially affect terrestrial ecological receptors around Building 527 will be excavated to a depth of approximately 6 inches if soil-borne aluminum concentrations exceed the 95th percentile upper confidence limit (UCL) of anthropogenic background

(i.e., greater than 14,830 milligrams per kilogram [mg/kg]). All excavated areas will be backfilled with clean soil and regraded.

## 2.5 Summary of Site Characteristics

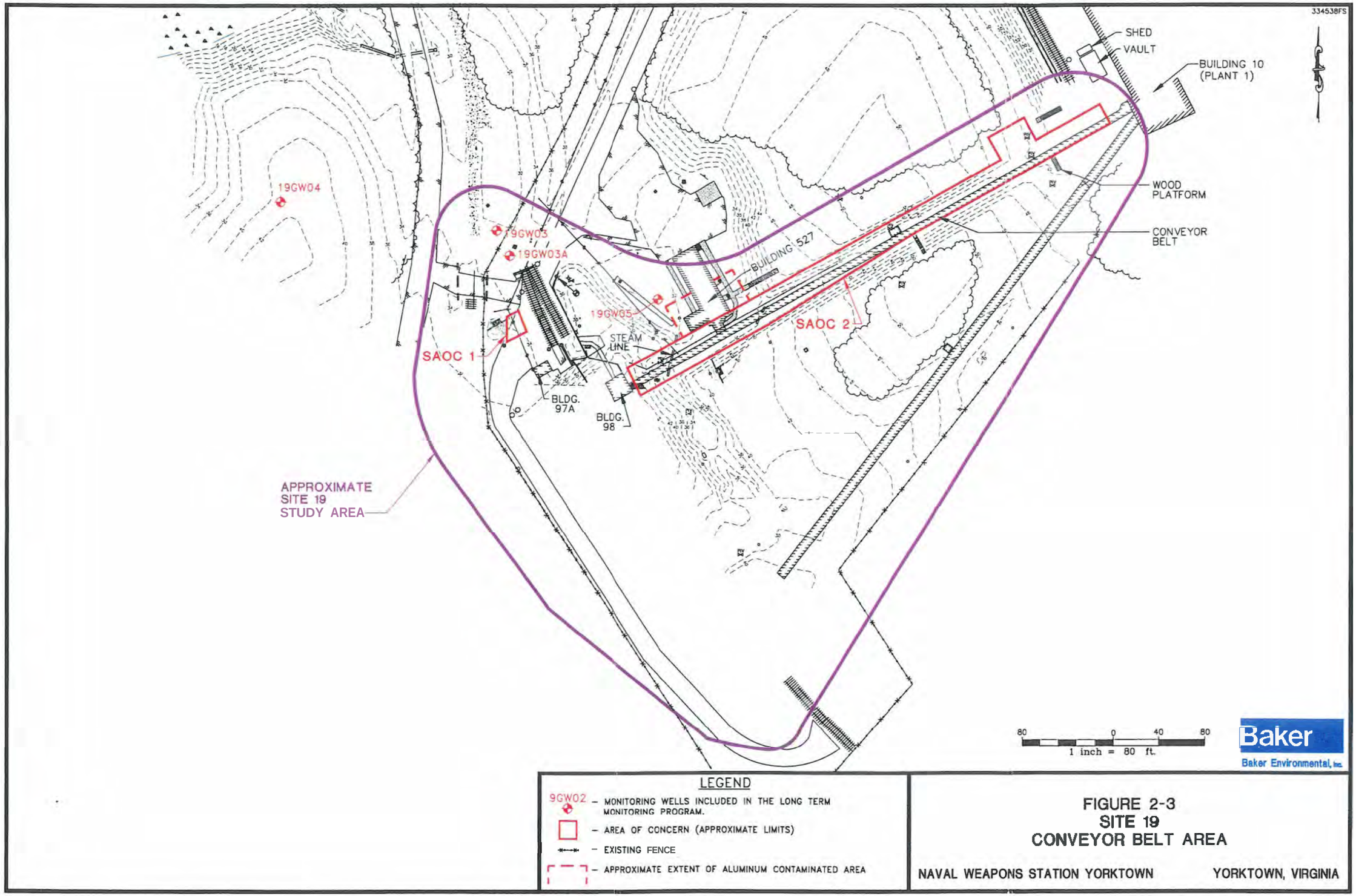
Results of previous investigations indicate that soil beneath the conveyor belt at Site 19 requires medial action (Figure 2-3). The Round Two RI indicates that contamination under the belt could migrate via runoff or leach through the soil and potentially impact groundwater. Contaminants of concern at Site 19 include 2,4,6-TNT, RDX, and aluminum. Aluminum is limited to the area around Building 527 where aluminum oxide powder was added as part of high explosives formulation. The total volume of soil to be remediated at Site 19 is 1,685 cubic yards as estimated using existing analytical data. Based on limited sampling, depth of 2,4,6-TNT and RDX contamination is approximately 4 feet below ground surface (bgs). Soil data also suggests that aluminum contamination is confined to the top 6 inches of soil around Building 527.

Previous investigations also indicate that inorganics including lead, chromium, copper, arsenic and iron are present in soil and sediment samples in or near the Site 9 drainage ditch. The drainage ditch received discharge from Plant 1 and this discharge is ultimately received by Lee Pond. Concentrations of inorganics and the presence of organics including polynuclear aromatic hydrocarbons (PAHs) and explosives indicate residual impacts from past Plant 1 activities. The presence of explosive compounds in Site 9 drainage ditch surface water appears to be associated with runoff from the Site 19 conveyor belt and as such will be addressed by the Site 19 remedial action. Because inorganic constituents are similar to Station-wide background concentrations and remediation of Site 9 soil and sediment would be detrimental to the local ecology (i.e., loss of habitat, erosion), no action is necessary at this time.

Support for the proposed medial action at site 19 and No Action at Site 9 is presented in the Summary of Site Risks section of this ROD.

## 2.6 Summary of Site Risks

A baseline risk assessment (RA) was conducted as part of the Sites 9 and 19 Round Two Remedial Investigation Report (Baker, 1997). Both human health and ecological risk assessments were conducted. This section presents the results of the baseline RA and those contaminants associated with unacceptable human health risks and potential adverse ecological effects.


334538FS
SHED
VAULT
BUILDING 10
(PLANT 1)
WOOD
PLATFORM
CONVEYOR
BELT
19GW04
19GW03
19GW03A
BUILDING 527
19GW05
SAOC 2
SAOC 1
STEAM
LINE
BLDG.
97A
BLDG.
98
APPROXIMATE
SITE 19
STUDY AREA
80
0
40
80
1 inch = 80 ft.
Baker
Baker Environmental, Inc.
LEGEND
9GW02 – MONITORING WELLS INCLUDED IN THE LONG TERM MONITORING PROGRAM.
– AREA OF CONCERN (APPROXIMATE LIMITS)
– EXISTING FENCE
– APPROXIMATE EXTENT OF ALUMINUM CONTAMINATED AREA
FIGURE 2-3
SITE 19
CONVEYOR BELT AREA
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

### 2.6.1 Human Health Risk Assessment

Because of the nature of activities conducted at and around *Sites* 9 and 19, potential current human exposure is limited. Both sites lie within the Explosive Safety Quantity Distance (ESQD) arc (associated with the *storage* of munitions) and inside of the restricted area of the Station. Current potential human receptors evaluated in the baseline RA include:

- Adult Civilian Workers (Site *9)*
- Adult *On-Si* Commercial Workers (Site 19)

Adult civilian workers work infrequently at Site *9* because *of* ongoing ordnance loading operations at Building 10. Exposure frequency was assumed to be approximately 14 days per year, based on conversations with Station personnel. Because operations at Site 19 have ceased, the default exposure frequency of 250 days per year was used.

Future residential property use was also evaluated at Sites *9* and 19. Both children (ages 1 to *6 years)* and adults were evaluated. Risk values were summed to account for a potential 30 year exposure. Groundwater was also evaluated as part of the future residential scenario. However, groundwater quality in the shallow aquifers (Cornwallis Cave and Upper Yorktown) precludes potable use. Although pump tests were not performed for the Cornwallis Cave or Upper Yorktown-Eastover aquifers in the vicinity of Sites 9 and 19, these aquifers produce low yields (0 to 10 gallons per minute throughout WPNSTA Yorktown) and contain naturally-occurring concentrations of inorganics including iron, manganese, and zinc in *excess of* Secondary Maximum Contaminant Levels (SMCLs). Based on field observations obtained during well purging and development, neither the Cornwallis Cave nor the Yorktown-Eastover aquifer would sustain a residential household requiring 150 gallons of water per day in the vicinity of Sites *9* and 19. Groundwater was therefore evaluated as a Class III aquifer and was evaluated in the baseline RA for non-potable use, considering a beneficial use scenario such as lawn watering and car washing by future residents. Potential human health risks associated with groundwater under a beneficial use scenario fall within the generally acceptable target risk range, but the potential effects on the ecology have not been determined. Groundwater is likely discharging to Lee Pond and will be evaluated when *the* investigation *of* Lee Pond is complete. As such, groundwater at Sites *9* and 19 is not addressed by this ROD.

The following subsections present a summary of unacceptable risks (i.e., incremental lifetime cancer risk [ILCR] values > $1x10^{-4}$ and hazard index [HI] values ≥ 1.0) for potential human receptors.

Site 9 Human Health Risks

Only future potential residential exposure to contamination at Site 9 produced unacceptable human health risks. Tables 2-1 through 2-4 present the human health chemicals of potential concern for Site 9. ILCR values fall within the generally acceptable target risk range for all evaluated media at Site 9. Table 2-5 presents the associated human health risk to future potential residents at Site 9. HI values d i n g 1.0 were observed only for future potential residential exposure to surface soil (HI = 1.2) and drainage ditch surface water (HI = 1.5). These HIs were evaluated further to determine those chemicals responsible for the values. Table 2-6 presents risks and HI values for each medium, pathway and contaminant. The constituent arsenic is responsible for HI values exceeding 1.0 (HQ = 1.06) cumulatively for both ingestion and dermal contact of soil. Arsenic concentrations detected in Site 9 surface soil ranged from 1.1 mg/kg (9HA08) to 233 mg/kg (9HA04). Shallow subsurface soil arsenic concentrations were somewhat higher, with concentrations ranging from 0.84 mg/kg (9HA08) to 54.7 mg/kg (9HA04). These concentrations fall within the range of Station-wide background concentrations (which includes anthropogenic background sample data). Arsenic was detected in the background sampling effort at a maximum detected concentration of 63.9 mg/kg. As such, arsenic could not be distinguished from naturally-occurring concentrations or concentrations associated with non-site related human activities. Therefore, remediation of arsenic in Site 9 soil would not be appropriate.

HI values for surface water were driven primarily by the presence of 2,4,6-TNT (480 micrograms per liter [µg/L]), which produced hazard quotient (HQ) value of 0.91 and a dermal HQ of 0.05 using the Reasonable Maximum Exposure (RME). A total HI value of 1.5 was derived for exposure to young children (ages 1 to 6 years of age). The contaminants 2,4,6-TNT and aluminum were responsible for the elevated HI value. However, these contaminants act on different target organs and should not as such be evaluated cumulatively. When evaluated individually, HI values are below 1.0, indicating no adverse health effects will likely occur.

Central Tendency (CT) risk calculations for contaminants in surface water produced HIs below 1.0 for all contaminants.

TABLE 2-1

STATISTICAL SUMMARY OF HUMAN HEALTH CHEMICALS OF POTENTIAL CONCERN
FROM SURFACE SOIL SAMPLE ANALYSES
SITE 9
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

| CHEMICAL | FREQUENCY OF DETECTION | RANGE OF DETECTED CONCENTRATIONS | RANGE OF DETECTION LIMITS | ARITHMETIC MEAN | NORMAL UPPER 95% CONFIDENCE INTERVAL | RANGE OF STATION BACKGROUND |
|---|---|---|---|---|---|---|
| **INORGANICS (mg/kg)** | | | | | | |
| ARSENIC | 10/10 | 1.1 - 23.3 | NA - NA | 14.83 | 19.25 | 0.46L - 63.9 |
| BERYLLIUM | 2/10 | 0.38 - 0.47 | 0.28 - 0.38 | 0.22 | 0.29 | 0.23J - 0.93J |
| MANGANESE | 10/10 | 53.6 - 204 | NA - NA | 123.49 | 153.22 | 7.6L - 491 |
| VANADIUM | 10/10 | 11.9 - 68.6 | NA - NA | 33.66 | 45.15 | 5.2J - 64.7 |
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| BENZO(A)ANTHRACENE | 7/10 | 87 - 1100 | 350 - 420 | 367.70 | 567.41 | NA |
| BENZO(A)PYRENE | 7/10 | 94 - 1200 | 350 - 420 | 376.40 | 588.03 | NA |
| BENZO(B)FLUORANTHENE | 9/10 | 58 - 2200 | 350 - 350 | 544.60 | 932.24 | NA |
| BENZO(K)FLUORANTHENE | 7/10 | 77 - 520 | 350 - 420 | 206.70 | 279.95 | NA |
| CHRYSENE | 9/10 | 43 - 1200 | 350 - 350 | 423.30 | 668.07 | NA |
| DIBENZO(A,H)ANTHRACENE | 4/10 | 55 - 160 | 350 - 460 | 161.60 | 193.96 | NA |
| INDENO(1,2,3-CD)PYRENE | 7/10 | 74 - 550 | 350 - 420 | 224.20 | 308.31 | NA |
| **NITRAMINES (ug/kg)** | | | | | | |
| 2,4,6-TNT | 5/10 | 210 - 540 | 120 - 120 | 230.00 | 348.26 | NA |

Notes:
1) Inorganic data considers both Station-wide and Anthropogenic Background Samples
NA - Not Applicable
UCL - Upper Confidence Limit

## TABLE 2-2

## STATISTICAL SUMMARY OF HUMAN HEALTH CHEMICALS OF POTENTIAL CONCERN FROM SHALLOW SUBSURFACE SOIL SAMPLE ANALYSES
## SITE 9
## NAVAL WEAPONS STATION YORKTOWN
## YORKTOWN, VIRGINIA

| CHEMICAL | FREQUENCY OF DETECTION | RANQE OF DETECTED CONCENTRATIONS | RANGE OF DETECTION LIMITS | ARITHMETIC MEAN | NORMAL UPPER 95% CONFIDENCE INTERVAL | RANGE OF STATION BACKGROUND |
|---|---|---|---|---|---|---|
| **INORGANICS (mg/kg)** | | | | | | |
| ALUMINUM | 19/19 | 3220 - 17,000 | NA - NA | 8231.58 | 9510.79 | 2690 - 24100 |
| ANTIMONY | 3/19 | 3.5 - 5.3 | 3.1 - 7.3 | 2.43 | 2.91 | 9.2L - 11.0L |
| ARSENIC | 19/19 | 0.84 - 54.7 | NA - NA | 18.18 | 24.15 | 0.46L - 63.9 |
| BERYLLIUM | 10/19 | 0.26 - 4.1 | 0.28 - 0.61 | 0.63 | 1.00 | 0.23J - 0.93J |
| CADMIUM | 10/19 | 0.61 - 4.5 | 0.52 - 0.76 | 0.94 | 1.34 | 1.2J - 1.5 |
| CHROMIUM | 19/19 | 5.8 - 46.5 | NA NA | 21.86 | 26.14 | 3.5 - 33.5 |
| MANGANESE | 19/19 | 165 - 1830 | NA - NA | 189.20 | 261.21 | 7.6L - 491 |
| VANADIUM | 19/19 | 8.5 - 219 | NA - NA | 41.43 | 59.26 | 5.2J - 64.7 |
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| BENZO(A)ANTHRACENE | 7/19 | 68 - 1700 | 340 - 440 | 307.53 | 452.63 | NA |
| BENZO(A)PYRENE | 7/19 | 72 - 1700 | 340 - 440 | 301.42 | 443.50 | NA |
| BENZO(B)FLUORANTHENE | 9/19 | 39 - 2500 | 340 - 440 | 375.42 | 595.12 | NA |
| BENZO(K)FLUORANTHENE | 7/19 | 64 - 980 | 340 - 440 | 224.68 | 299.54 | NA |
| CHRYSENE | 8/19 | 48 - 1900 | 340 - 440 | 330.68 | 495.93 | NA |
| DIBENZO(A,H)ANTHRACENE | 4/19 | 51 - 270 | 340 - 460 | 180.63 | 200.42 | NA |
| INDENO(1,2,3-CD)PYRENE | 7/19 | 53 - 1000 | 340 - 440 | 249.37 | 329.58 | NA |
| **NITRAMINES (ug/kg)** | | | | | | |
| 2,4-DINITROTOLUENE | 1/19 | 47 - 47 | 340 - 740 | 200.11 | 223.08 | NA |
| 2,4,6-TNT | 6/19 | 140 - 33000 | 120 - 120 | 2245.79 | 5276.40 | NA |

Notes:
1) Inorganic data considers both Station-wide and Anthropogenic Background Samples
NA - Not Applicable
UCL - Upper Confidence Limit

## TABLE 2-3

## STATISTICAL SUMMARY OF HUMAN HEALTH CHEMICALS OF POTENTIAL CONCERN FROM SURFACE WATER SAMPLE ANALYSES
## SITE 9
## NAVAL WEAPON8 STATION YORKTOWN
## YORKTOWN, VIRGINIA

| CHEMICAL | FREQUENCY OF DETECTION | RANGE OF DETECTED CONCENTRATIONS | RANGE OF DETECTION LIMITS | ARITHMETIC MEAN | NORMAL UPPER 85% CONFIDENCE INTERVAL | RANGE OF STATION BACKGROUND |
|---|---|---|---|---|---|---|
| **INORGANICS (ug/L)** | | | | | | |
| ARSENIC | 4/4 | 2 - 5 | NA - NA | 3.10 | 4.45 | 0.46L-63.9 |
| MANQANESE | 4/4 | 89 - 231 | NA - NA | 144.93 | 216.22 | 7.6L-491 |
| **PESTICIDES (ug/L)** | | | | | | |
| HEPTACHLOR EPOXIDE | 1/4 | 0.08 - 0.08 | 0.05 - 0.05 | 0.04 | 0.07 | NA |
| **NITRAMINES (ug/L)** | | | | | | |
| 1,3-DINITROBENZENE | 1/4 | 0.46 - 0.46 | 0.1 - 0.16 | 0.17 | 0.40 | NA |
| 2,4-DINITROTOLUENE | 1/4 | 6 - 6 | 10 - 10 | 5.25 | 5.84 | NA |
| 2,6-DINITROTOLUENE | 2/4 | 2 - 4 | 10 - 10 | 4.00 | 5.66 | NA |
| 2,4,6-TNT | 4/4 | 25 - 480 | NA - NA | 160.00 | 415.38 | NA |
| 1,3,5-TRINITROBENZENE | 1/3 | 0.44 - 0.44 | 0.11 - 0.17 | 0.19 | 0.55 | NA |
| HMX | 1/4 | 14 - 14 | 9.1 - 150 | 35.89 | 74.25 | NA |
| RDX | 2/4 | 6 - 6.1 | 0.51 - 0.71 | 3.18 | 7.08 | NA |

Notes:
1) Inorganic data considers both Station-wide and Anthropogenic Background Samples
NA - Not Applicable
UCL - Upper Confidence Limit

TABLE 2-4

STATISTICAL SUMMARY OF HUMAN HEALTH CHEMICALS OF POTENTIAL CONCERN
FROM SEDIMENT SAMPLE ANALYSES
SITE 9
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

| CHEMICAL | FREQUENCY OF DETECTION | RANQE OF DETECTED CONCENTRATIONS | RANGE OF DETECTION LIMITS | ARITHMETIC MEAN | NORMAL UPPER 95% CONFIDENCE INTERVAL | RANGE OF STATION BACKGROUND |
|---|---|---|---|---|---|---|
| **INORGANICS (mg/kg)** | | | | | | |
| ARSENIC, TOTAL | 9/9 | 5.7 - 55.5 | NA - NA | 19.57 | 31.54 | 0.46L-63.9 |
| BERYLLIUM, TOTAL | 9/9 | 0.26 - 0.85 | NA - NA | 0.46 | 0.58 | 9.2L-11.0L |
| CHROMIUM, TOTAL | 9/9 | 8.7 - 47.3 | NA - NA | 19.61 | 26.52 | 3.5-33.5 |
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| BENZO(A)ANTHRACENE | 8/9 | 42 - 2400 | 490 - 490 | 749.67 | 1295.44 | NA |
| BENZO(A)PYRENE | 7/9 | 46 - 2100 | 460 - 490 | 603.44 | 1008.60 | NA |
| BENZO(B)FLUORANTHENE | 7/9 | 60 - 2600 | 460 - 490 | 888.33 | 1492.59 | NA |
| BENZO(K)FLUORANTHENE | 6/9 | 110 - 970 | 420 - 490 | 403.89 | 602.58 | NA |
| CHRYSENE | 8/9 | 54 - 2600 | 490 - 490 | 855.44 | 1456.89 | NA |
| DIBENZO(A,H)ANTHRACENE | 5/9 | 68 - 300 | 420 - 490 | 184.67 | 235.25 | NA |
| INDENO(1,2,3-CD)PYRENE | 7/9 | 83 - 1300 | 420 - 490 | 469.78 | 738.04 | NA |
| **NITRAMINES (ug/kg)** | | | | | | |
| 2,4-DINITROTOLUENE | 1/9 | 3700 - 3700 | 420 - 590 | 627.22 | 1341.85 | NA |
| 2,4,6-TNT | 6/9 | 120 - 620 | 120 - 120 | 206.67 | 317.71 | NA |

Notes:
1) Inorganic data considers both Station-wide and Anthropogenic Background Samples
NA - Not Applicable
UCL - Upper Confidence Limit

TABLE 2-5

**INCREMENTAL LIFETIME CANCER RISK (ILCR) AND HAZARD INDEX (HI)**
**FOR FUTURE ADULT AND CHILD ON-SITE RESIDENTS**
**REASONABLE MAXIMUM EXPOSURE AND CENTRAL TENDENCY VALUES**
**SITE 9**
**NAVAL WEAPONS STATION YORKTOWN**
**YORKTOWN, VIRGINIA**

| Pathway | Receptors | | | |
|---|---|---|---|---|
| | Adults | | Children (1-6 yrs.) | |
| | ILCR | HI | ILCR | HI |
| Surface Soil | | | | |
| Ingestion | $1.7 \times 10^{-05}$ ($1.6 \times 10^{-06}$) | 0.1 (0.03) | $4.0 \times 10^{-05}$ ($1.0 \times 10^{-05}$) | 0.91 (0.23) |
| Dermal Contact | $5.7 \times 10^{-05}$ ($2.0 \times 10^{-06}$) | 0.18 (0.02) | $2.5 \times 10^{-05}$ ($2.1 \times 10^{-06}$) | 0.31 (0.03) |
| Subtotal | $7.4 \times 10^{-05}$ ($3.6 \times 10^{-06}$) | 0.28 (0.05) | $6.5 \times 10^{-05}$ ($1.2 \times 10^{-05}$) | 1.2 (0.26) |
| Surface Water[1] [2] | | | | |
| Ingestion | $2.1 \times 10^{-06}$ ($4.3 \times 10^{-07}$) | 0.2 (0.07) | $2.4 \times 10^{-06}$ ($1.3 \times 10^{-06}$) | 0.96 (0.33) |
| Dermal Contact | $3.4 \times 10^{-07}$ ($9.4 \times 10^{-08}$) | 0.29 (0.09) | $1.5 \times 10^{-07}$ ($1.0 \times 10^{-07}$) | 0.51 (0.15) |
| Subtotal | $2.4 \times 10^{-06}$ ($5.2 \times 10^{-07}$) | 0.5 (0.2) | $2.6 \times 10^{-06}$ ($1.4 \times 10^{-06}$) | 1.5 (0.5) |
| Sediment | | | | |
| Ingestion | $3.3 \times 10^{-06}$ ($7.8 \times 10^{-08}$) | 0.02 (<0.01) | $7.8 \times 10^{-06}$ ($4.9 \times 10^{-07}$) | 0.16 (<0.01) |
| Dermal Contact | $1.1 \times 10^{-05}$ ($3.0 \times 10^{-07}$) | 0.03 (<0.01) | $5.0 \times 10^{-06}$ ($3.3 \times 10^{-07}$) | 0.05 (4.0 I) |
| Subtotal | $1.4 \times 10^{-05}$ ($3.8 \times 10^{-07}$) | 0.05 (<0.01) | $1.3 \times 10^{-05}$ ($8.2 \times 10^{-07}$) | 0.21 (<0.01) |

TABLE 2-5 (continued)

INCREMENTAL LIFETIME CANCER RISK (ILCR) AND HAZARD INDEX (HI)
FOR FUTURE ADULT AND CHILD ON-SITE RESIDENTS
REASONABLE MAXIMUM EXPOSURE AND CENTRAL TENDENCY VALUES
SITE 9
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

Notes:

(1) Risk value derived using organic and total inorganic concentrations.
(2) Surface water/sediment samples obtained from the intermittent stream in the Si 9 ditch.

( ) = Central tendency value

Shaded areas indicated exceedances of the USEPA's generally acceptable target risk range or a Hazard Index equal to or greater than 1.0, but are not apportioned by target organ.

## TABLE 2-6

**POTENTIAL HUMAN HEALTH RISKS ASSOCIATED WITH SITE 9 BY CHEMICAL REASONABLE MAXIMUM EXPOSURE**
**NAVAL WEAPONS STATION YORKTOWN**
**YORKTOWN, VIRGINIA**

| Medium/Pathway | Chemical | Future Receptors | | | |
|---|---|---|---|---|---|
| | | HI (Child) | ILCR (Child) | HI (Adult) | ILCR (Adult) |
| Surface Soil Dermal Contact | benzo(a)pyrene* | -- | $9.5 \times 10^{-6}$ | -- | $2.1 \times 10^{-5}$ |
| | dibenzo(a,h)anthracene* | -- | $2.6 \times 10^{-6}$ | -- | $5.8 \times 10^{-5}$ |
| | arsenic | 0.26 | $1.0 \times 10^{-5}$ | 0.15 | $2.3 \times 10^{-5}$ |
| Surface Soil Accidental Ingestion | benzo(a)pyrene | -- | $4.6 \times 10^{-7}$ | -- | $2.0 \times 10^{-6}$ |
| | dibenzo(a,h)anthracene | -- | $1.3 \times 10^{-6}$ | -- | $5.5 \times 10^{-7}$ |
| | arsenic | 0.8 | $3.2 \times 10^{-5}$ | 0.09 | $1.4 \times 10^{-5}$ |
| Surface Soil Total | | 1.06 | $5.6 \times 10^{-5}$ | 0.24 | $6.6 \times 10^{-5}$ |
| Surface Water Ingestion | 2,4/2,6-Dinitrotoluene | NA | $5.5 \times 10^{-7}$ | NA | $4.7 \times 10^{-7}$ |
| | 2,4,6-Trinitrotoluene | 0.91 | $1.2 \times 10^{-6}$ | 0.2 | $1.0 \times 10^{-6}$ |
| | arsenic | 0.02 | $5.6 \times 10^{-7}$ | 0.003 | $4.8 \times 10^{-7}$ |
| Surface Water Dermal Contact | 2,4/2,6-Dinitrotoluene | NA | $8.9 \times 10^{-8}$ | NA | $2.0 \times 10^{-7}$ |
| | 2,4,6-Trinitrotoluene | 0.05 | $6.9 \times 10^{-8}$ | 0.03 | $1.6 \times 10^{-7}$ |
| | arsenic | 0.001 | $2.4 \times 10^{-8}$ | 0.001 | $5.4 \times 10^{-8}$ |
| Surface Water Total | | 0.97 | $2.5 \times 10^{-6}$ | 0.23 | $2.4 \times 10^{-6}$ |

Note:

* - Dermal pathway is not considered quantitatively for these constituents because of the potential for direct acting effects.
RME - Reasonable Maximum Exposure
HI - Hazard Index
ILCR - Incremental Lifetime Cancer Risk

Site 19 Human Health Risks

Tables 2-7 and 2-8 present the human health chemicals of concern at Site 19. Table 2-9 presents the risks associated with future potential residential contact of contaminated soil, The presence of aluminum (HQ = 0.9) and arsenic (HQ = 0.5) combine for an HI in excess of 1.0 (Table 2-10). However, these contaminants have separate target organs for which reference doses were derived. The skin (keratosis/hyperpigmentation) is the target organ for arsenic and aluminum causes potential neurological effects. As such, the HQ values cannot be summed and systemic human health effects associated with these chemicals will likely not occur.

Additional surface soil samples were obtained from under the conveyor belt to determine whether the soil was affected by former TNT loading operations. EnSys® Test Kits were used to establish the presence of contamination under the belt and in areas where discrepancies between Round One RI data and Round Two RI data were evident. Table 2-11 presents the potential human health risk associated with commercial/industrial exposure to affected conveyor belt soil. The ILCR value ($4.8 \times 10^{-4}$) and the HI value (92.0) indite the potential for unacceptable cancer risks and potential adverse systemic health effects for this scenario. Other explosive compounds were also detected in laboratory confirmation samples (HMX, RDX), but were not evaluated quantitatively because of the significant potential risks posed by 2,4,6-TNT.

### 2.6.2 Ecological Risk Assessment

The objective of the ecological risk assessment is to determine whether past operations at Sites 9 and 19 have adversely affected the ecological integrity of terrestrial and aquatic communities. Tables 2-12 through 2-15 present ecological contaminants of concern for both Sites 9 and 19. Results of the ecological risk assessment are presented by site in the following subsections.

Site 9 Ecological Risk

Potential ecological risks were evaluated in the terrestrial and aquatic environment at Site 9.

Potential terrestrial receptors considered in the ecological risk assessment for Site 9 include: soil invertebrates, plants, robins, red-tailed hawks, short-tailed shrews, and meadow voles. The

## TABLE 2-7

## STATISTICAL SUMMARY OF HUMAN HEALTH CHEMICALS OF POTENTIAL CONCERN FROM SURFACE SOIL SAMPLE ANALYSES
## SITE 19
## NAVAL WEAPONS STATION YORKTOWN
## YORKTOWN, VIRGINIA

| CHEMICAL | FREQUENCY OF DETECTION | RANOE OF DETECTED CONCENTRATIONS | RANGE Of DETECTION LIMITS | ARITHMETIC MEAN | NORMAL UPPER 95% CONFIDENCE INTERVAL | RANGE OF STATION BACKGROUND |
|---|---|---|---|---|---|---|
| **INORGANICS (mg/kg)** | | | | | | |
| ALUMINUM | 8/8 | 5880 - 90,600 | NA - NA | 28635.00 | 49103.70 | 2690-24100 |
| ANTIMONY | 1/8 | 5.6 - 5.6 | 5.6L - 5.6L | 2.90 | 5.02 | 9.2L-11.0L |
| ARSENIC | 7/8 | 0.68 - 14 | 2 - 2 | 6.29 | 9.71 | 0.46L-63.9 |
| BERYLLIUM | 6/8 | 0.29 - 0.73 | 0.31 - 0.33 | 0.37 | 0.49 | 0.23J-0.93J |
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| BENZO(A)ANTHRACENE | 2/8 | 88 - 130 | 370 - 450 | 180.38 | 212.04 | NA |
| BENZO(A)PYRENE | 2/8 | 95 - 140 | 370 - 450 | 182.50 | 211.87 | NA |
| BENZO(B)FLUORANTHENE | 3/8 | 43 - 230 | 370 - 450 | 184.13 | 224.71 | NA |
| BENZO(K)FLUORANTHENE | 2/8 | 51 - 100 | 370 - 450 | 172.00 | 213.77 | NA |
| CHRYSENE | 3/8 | 39 - 140 | 370 - 450 | 166.13 | 208.49 | NA |
| INDENO(1,2,3-CD)PYRENE | 2/8 | 62 - 130 | 370 - 450 | 177.13 | 213.85 | NA |
| **NITRAMINES (ug/kg)** | | | | | | |
| 2,4,6-TNT | 6/8 | 130 - 380 | 120 - 120 | 192.50 | 268.28 | NA |
| AMINO-DNTS | 6/8 | 350 - 2100 | 200 - 200 | 871.25 | 1348.66 | NA |

Notes:
1) Inorganic data considers both Station-wide and Anthropogenic Background Samples
NA = Not Applicable
UCL = Upper Confidence Limit

TABLE 2-8

STATISTICAL SUMMARY OF HUMAN HEALTH CHEMICALS O f POTENTIAL CONCERN
FROM SHALLOW SUBSURFACE SOIL (0-2') SAMPLE ANALYSES
SITE 19
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

| CHEMICAL | FREQUENCY OF DETECTION | RANGE OF DETECTED CONCENTRATIONS | RANGE OF DETECTION LIMITS | ARITHMETIC MEAN | NORMAL UPPER 95% CONFIDENCE INTERVAL | RANGE OF STATION BACKGROUND |
|---|---|---|---|---|---|---|
| **INORGANICS (mg/kg)** | | | | | | |
| ALUMINUM, TOTAL | 18/18 | 2450 - 14000 | NA - NA | 7567.22 | 8913.26 | 26990-24100 |
| ARSENIC, TOTAL | 18/18 | 0.8 - 37.2 | NA - NA | 10.37 | 14.63 | 0.46L-63.9 |
| BERYLLIUM, TOTAL | 17/18 | 0.28 - 1.7 | 0.35 - 0.35 | 0.60 | 0.78 | 0.23J-0.93J |
| CHROMIUM, TOTAL | 18/18 | 6.3 - 52.4 | NA - NA | 20.41 | 25.47 | 3.5-33.5 |
| VANADIUM, TOTAL | 18/18 | 6.8 - 74 | NA - NA | 31.30 | 39.94 | 5.2-64.7 |
| **NITRAMINES (ug/kg)** | | | | | | |
| 2,4,6-TNT | 6/18 | 110 - 2100 | 120 - 120 | 368.33 | 631.27 | NA |
| AMINO-DNTS | 4/18 | 310 - 8200 | 200 - 200 | 639.44 | 1420.87 | NA |

Notes:
1) Inorganic data considers both Station-wide and Anthropogenic Background Samples
NA - Not Applicable
UCL - Upper Confidence Limit

TABLE 2-9

**INCREMENTAL LIFETIME CANCER RISK (ILCR) AND HAZARD INDEX (HI)**
**FOR FUTURE ADULT AND CHILD ON-SITE RESIDENTS**
**REASONABLE MAXIMUM EXPOSURE AND CENTRAL TENDENCY VALUES**
**SITE 19**
**NAVAL WEAPONS STATION YORKTOWN**
**YORKTOWN, VIRGINIA**

| Pathway | Receptors | | | |
|---|---|---|---|---|
| | Adults | | Children (1-6 yrs.) | |
| | ILCR | HI | ILCR | HI |
| Surface Soil | | | | |
| Ingestion | $8.5 \times 10^{-06}$ ($7.5 \times 10^{-07}$) | 0.13 (0.03) | $2.0 \times 10^{-05}$ ($4.7 \times 10^{-06}$) | 1.2 (0.24) |
| Dermal Contact | $1.9 \times 10^{-05}$ ($7.8 \times 10^{-07}$) | 0.3 (0.02) | $8.4 \times 10^{-06}$ ($8.5 \times 10^{-07}$) | 0.54 (0.04) |
| Subtotal | $2.8 \times 10^{-05}$ ($1.5 \times 10^{-06}$) | 0.43 (0.05) | $2.8 \times 10^{-05}$ ($5.6 \times 10^{-06}$) | 1.7 (0.28) |

Notes:

( ) = Central tendency values

Shaded areas indicated exceedances of the USEPA's generally acceptable target risk range or Hazard Indices equal to or exceeding 1.0.

## TABLE 2-10

### POTENTIAL HUMAN HEALTH RISKS ASSOCIATED WITH SITE 19 BY CHEMICAL REASONABLE MAXIMUM EXPOSURE
### NAVAL WEAPONS STATION YORKTOWN
### YORKTOWN, VIRGINIA

| Medium/Pathway | Chemical | Future Potential Receptors | | | |
|---|---|---|---|---|---|
| | | HI (Child) | ILCR (Child) | HI (Adult) | ILCR (Adult) |
| Surface Soil Dermal Contact | benzo(a)pyrene* | -- | $1.1 \times 10^{-6}$ | -- | $4.8 \times 10^{-7}$ |
| | aluminum | *0.6* | -- | *0.07* | -- |
| | arsenic | 0.4 | $1.6 \times 10^{-5}$ | 0.04 | $6.8 \times 10^{-6}$ |
| Surface Soil Accidental Ingestion | benzo(a)pyrene* | -- | $2.2 \times 10^{-6}$ | -- | $5.1 \times 10^{-6}$ |
| | aluminum | 0.3 | -- | *0.2* | -- |
| | arsenic | 0.1 | $5.1 \times 10^{-6}$ | 0.07 | $1.1 \times 10^{-5}$ |
| Surface Soil Total | | 1.4 | $7.3 \times 10^{-6}$ | 0.4 | $2.5 \times 10^{-5}$ |

Note:

* - Dermal pathway is not considered quantitatively for these constituents because of the potential for direct acting effects.

Shaded areas indicate exceedences of the USEPAs generally acceptable target risk range or Hazard Indices equal to or exceeding 1.0.

ILCR - Incremental Lifetime Cancer Risk
HI - Hazard Index

TABLE 2-11

INCREMENTAL LIFETIME CANCER RISKS (ILCRs) AND HAZARD INDEX (HI) VALUES FOR CONVEYOR BELT SURFACE SOIL SAMPLES - SITE 19
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

| Medium/Pathway | Chemical | Commercial Worker | |
|---|---|---|---|
| | | HI | ILCR |
| Surface Soil Accidental Ingestion | 2,4,6-Trinitrotoluene | 14.0 | $7.5 \times 10^{-5}$ |
| Surface Soil Dermal Contact | 2,4,6-Trinitrotoluene | 78.0 | $4.5 \times 10^{-4}$ |
| Surface Soil Total | | 92.0 | $4.8 \times 10^{-4}$ |

TABLE 2-12

STATISTICAL SUMMARY OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN
FROM SURFACE SOIL SAMPLE ANALYSES
SITE 9
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

| CHEMICAL | FREQUENCY OF DETECTION | RANGE OF DETECTED CONCENTRATIONS | RANGE OF DETECTION LIMITS | ARITHMETIC MEAN | NORMAL UPPER 95% CONFIDENCE INTERVAL | RANGE OF STATION BACKGROUND |
|---|---|---|---|---|---|---|
| **INORGANICS (mg/kg)** | | | | | | |
| ALUMINUM | 10/10 | 3160 - 7750 | NA - NA | 5636.00 | 6475.78 | 2690 - 24100 |
| BERYLLIUM | 2/10 | 0.38 - 0.47 | 0.28 - 0.38 | 0.22 | 0.29 | 0.23J - 0.93J |
| CHROMIUM | 10/10 | 6.7 - 29.8 | NA - NA | 16.40 | 20.97 | 3.50 - 33.50 |
| COPPER | 10/10 | 2.4 - 26.1 | NA - NA | 11.54 | 16.48 | 1.2J - 24.4 |
| IRON | 10/10 | 5080 - 20200 | NA - NA | 13243.00 | 16257.33 | 2070 - 46400 |
| LEAD | 10/10 | 9.7 - 68.4 | NA - NA | 31.03 | 43.82 | 6.40 - 43.1 |
| NICKEL | 10/10 | 2.6 - 11 | NA - NA | 5.24 | 6.67 | 4.2J - 12.5 |
| POTASSIUM | 10/10 | 149 - 598 | NA - NA | 384.60 | 459.53 | 398J - 1640J |
| SELENIUM | 3/10 | 0.4 - 0.47 | 0.31 - 0.47 | 0.26 | 0.33 | 0.21L - 0.61L |
| VANADIUM | 10/10 | 11.9 - 68.6 | NA - NA | 33.66 | 45.15 | 5.2J - 64.7 |
| ZINC | 10/10 | 10.6 - 133 | NA - NA | 61.39 | 89.38 | 3.2KJ - 48.4 |
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| ACENAPHTHENE | 2/10 | 69 - 120 | 350 - 460 | 180.40 | 209.48 | NA |
| ANTHRACENE | 4/10 | 58 - 310 | 350 - 460 | 188.30 | 228.86 | NA |
| BENZO(A)ANTHRACENE | 7/10 | 87 - 1100 | 350 - 420 | 367.70 | 567.41 | NA |
| BENZO(A)PYRENE | 7/10 | 94 - 1200 | 350 - 420 | 376.40 | 588.03 | NA |
| BENZO(B)FLUORANTHENE | 9/10 | 58 - 2200 | 350 - 350 | 544.60 | 932.24 | NA |
| BENZO(G,H,I)PERYLENE | 7/10 | 74 - 770 | 350 - 420 | 271.80 | 398.90 | NA |
| BENZO(K)FLUORANTHENE | 7/10 | 77 - 520 | 350 - 420 | 206.70 | 279.95 | NA |
| BUTYLBENZYLPHTHALATE | 4/10 | 55 - 310 | 390 - 470 | 184.30 | 230.02 | NA |
| CARBAZOLE | 4/10 | 47 - 250 | 350 - 460 | 170.10 | 207.51 | NA |
| CHRYSENE | 9/10 | 43 - 1200 | 350 - 350 | 423.30 | 668.07 | NA |
| DIBENZO(A,H)ANTHRACENE | 4/10 | 55 - 160 | 350 - 460 | 161.60 | 193.96 | NA |
| DIBENZOFURAN | 2/10 | 49 - 77 | 350 - 460 | 174.10 | 209.80 | NA |
| FLUORANTHENE | 9/10 | 65 - 2200 | 350 - 350 | 620.00 | 1018.15 | NA |
| FLUORENE | 2/10 | 75 - 120 | 350 - 460 | 181.00 | 209.23 | NA |
| INDENO(1,2,3-CD)PYRENE | 7/10 | 74 - 550 | 350 - 420 | 224.20 | 308.31 | NA |
| PHENANTHRENE | 8/10 | 76 - 1600 | 350 - 420 | 444.20 | 739.66 | NA |
| PYRENE | 10/10 | 35 - 2000 | NA - NA | 656.10 | 1077.38 | NA |
| **NITRAMINES (ug/kg)** | | | | | | |
| AMINO-DNTS | 3/10 | 210 - 1500 | 200 - 200 | 264.00 | 517.40 | NA |

Notes:
1) Inorganic data considers both Station-wide and Anthropogenic Background Samples
NA - Not Applicable
UCC - Upper Confidence Limit

TABLE 2-13

STATISTICAL SUMMARY OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN
FROM SURFACE WATER SAMPLE ANALYSES
SITE 9
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

| CHEMICAL | FREQUENCY OF DETECTION | RANGE OF DETECTED CONCENTRATIONS | RANGE OF DETECTION LIMITS | ARITHMETIC MEAN | NORMAL UPPER 95% CONFIDENCE INTERVAL | RANGE OF STATION BACKGROUND |
|---|---|---|---|---|---|---|
| **INORGANICS (mg/kg)** | | | | | | |
| ALUMINUM | 4/4 | 15 - 200 | NA - NA | 79.90 | 181.29 | 94.4J-1050 |
| CYANIDE | 1/4 | 28 - 28 | 10 - 10 | 10.68 | 24.03 | ND |
| IRON | 4/4 | 589 - 2960 | NA - NA | 1218.75 | 2585.15 | 630-2500J |
| LEAD | 1/4 | 3.6K - 3.6K | 1.4L - 1.4L | 1.43 | 3.13 | 1.6J-15.9 |
| **PESTICIDES (ug/kg)** | | | | | | |
| HEPTACHLOR EPOXIDE | 1/4 | 0.08 - 0.08 | 0.05 - 0.05 | 0.04 | 0.07 | NA |
| **NITRAMINES (ug/kg)** | | | | | | |
| AMINO-DNTS | 4/4 | 97 - 1000 | NA - NA | 431.75 | 933.79 | NA |

Notes:
1) Inorganic data considers both Station-wide and Anthropogenic Background Samples
NA - Not Applicable
UCL - Upper Confidence Limit

TABLE 2-44

STATISTICAL SUMMARY OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN
FROM SEDIMENT SAMPLE ANALYSES
SITE 9
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

| CHEMICAL | FREQUENCY OF DETECTION | RANGE OF DETECTED ONCENTRATIONS | RANGE OF DETECTION LIMITS | ARITHMETIC MEAN | NORMAL UPPER 95% CONFIDENCE INTERVAL | RANGE OF STATION BACKGROUND |
|---|---|---|---|---|---|---|
| INORGANICS (mg/kg) | | | | | | |
| ALUMINUM | 9/9 | 1690 - 6320 | NA - NA | 3861.11 | 4810.47 | 482K - 17700J |
| ARSENIC | 9/9 | 5.7 - 55.5 | NA - NA | 19.57 | 31.54 | 0.27L - 5.4L |
| BERYLLIUM | 9/9 | 0.26 - 0.85 | NA - NA | 0.46 | 0.58 | 0.28J - 0.99J |
| COBALT | 9/9 | 1.6 - 5.2 | NA - NA | 3.16 | 3.98 | 1.1J - 7.9J |
| IRON | 9/9 | 11100 - 54400 | NA - NA | 23333.33 | 31121.00 | 329.00 - 27700J |
| LEAD | 9/9 | 7.9 - 109 | NA - NA | 29.18 | 48.95 | 1.8L - 381L |
| VANADIUM | 9/9 | 13.1 - 43.4 | NA - NA | 27.67 | 33.28 | 1.9J - 38.90 |
| SEMIVOLATILES (ug/kg) | | | | | | |
| ACENAPHTHENE | 2/9 | 130 - 220 | 420 - 550 | 222.22 | 247.03 | NA |
| ACENAPHTHYLENE | 2/9 | 77 - 150 | 420 - 550 | 208.56 | 245.83 | NA |
| ANTHRACENE | 6/9 | 54 - 750 | 420 - 490 | 274.33 | 409.87 | NA |
| BENZO(A)ANTHRACENE | 8/9 | 42 - 2400 | 490 - 490 | 749.67 | 1295.44 | NA |
| BENZO(A)PYRENE | 7/9 | 46 - 2100 | 460 - 490 | 603.44 | 1008.60 | NA |
| BENZO(G,H,I)PERYLENE | 7/9 | 66 - 1000 | 420 - 490 | 376.78 | 579.20 | NA |
| BUTYLBENZYLPHTHALATE | 1/9 | 660 - 660 | 420 - 590 | 282.78 | 371.95 | NA |
| CARBAZOLE | 5/9 | 72 - 250 | 420 - 490 | 185.22 | 224.64 | NA |
| CHRYSENE | 8/9 | 54 - 2600 | 490 - 490 | 855.44 | 1456.89 | NA |
| DIBENZO(A,H)ANTHRACENE | 5/9 | 68 - 300 | 420 - 490 | 184.67 | 235.25 | NA |
| FLUORANTHENE | 9/9 | 73 - 4600 | NA - NA | 1415.78 | 2473.42 | NA |
| FLUORENE | 4/9 | 52 - 420 | 420 - 500 | 205.22 | 272.92 | NA |
| INDENO(1,2,3-CD)PYRENE | 7/9 | 83 - 1300 | 420 - 490 | 469.78 | 738.04 | NA |
| PHENANTHRENE | 8/9 | 57 - 3200 | 490 - 490 | 972.44 | 1680.95 | NA |
| PYRENE | 9/9 | 67 - 3300 | NA - NA | 1097.00 | 1855.96 | NA |
| NITRAMINES (ug/kg) | | | | | | |
| AMINO-ONTS | 6/9 | 220 - 2300 | 200 - 200 | 546.67 | 997.78 | NA |
| 2,4-DINITROTOLUENE | 1/9 | 3700 - 3700 | 420 - 590 | 627.22 | 1341.85 | NA |
| 2,4,6-TNT | 6/9 | 120 - 620 | 120 - 120 | 206.67 | 317.71 | NA |

Notes:
1) Inorganic data considers both Station-wide and Anthropogenic Background Samples
NA - Not Applicable
UCL - Uppr Confidence Limit

## TABLE 2-16

## STATISTICAL SUMMARY OF ECOLOGICAL CHEMICALS OF POTENTIAL CONCERN FROM SURFACE SOIL SAMPLE ANALYSES SITE 19 NAVAL WEAPONS STATION YORKTOWN YORKTOWN, VIRGINIA

| CHEMICAL | FREQUENCY OF DETECTION | RANGE OF DETECETD ONCENTRATIONS | RANGE OF DETECTION LIMITS | ARITHMETIC MEAN | NORMAL UPPER 95% CONFIDENCE .INTERVAL | RANGE OF STATION BACKGROUND |
|---|---|---|---|---|---|---|
| **INORGANICS (mg/kg)** | | | | | | |
| ALUMINUM | 8/8 | 5880 - 90600 | NA - NA | 28635.00 | 49103.70 | 2690 - 24100 |
| BERYLLIUM | 6/8 | 0.29 - 0.73 | 0.31 - 0.33 | 0.37 | 0.49 | 0.23J - 0.93J |
| CHROMIUM | 8/8 | 13 - 31 | NA - NA | 23.30 | 28.20 | 3.5 - 33.5 |
| COPPER | 8/8 | 7.80 - 42 | NA - NA | 19.38 | 27.40 | 1.2J - 24.4 |
| IRON | 8/8 | 12300 - 48700 | NA - NA | 25575.00 | 34040.44 | 2070 - 46400 |
| LEAD | 8/8 | 46 - 392 | NA - NA | 142.80 | 218.93 | 6.4 - 43.1 |
| MERCURY | 1/8 | 0.1K - 0.1K | 0.09 - 0.14 | 0.10 | 0.07 | 0.05J - 0.05J |
| VANADIUM | 8/8 | 22.7J - 53 | NA - NA | 36.01 | 43.36 | 5.2J - 64.7 |
| NICKEL | 8/8 | 2.6 - 7.4 | NA - NA | 5.18 | 6.34 | 4.2J - 12.5 |
| ZINC | 8/8 | 34 - 365 | NA - NA | 161.38 | 246.02 | 3.2KJ - 48.4 |
| **SEMIVOLATILES (ug/kg)** | | | | | | |
| BENZO(A)ANTHRACENE | 2/8 | 88 - 130 | 370 - 450 | 180.38 | 212.04 | NA |
| BENZO(A)PYRENE | 2/8 | 95 - 140 | 370 - 450 | 182.50 | 211.87 | NA |
| BENZO(B)FLUORANTHENE | 3/8 | 43 - 230 | 370 - 450 | 184.13 | 224.71 | NA |
| CHRYSENE | 3/8 | 39 - 140 | 370 - 450 | 166.13 | 208.49 | NA |
| FLUORANTHENE | 5/8 | 46 - 370 | 370 - 450 | 165.63 | 240.13 | NA |
| INDENO(1,2,3-CD)PYRENE | 2/8 | 62 - 130 | 370 - 450 | 177.13 | 213.85 | NA |
| PHENANTHRENE | 2/8 | 75 - 210 | 370 - 450 | 188.75 | 220.77 | NA |
| PYRENE | 4/8 | 44 0 210 | 370 - 450 | 163.88 | 209.83 | NA |
| **NITRAMINES (ug/kg)** | | | | | | |
| 2,4,6-TNT | 6/8 | 130 380 | 120 - 120 | 192.50 | 268.28 | NA |

Notes:
1) Inorganic data considers both Station-wide and Anthropagenic Background Samples
NA - Not Applicable
UCL - Upper Confidence Limit

terrestrial receptors were selected to represent various trophic levels. Plants and soil invertebrates were evaluated by a comparison to toxicity values for flora and fauna. Robins, hawks, voles, and shrews were evaluated through conservative modeling of potential contaminant uptake. Contaminant uptake was then compared to literature No Observable Adverse Effect Levels (NOAELs) or Lowest Observable Adverse Effect Levels (LOAELs).

Terrestrial models indicate that aluminum, chromium, iron, lead, and vanadium concentrations in Site 9 soil could produce unacceptable ecological effects. However, aluminum, chromium, and iron concentrations fall within Station-wide background concentrations, and it is not considered appropriate to attempt to cleanup to below background concentrations at Site 9. Concentrations of lead exceed background concentrations at only three of ten sample locations. Vanadium exceeds background concentrations at only one of ten locations. No apparent source of inorganic constituents has been identified at Site 9.

Potential aquatic receptors considered in the Site 9 ecological risk assessment include: fish (including the yellow bullhead catfish), sediment benthic macroinvertebrates, bullfrogs, and great blue herons. The aquatic receptors are not present in the drainage ditch proper, but were selected to represent various trophic levels. Sediment benthic macroinvertebrates and fish were evaluated by a comparison to available benchmarks. Yeliow bullhead catfish, bullfrogs and great blue herons were evaluated using conservative uptake modeling.

Surface water samples collected from the Site 9 drainage ditch contained heptachlor epoxide, nitramines, aluminum, cyanide, and iron exceeding corresponding benchmark values used to select ecological contaminants of concern These contaminants did not produce significant risks (i.e., ecological HQ values greater than 1.0) to aquatic receptors evaluated using conservative uptake modeling. Aluminum concentrations fall within freshwater background concentrations. Heptachlor epoxide was detected in only one of four surface water samples and, from an historical perspective, its use at Site 9 could not be documented. Iron concentrations are similar to Station background values and as such, remediation of these constituents is not appropriate at Site 9.

Sediment samples collected from the Site 9 drainage ditch contained concentrations of PAHs, nitramines, aluminum, arsenic, beryllium, cobalt, iron, lead, and vanadium. PAHs did not produce significant risk to aquatic receptors. Aluminum, beryllium, cobalt, and lead were detected below

background concentrations for freshwater sediment. Vanadium was detected in one 0 to 4 inch sediment sample (SD09) at 43.4 mg/kg. This concentration is similar to the maximum detected background vanadium concentration in freshwater sediments of 38.9 mg/kg. All other vanadium concentrations in Site 9 sediment samples fell within the Station-wide background range. Maximum detected concentrations of nitramines and iron were detected in a single deep sample (4 to 8 inches bgs) obtained from the middle of the drainage ditch where the potential for contact by ecological receptors is limited. Therefore, the need to conduct remediation activities in the ditch is unnecessary.

Sediment concentrations of iron produced risks to the great blue heron using conservative uptake modeling. An HQ of 45.7 was derived for iron (in the least conservative model). Iron, however, was detected m deeper sediments (4 to 8 inch depth) to which the heron is unlikely to be exposed. Lead produced HQ values in excess of 1.0, but sediment concentrations fall within background. As such, lead concentrations may not be discernable from background and remediation would not be appropriate.

Arsenic concentrations in Site 9 sediments exceed background freshwater stream sediment concentrations. Although HQ values for arsenic exceed 1.0 when using the Effects Range-Low (ER-L) value, they do not produce unacceptable HQ values when using the Effects Range-Median (ER-M) value for arsenic. Because arsenic does not produce unacceptable HQ values using the ER-M, remediation of ditch sediments is not necessary. Remediation of ditch sediments would also cause greater harm to the local ecology than leaving contaminants such as arsenic, iron, vanadium, and lead in place.

No action is necessary to protect human health at Site 9.

Site 19 Ecological Risk

Potential ecological risks were evaluated in the terrestrial environment at Site 19. There are no aquatic habitats associated with this site.

Potential terrestrial receptors considered in the ecological risk assessment for Site 19 include: soil invertebrates, plants, robins, red-tailed hawks, short-tailed shrews, and meadow voles. The terrestrial receptors were selected to represent various trophic levels. Plants and invertebrates were evaluated

by a comparison to literature toxicity values for flora and fauna. Soil concentrations of 2,4,6-TNT, aluminum, chromium, copper, iron, lead, mercury, vanadium, and zinc may be adversely impacting soil flora and fauna. Terrestrial uptake modeling results indicate that only 2,4,6-TNT, aluminum, chromium, lead, and iron produce HQ values exceeding 1.0.

Remediation of the inorganic constituents mercury, vanadium, and zinc is not necessary because they did not produce ecological HQs in excess of 1.0.

### 2.63 Summary of Risk Assessment Results

Only future potential residential exposure to soil produced unacceptable human health HI values at Site 9. Arsenic was responsible for the unacceptable HI values, but was detected at concentrations that could not be distinguished from Station-wide background.

Inorganics detected in Site 9 sediment samples produced potentially unacceptable risks to aquatic receptors. Arsenic was detected above background freshwater sediment concentrations, but did not exceed the ER-M value. Lead was detected below background freshwater sediment concentrations and below its ER-M value.

Because vanadium was detected in only one shallow (0-4 inch) sediment sample at a concentration similar to background and iron was detected in a deep (4-8 inch) sediment sample (limiting the potential for exposure to aquatic receptors), no action is necessary. Remediation of Site 9 sediments, because of arsenic, iron, lead, and vanadium, would be more harmful to the ecology than leaving these inorganic contaminants in place.

At Site 19, the compound 2,4,6-TNT produced ILCR values in excess of the generally acceptable target risk range and HI values above 1.0 for current and future potential human receptors. The compound RDX was also detected at concentrations that could pose unacceptable human health risks, but was detected at much lower concentrations than 2,4,6-TNT. 2,4,6-TNT, aluminum, iron, and lead produced unacceptable HQ values above 1.0 for all potential terrestrial receptors. Soil concentrations of RDX and HMX did not produce unacceptable risks to ecological receptors. Soil under the conveyor belt must be remediated to protect current and future potential human receptors and terrestrial environmental receptors. Remediation levels (RLs) of 15 mg/kg and 5 mg/kg were derived

using exposure scenarios and potential current receptors described in the baseline RA for 2,4,6-TNT and RDX, respectively. These RLs are protective of both human health and the environment.

## 2.7 Description of Remedial Alternatives for Site 19

The DoN considered a range of potential alternatives for the remediation of explosives contaminated soil at Site 19. Each of the "treatment" alternatives (Alternatives 3 through 6) requires that the conveyor belt at Site 19 be dismantled and disposed of properly. The following alternatives were evaluated:

- Alternative 1 - No Action
- Alternative 2 - No Action with Institutional Controls
- Alternative 3 - Capping
- Alternative 4 - Excavation/Biological Treatment/Reuse-Recycle
- Alternative 5 - Excavation/Soil Washing/Incineration
- Alternative 6 - Excavation/Off-Site Incineration

### 2.7.1 Alternative 1: No Action

This alternative involves no remedial action to contain, remove or treat contaminants in Site 19 soil, it is not protective of human health or the environment, nor does it comply with ARARs. It was, however, evaluated to provide a baseline for comparison to other remedial alternatives.

- Estimated Capital Cost: $0
- Estimated Operation and Maintenance (O&M) Costs: $0
- Estimated Present Worth Cost $0
- Estimated Time to Implement: Immediate

### 2.7.2 Alternative 2: No Action with Institutional Controls

This alternative also involves no action to contain, remove or treat Site 19 soil contaminants, but does provide for some protection of human health by restricting property use (i.e., no future residential development of Site 19 and restrictions concerning groundwater usage in the Station Master Plan).

This alternative does not protect the environment and does not comply with ARARs as would "treatment" medial alternatives.

- Estimated Capital Cost: $9,000
- Estimated O&M Costs: $18,000
- Estimated Present Worth Cost: $280,000
- Estimate to Implement: Installation of a chain link fence would be completed within 4 to 6 months (pending receipt of funding), property use restrictions could be added to the Station Master Plan during the same time period.

### 2.7.3 Alternative 3: Capping

This alternative calls for contaminated Site 19 soil to be left in place and covered. The cover will consist of a 12 inch clay layer or a clay equivalent liner and 6 inches of top soil over the explosives contaminated soil. It will be &signed, constructed and maintained in accordance with appropriate USEPA and Commonwealth of Virginia criteria and guidance. The areas to be covered will be delineated with additional sampling. The cover will then be revegetated to prevent the erosion of top soil. Although no chemical specific ARARs exist, action and location specific ARARs including the protection of wetlands and erosion and sediment control regulations would be met. Because affected soil at Site 19 is not a listed waste, and affected soil is not hazardous by characteristics (ignitability, reactivity, corrosivity, toxicity), RCRA Subtitle C (40 CFR Part 261) and Virginia Hazardous Waste Management Regulations (VR672-10-1/9VAC20-60-10 et. seq.) will not apply under this capping alternative. Land use restrictions (i.e., no future residential development, excavation activities, etc. within the confines of the cap) will also be implemented.

- Estimated Capital Cast: $453,000
- Estimated O&M Costs: $16,000
- Estimated Present Worth Cost: $620,000
- Estimated Time to Implement Dismantling of the conveyor belt, clearing and grubbing activities can begin in 6 months pending receipt of funding and approval of the Remedial Action Work Plan. Land use restrictions will be added to the Station Master Plan during this time

period. The cap will be completed within 6 months of the completion of clearing and grubbing activities.

### 2.7.4 Alternative 4: Excavation/Biological Treatment/Reuse-Recycle

Alternative 4 involves the dismantling and disposal of the conveyor belt, removing soil containing concentrations of explosives in soil exceeding RL values (to a depth of approximately 4 feet bgs) beneath the belt, and transporting soil to the biocell at Site 22. Soil will be treated using a carbon source and microbes to degrade explosive contaminants. Soil will be treated to RLs protective of human health and the environment, moved from the cell, and applied to the ground around the biocell.

Hotspot locations of aluminum in soil around Building 527 that could cause potential ecological risks to terrestrial receptors will also be addressed under this alternative. Details concerning aluminum contaminated soil disposal will be discussed in the Remedial Action Work Plan which will be developed prior to remediation activities at Site 19.

The Site 19 area will be backfilled using clean fill and regraded. Institutional controls to prevent residential property use and groundwater use restrictions will also be implemented. Although no chemical ARARs exist for soil, action and location-specific ARARs including: RCRA Subtitle C - surface impoundments (Subpart K), closure and post-closure care of the Site 22 biocell (Subpart G); protection of wetlands and erosion and sediment control (VR 450-01-0051 14 VAC 20-390-10 et seq.) will be met. Treated soil (i.e., soil below USEPA approved RLs) will be disposed in the area around the biocell and the excavated areas at Site 19 will be backfilled with clean soil and returned to grade.

- Estimated Capital Cost: $883,000
- Estimated O&M Costs: $0
- Estimated Present Worth Cost: $883,000
- Estimated Time to Implement: Dismantling of the conveyor belt and excavation activities can begin in the spring of FY 1998 (approximately 7 months) pending receipt of funding and approval of the Remedial Action Work Plan. Warm weather is necessary for

biological treatment processes. Land use restrictions prohibiting future residential land use can be added to the Station Master Plan during the 7 month time period. The total timeframe for implementation and completion of this remedy is approximately 6 months,

### 2.7.5 Alternative 5: Excavation/Soil Washing/Incineration

This alternative is similar to Alternative 4 in that soil will be excavated from the conveyor belt area to a depth of approximately 4 feet bgs. Rather than soil treatment at the on-site biocell, an on-site soil washing treatment system would be established at Site 19. The contaminated soil would be washed, certified to be below RL values, and used as backfill at the site. Contaminated wash residuals will be transported off site. to a permitted incineration facility. Although no ARARs exist for soil, this alternative will meet action and location specific ARARs including: RCRA-Subtitle C (40 CFR Part 264) Subpart E (manifest system, record keeping and reporting) for off-site transport of residuals, Subpart I (Use and management of Containers; Subpart K (surface impoundments), protection of wetlands and erosion and sediment control (VR 450-01-005 1/4 VAC 20-390-10 et seq.); and Department of Transportation regulations concerning off-site transport of residuals.

- Estimated Capital Cost: $1,418,000
- Estimated O&M Costs: $0
- Estimated Present Worth Cost: $1,418,000
- Estimated Time to Implement: Dismantling of the conveyor belt and excavation activities can begin in 6 months pending the receipt of funding, approval of the Remedial Action Work Plan and availability of a permitted incinerator facility to accept residuals. Property use restrictions prohibiting residential future property use will be added to the Station Master Plan during this time period. This alternative will be completed within I year pending the identification of a permitted incineration facility willing to accept residuals.

### 2.7.6 Alternative 6: Excavation/Off-Site Incineration

This alternative is similar to Alternative 5 in that Site 19 soil will be excavated, but no on-site washing will occur. Site 19 soil will be transported to an off-site incineration facility permitted to treat explosives-contaminated waste. Although no ARARs exist for soil, this alternative will meet action and location specific ARARs including: RCRA-Subtitle C (Subparts E, I, and K); Department of Transportation regulations concerning off-site transport of soils (49 CFR Parts 107 and 171.1-500); wetlands; and erosion and sediment control (VR 450-01-005 1/4 VAC 20-390-10 et seq.).

- Estimated Capital Cost: $3,147,000
- Estimated O&M Costs: $0
- Estimated Present Worth Cost: $3,147,000
- Estimated Time to Implement: Dismantling of the conveyor belt and excavation activities can begin in 6 months pending the receipt of funding, approval of the Remedial Action Work Plan and availability of a permitted incinerator facility to accept soil. Property use restrictions prohibiting future residential property use will be added to the Station Master Plan during this time period. This alternative will be completed within 1 year pending the identification of a permitted incineration facility willing to accept soil.

## 2.8 Summary of the Comparative Analysis of Alternatives

As required by CERCLA, the six remedial alternatives were evaluated using the nine criteria specified by USEPA (Table 2-16). This section and Table 2-17 summarize the detailed analysis of each alternative.

TABLE 2-16

USEPA EVALUATION CRITERIA FOR REMEDIAL ALTERNATIVES
SITES 9 AND 19
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA

| | |
|---|---|
| 1. | Overall protection of human health a d the environment |
| | Addresses whether a cleanup method adequately protects human health and the environment and describes how risks presented by each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls. |
| 2. | Compliance with ARARs |
| | Addresses whether a cleanup method meets all ARARs (federal and state environmental requirements) and provides grounds for invoking a waiver. |
| 3. | Long-term effectiveness and permanence |
| | Refers to the ability of the cleanup method to reliably protect human health and the environment over time, after the action is completed. |
| 4. | Reduction of toxicity, mobility, or volume through treatment |
| | Addresses the effectiveness of a cleanup method in reducing the toxicity, mobility, or volume of hazardous substances through treatment. |
| 5. | Shod-term effectiveness |
| | Addresses the period of time needed to complete the cleanup, and any adverse impacts on human health and the environment that may occur during construction and operation. |
| 6. | Implementability |
| | Refers to the technical and administrative feasibility of a cleanup method, including the availability of required materials and services. |
| 7. | Cost |
| | Includes the estimated capital and O&M costs of each cleanup method. |
| 8. | State acceptance |
| | Indicates whether the Commonwealth of Virginia agrees with the preferred cleanup method. |
| 9. | Community acceptance |
| | Indicates whether public concerns are addressed by the cleanup method and whether the community has a preference. (Public comment is an important part of the final decision.) |

TABLE 2-17

SUMMARY OF DETAILED ANALYSIS
SITES 9 AND 19
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA

| Evaluation | RAA 1: No Action | RAA 2: No Action with Institutional Controls | RAA 3: Capping | RAA 4: Excavation/Biological Treatment/Reuse/Recycle | RAA 5: Excavation/Soil/ Washing/Incineration | RAA 6: Excavation/Incineration |
|---|---|---|---|---|---|---|
| Overall Protectiveness | • No reduction in risk to human health and the environment<br>• Existing conditions allow for further migration of contaminants off site. | • Reduction in direct exposure to contaminated media through access restrictions and deed restrictions.<br>• Existing conditions allow for further migration of contaminants off site. | • Reduction in direct exposure to contaminated soil.<br>• Prevents erosion thus reducing the migration of contaminants.<br>• Prevents percolation of surface water through contaminated soil.<br>• Monitors quality of groundwater.<br>• Lessens potential of environmental contact with contaminated media, but does not remove contamination. | • Significant reduction in risk by removal and treatment of contaminated soil.<br>• Removes potential source of contamination to other environmental media. | • Significant reduction in risk by removal and treatment of contaminated soil.<br>• Removes potential source of contamination to other environmental media. | • Significant reduction in risk by removal and treatment of contaminated rott.<br>• Removes potential source of contamination to other environmental media. |
| Compliance with ARARs | • Will not meet ARARs. | • Will not meet ARARs. | Will meet ARARs. | • Will meet all applicable ARARs. | • Will meet all applicable ARARs. | • Will meet all applicable ARARs. |
| Long-Term Effectiveness and Permanence | • Unknown.<br>• 5-year review required. | • If institutional controls are maintained, will be effective at reducing exposure.<br>• 5-year review required. | • If cops are maintained, will be effective and permanent at reducing exposure.<br>• 5-year review required. | • Since soil/sediment COCs are removed, will be an effective and permanent option.<br>• 5-year reviews will not be required. | • Since soil/sediment COCs are removed, will be an effective and permanent option.<br>• 5-year reviews will not be required. | • Since soil/sediment COCs are removed, will be an effective and permanent option.<br>• 5-year reviews will not be required. |
| Reduction of Toxicity, Mobility, or Volume through Treatment | • Will not treat or reduce contaminants. | • Will not treat or reduce contaminants. | • Will not treat or reduce contaminants. | • Soil COCs treated by biological methods | • Soil COCs treated by soil washing; residuals by incineration. | • Soil COCs treated by off-site incineration. |
| Short-Term Effectiveness | • Risk to community not increased. No significant risk to workers. | • Risk to community not increased.<br>• Increased risk to workers during implementation of institutional controls. | • Risk to community m y increase due lo fugitive dust from conveyor demolition and earth-moving activities.<br>• Increased risk to workers during cap installation. | • Risks to community may increase due to fugitive dust from conveyor demolition m d earth removal activities.<br>• Increased risk to workers during soil removal and treatment activities. | • Risks to community may increase due to fugitive dun from demolition n d earth removal activities.<br>• Risk to community increased during off-site transpo n of soil.<br>• Increased risk to workers during soil removal and treatment activities. | • Risks to community may increase due to fugitive dun from demolition and earth removal activities.<br>• Risk to community increased during off-site transport of ail.<br>• Increased risk to workers during mil removal activitia. |
| Implementability | • No construction or operation activities planned,<br>• No monitoring proposed. | • Institutional controls easily implemented.<br>• Equipment and materials readily available. | • Easy to construct and maintain.<br>• Effectiveness will be evaluated by monitoring.<br>• Equipment and materials readily available. | • Requires soil excavation activities.<br>• Requires assembly and operation of on-site treatment unit.<br>• Equipment should be readily available.<br>• Adequate system monitoring. | • Requires soil excavation activities.<br>• Requires assembly and operation of on-site treatment unit.<br>• Equipment should be readily available.<br>• Requires coordination with a permitted off-site incinerator facility.<br>• Adequate system monitoring. | • Requires soil excavation activities.<br>• Required coordination with a permitted off-site incinerator facility. |
| Costs (NPW) | $0.00 | $280,000.00 | $620,000.00 | $883,000.00 | $1,418,000.00 | $3,147,000.00 |

### 2.8.1 Threshold Criteria

Overall Protection of Human Health and the Environment:

Evaluation of the overall protectiveness of alternatives focused on whether a specific alternative would achieve adequate protection of human health and the environment and how risks posed by each pathway would be eliminated, reduced, or controlled through treatment, engineering, or institutional controls. The overall assessment of the level of protection included the evaluations conducted under other criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Alternatives 1 and 2 are not protective of human health or the environment because waste is left in place and the potential for exposure is limited, but not eliminated by institutional controls. Alternatives 3, 4, 5 and 6 are protective of human health and the environment because waste is removed (Alternatives 4, 5, and 6) or covered (Alternative 3).

Compliance with ARARs:

This evaluation involved determining whether each alternative would meet all of the pertinent Federal and state ARARs (as identified in Section 2.11 2 of this report).

Each alternative was evaluated for compliance with applicable or relevant and appropriate Federal and state requirements. The evaluation summarized which requirements are applicable or relevant and appropriate to each alternative. The following items were considered for each alternative:

- Compliance with chemical-specific ARARs (e.g., ambient water quality criteria). This factor addresses whether the ARARs can be met, and, if not, whether a waiver may be appropriate.

- Compliance with location-specific ARARs (e.g., preservation of historic sites, regulations relative to activities near wetlands or floodplains, etc.). As with other ARAR-related factors, these involve consideration of whether the ARARs can be met or whether a waiver is appropriate.

- Compliance with action-specific ARARs (e.g., RCRA minimum technology standards). It must be determined whether ARARs can be met or must be waived.

No chemical specific ARARs apply to the remediation of Site 19. Remedial Alternatives 1 and 2 will not comply with chemical specific soil remediation levels established to protect human health and the environment. Furthermore, Site 19 soil may act as a source of potential contamination to underlying groundwater and Virginia Groundwater Standards may not be attained. Alternatives 3, 4, 5, and 6 will comply with soil RLs and will achieve all location-specific and action-specific ARARs.

## 2.83 Primary Balancing Criteria

Long-term Effectiveness and Permanence:

This criterion evaluated alternatives with respect to their long-term effectiveness and the degree of permanence. The primary focus of this evaluation was the residual risk that will remain at the sites and the effectiveness of the controls that will be applied to manage residual risks. The assessment of long-term effectiveness was made considering the following four factors:

- The magnitude of the residual risk to human and environmental receptors remaining from untreated waste or treatment residues at the completion of remedial activities.

- An assessment of the type, degree, and adequacy of long-term management (including engineering controls, institutional controls, monitoring, and operation and maintenance) required for untreated waste or treatment residues remaining at the site.

- An assessment of the long-term reliability of engineering and/or institutional controls to provide continued protection from untreated waste or treatment residues.

- The potential need for replacement of the remedy and the continuing need for repairs to maintain the performance of the remedy.

Alternatives 1 and 2 are not effective or permanent because waste is left in place at Site 19. Alternative 3 is permanent, but its long-term effectiveness is a function of future cover maintenance.

Alternatives 4, 5, and 6 are effective and permanent because waste is removed from the site and contamination is destroyed by biological processes or incineration.

Reduction of Toxicity, Mobility, or Volume Through Treatment:

This evaluation criterion addressed the degree to which the alternatives employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances. Alternatives that do not employ treatment technologies do not reduce toxicity, mobility, or volume of COCs. The evaluation considered the following specific factors:

- The treatment processes, the remedies that will be employed, and the materials that will be treated.
- The amount or volume of hazardous materials that will be destroyed or treated.
- The degree of expected reduction in toxicity, mobility, or volume, including how the principal threat is addressed through treatment.
- The degree to which the treatment will be irreversible.
- The type and quantity of treatment residuals that will remain following treatment.

Alternatives 1, 2, and 3 do not employ treatment technologies which reduce toxicity, mobility or volume. Alternative 3 (capping) would reduce potential mobility of contaminants to migrate vertically or horizontally by not allowing precipitation to facilitate transport. Again, the effectiveness of Alternative 3 to preclude migration is dependent on the maintenance of the cover. Alternatives 4, 5, and 6 do reduce toxicity, mobility and volume of waste at the site. Alternative 4 utilizes biological treatment to destroy 2,4,6-TNT and RDX and produces relatively non-toxic intermediates such as amino-dinitrotoluenes. Intermediates including amino-dinitrotoluenes are also destroyed as part of the bioremediation process with time. Soil removed from the Site 22 biocell following treatment will be certified as clean and placed on the ground at Site 22 for dewatering. There will be no residual contamination (other than limited investigation derived waste [IDW]) associated with this alternative.

Alternatives 5 and 6 reduce toxicity, mobility and volume at the site but residuals and soil subjected to incineration will produce ash as a byproduct. Ash produced by incineration technologies must be disposed of properly.

Short-Tern Effectiveness:

*The* short-term effectiveness of each alternative was evaluated relative to its effect on human health and the environment during implementation of the medial action. Potential threats to human health and the environment associated with handling, treatment, or transportation of hazardous substances were considered. The short-term effectiveness assessment was based on four key factors:

- Short-tam risks that might be posed to the community during implementation of an alternative.
- Potential impacts on workers during medial action and the effectiveness and reliability of protective measures.
- Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation.
- Time until remedial response objectives are achieved.

Although dismantling of the conveyor belt and excavation activities could potentially expose workers to contamination during implementation of Alternatives 3, 4, 5, and 6, these alternatives are protective of human health and the environment in the short-term and could be completed within one *year* after implementation. Of these alternatives, Alternatives 3 and 4 could be implemented most quickly because an off-site permitted incineration facility is not necessary to begin remedial action. Alternatives 1 and 2 are not protective in the short-term.

Implementability:

Implementability considerations included *the* technical and administrative feasibility of each alternative and the availability of various materials and services required for its implementation. The following factors were considered during the implementability analysis:

- *Technical Feasibility*: The relative ease of implementing or completing an action based *on* site-specific constraints, including the use of established technologies, such as:

  - Ability to construct the alternative as a whole (constructability).

  - Operational reliability or the ability of a technology to meet specified process efficiencies or performance goals.

  - Ability to undertake future remedial actions that may be required.

  - Ability to monitor the effectiveness of the remedy.

- *Administrative Feasibility*: The ability and *time* required to obtain any necessary approvals and permits from regulatory agencies

- *Availability of Services and Materials*: The availability of the technologies, materials, or services required to implement an alternative, including:

  - Available capacity and location of needed treatment, storage, and disposal services.

  - Availability of necessary equipment, specialists, and provisions for necessary additional resources.

  - Timing of the availability of prospective technologies under consideration.

Availability of services and materials, plus the potential for obtaining bids that are competitive (this may be particularly important for innovative technologies).

Alternatives 5 and 6 can be implemented only if a permitted off-site incineration facility is available. Alternatives 3 and 4 are readily implementable as are Alternatives 1 and 2.

Cost:

For each medial alternative, a detailed cost analysis was developed based on conceptual engineering and analyses. Unit prices were based on published construction cost data, quotes from vendors and contractors, and/or engineering judgment. Costs are expressed in terms of 1997 dollars. In order to allow the costs of remedial alternatives to be compared on the basis of a single figure, the net present worth (NPW) value of all capital and annual costs was determined for each alternative. The USEPA CERCLA RI/FS Guidance Document recommends that a 5 percent discount rate be used in present worth analyses. Of the treatment alternatives, Alternative 4 (Excavation/Biological Treatment/Reuse-Recycle) is approximately $260,000 more expensive than Alternative 3 (Capping). Alternative 4 is considerably less expensive than Alternative 5 (Excavation/Soil Washing/Incineration) and Alternative 6 (Excavation/Off-Site Incineration).

### 2.8.3 Modifying Criteria

State Acceptance:

The Commonwealth of Virginia was involved in the selection of the remedy for Sites 9 and 19. information regarding remedy selection was conveyed through Restoration Advisory Board (RAB) meetings, the FS Report and at the public meeting. No state comments were received disputing the final remedy. The Commonwealth is satisfied that the appropriate process was followed in evaluating remedial action alternatives for Sites 9 and 19 and concurs with the selected remedy.

Community Acceptance:

WPNSTA Yorktown solicited input from the public on the development of alternatives and on the alternatives identified in the Proposed Plan. A public meeting on *the* Proposed Plan was held on July 21, 1997. The public is in agreement with the cleanup objectives. No additional information on the Proposed Plan has been requested and the 45 day public comment period closed on August 13,1997, with no additional comments being received on the selection of a remedy.

## 2.9 Selected Remedy

The selected remedy for Site 9 (OU VII) is no action.

The selected remedy for the cleanup of explosive-contaminated soil at Site 19 (OU VI) is Alternative 4 (Excavation/Biological Treatment/Reuse-Recycle). This alternative is protective of human health and the environment; complies with all ARARs; has a high degree of short-term and long-term effectiveness and permanence; and reduces the toxicity, mobility, and volume of wastes to be disposed of through removal, treatment, and reuse. Furthermore, Alternative 4 requires no maintenance to ensure its long-term effectiveness, a draw back to Alternative 3 (Capping). Because of bench-scale and pilot scale treatability studies conducted for explosives contaminated soil, it is a demonstrated and easily implementable technology and is significantly more cost effective than other "treatment" technologies. Alternative 4 will not produce residual ash, a drawback to Alternatives 5 and 6 which utilize incineration technology. Alternative 4 is also the second least costly treatment alternative evaluated during the remedial process. Table 2-18 presents the detailed costs *for* Alternative 4.

## 2.10 Performance Standard

Alternative 4 requires the dismantling and disposal of the conveyor belt at Site 19 and the excavation of 2,4,6-TNT contaminated soil greater than or equal to 15 mg/kg and RDX contaminated soil greater than or equal to 5 mg/kg. Soil shall be excavated along the entirety of the conveyor belt (and in the near vicinity of the conveyor belt) to a depth of approximately 4 feet bgs. Contamination is not believed to be deeper *than* 4 feet in depth ( b a d on limited sampling), but samples shall be taken throughout the area of excavation during remediation to confirm concentrations in underlying soil.

TABLE 2-18

COST ESTIMATE: RAA No. 4 - EXCAVATION/BIOLOGICAL TREATMENT
SITE 19
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA

| COST COMPONENT | UNIT | QUANTITY | UNIT COST | SUBTOTAL COST | TOTAL COST | SOURCE | M I S / COMMENTS |
|---|---|---|---|---|---|---|---|
| **DIRECT CAPITAL COSTS** | | | | | | | |
| **General** | | | | | | | |
| Pre-Construction Submittals | LS | 1 | $ 20,000 | $ 20,000 | | Engineering Estimate | Work, E&S, H&S, & QC Plans; Permits; Shop Drawings |
| Mobilization/Demobilization | LS | 1 | $ 25,000 | $ 25,000 | | Engineering Estimate; Vendor Quote | Includes mob/demob for excavation/demolition subcontractors (not biological treatment subcontractors) |
| Decontamination Pad | LS | 1 | $ 10,000 | $ 10,000 | | Engineering Estimate | Includes decon/laydown area |
| Stockpile Area | LS | 1 | $ 10,000 | $ 10,000 | | Engineering Estimate | Stockpile area for contaminated soil |
| Contract Administration | LS | 1 | $ 4,000 | $ 40,000 | | Engineering Estimate | Invoicing, project management, field supervision, H&S, etc. |
| Post-Construction Submittals | LS | 1 | $ 10,000 | $ 10,000 | | Engineering Estimate | Operation manuals, record drawings, etc. |
| **General - Subtotal** | | | | | $ 115,000 | | |
| **Site Work** | | | | | | | |
| Clearing and Grubbing | Am | 0.5 | $ 3,000 | $ 1,100 | | Engr. Estimate; Means Site Work, 1995, 021-100 | Cost includes matl, labor, and equipment |
| Temporary Safety Fencing | W | 2,020 | $ 2 | $ 4,040 | | Engr. Estimate; Means Site Work, 1995, 028-320 | Assume safety fencing around all excavation areas |
| Temporary Silt Fencing | W | 1,000 | $ 1 | $ 2,000 | | Engr. Estimate; Means Site Work, 1995, 028-320 | |
| Fine Grading and Seeding (Revegetation) | SY | 2,500 | $ 2 | $ 5,000 | | Engr. Estimate; Means Site Work, 1995, 022-286 | Revegetation over all excavation areas & conveyor belt trench |
| **Silt Work - Subtotal** | | | | | $ 12,500 | | |
| **Conveyor Bdl Demolition** | | | | | | | |
| Demolition | LF | 500 | $ 30 | $ 15,000 | | Engr. Estimate; Means Bldg. Constr., 1995, Demolition | Assume $30/LF (includes labor & equipment, asbestos protection) |
| Transportation to Disposal Facility | LS | 1 | $ 15,000 | $ 15000 | | Engineering Estimate; Vendor Quote | |
| Disposal Fees | Ton | 1,000 | $ 170 | $ 170,000 | | Engineering Estimate; Vendor Quote | Assume 1,000 tons of belt debris |
| Fill for Conveyor Belt Trench | CY | 2,000 | $ 5 | $ 10000 | | Engr. Estimate; Means Site Work, 1995, A12.1-724 | Cost includes hauling, spreading, & compacting; assume half of the belt line will require backfill; fill obtained from an on-Station borrow pit (no material cost) |
| **Conveyor Belt Demolition - Subtotal** | | | | | $ 210,000 | | |
| **Soil Excavation/Backfill** | | | | | | | |
| Characterization Sampling of Areas of Concern | | | | | | | Sampling to more accurately define the AOCs to be capped |
| In Field Explosives Test Kit | Each | 20 | $ 123 | $ 2,460 | | Vendor Quote | Assume 20 samples; $123/test kit |
| Labor | Hours | 32 | $ 26 | $ 832 | | Engineering Estimate; Previous Projects | Labor=2 geo./eng. @ $26/hr, 2 days |
| Excavation | CY | 1,685 | $ 7.50 | $ 12,638 | | Engr. Estimate; Means Site Work, 1995, A12.1-414 | Cost includes 1 1/2 CY backhoe & two 6 CY dump trucks |
| Confirmatory Sampling of Excavation Areas | Sample | 35 | $ 190 | $ 6,650 | | Engineering Estimate; Baker Average 1996 BOAs | Cost includes 35 soil samples @ $171/sample (explosives analysis); labor; shipping |
| Backfilling of Excavation Areas | CY | 1,685 | $ 4 | $ 6,740 | | Engr. Estimate; Means Site Work, 1995, A12.1-724 | Assume treated soil and clean fill from an on-Station borrow pit are used for backfill (no material cost); cost includes hauling, spreading, and compacting; 20% added for small project size |
| Top Soil Over Excavation Areas | CY | 400 | $ 25 | $ 10,000 | | Engr. Estimate; Means Site Work, 1995, 022-216 | Assume 6" of top soil; cost includes matl, hauling, spreading, & compacting |
| **Soil Excavation/Backfill - Subtotal** | | | | | $ 39,300 | | |

TABLE 2-18

COST ESTIMATE: RAA No. 4 - EXCAVATION/BIOLOGICAL TREATMENT
SITE 19
WPNSTA YORKTOWN, YORKTOWN, VIRGINIA

| COST COMPONENT | UNIT | QUANTITY | UNIT COST | SUBTOTAL COST | TOTAL COST | SOURCE | BASIS / COMMENTS |
|---|---|---|---|---|---|---|---|
| DIRECT CAPITAL COSTS (Continued) | | | | | | | |
| Biological Treatment | | | | | | | |
| Treatment Fees | CY | 1,685 | $ 200 | $ 337,000 | | Engineering Estimate; Vendor Quote | Assume 20% increase in soil volume after excavation; 100 lbs/CF; cost includes mob, slurrying of soil, nutrients/additives, patented aerobic bacteria, OQM for approx. 4 months, solid-liquid separation after treatment, and demob |
| Biological Treatment - Subtotal | | | | | $ 337,000 | | |
| Treatment Residual Management | | | | | | | |
| Additional Dewatering of Slurry | CY | 1,685 | $ 7.50 | $ 12,638 | | Engr. Estimate; Means Site Work 1995, 021-404 | After treatment, the slurried soil will contain 50% moisture; further dewatering will reduce the soil's moisture content to in situ conditions so that it may be used as backfill |
| Disposal of Process Water | LS | 1 | $ 3,000 | $ 3,000 | | Engineering Estimate | Assume process water is clean and can be discharge via tanker truck a Lee Pond |
| Treatment Residual Management - Subtotal | | | | | $ 15,600 | | |
| DIRECT CAPITAL COSTS. TOTAL | | | | | $ 729,500 | | |
| INDIRECT CAPITAL COSTS | | | | | | | |
| Engineering and Design | LS | 1 | $ 43,770 | $ 43,770 | | Engineering Estimate | Assume 6% of Total Direct Capital Costs |
| Contingency Allowance | LS | 1 | $ 109,425 | $ 109,425 | | Engineering Estimate | Assume 15% of Total Direct Capital Costs |
| INDIRECT CAPITAL COSTS - TOTAL | | | | | $ 153,195 | | |
| | | | | | | | |
| CAPITAL COSTS (DIRECT AND INDIRECT) | | | | | $ 883,000 | | |
| TOTAL COST (PW) - RAA No. 4 | | | | | $ 883,000 | | |

EnSys® test kits shall be used to obtain real time data in the field. Soil having exceedences of RLs shall be removed and transported to the Site 22 biocell for biological treatment and reuse. Aluminum detected in soil around Building 527 exceeding 14,830 mg/kg (the 95th percent UCL of Station-wide background) shall be excavated to a depth of approximately 6 inches bgs (based on limited sampling). The soil shall be placed in the deeper excavated area. Clean fill shall then be placed in all areas of excavation and the area shall be regraded and vegetated to prevent erosion. The extent of 2,4,6-TNT, RDX and aluminum contamination in soil shall be determined during remediation and sampling and analysis information will be presented in the Remedial Action Work Plan.

Soil shall be treated biologically at Site 22 to the RL values used to determine the area of excavation at Site 19. The soil shall then be dewatered and used as clean fill at Site 22, not Site 19. Currently, property use is restricted by the location of the site (Site 19 is in the restricted area). Property use restrictions shall be added to the Station Master Plan to preclude future residential development of Site 19.

## 2.11 Statutory Determination

The selected remedy for Site 19 satisfies the requirements under Section 121 of CERCLA to:

- Protect human health and the environment.
- Comply with ARARs.
- Use permanent solutions and treatment technologies/resource recovery technologies to the maximum extent practicable.
- Satisfy the preference for treatment as a principle element.

### 2.11.1 Overall Protection of Human Health and the Environment

Alternative 4 will provide a significant reduction in risks to human health and the environment at Site 19 through the removal and on-site biological treatment of the soil contaminants. As such, this

alternative will provide protectiveness to human health and the environment. The potential source of contamination to other environmental media will be removed.

### 2.112 Compliance with ARARs

The selected remedy for Site 19, Alternative 4, complies with all Federal and state location and action specific ARARs as outlined below. Chemical specific ARARs or to-be-considered criterion (TBCs) are not available for soil; therefore, risk-based RLs were developed that are protective of both human health and the environment

Location-Specific ARARs

- **Archaeological Resources** Protection Act, 16 U.S.C. 470aa-mm; National Historic Preservation Act 16 U.S.C. 470 to 470 x-6

  (16 U.S.C. 432,433; 32 CFR Parts *229* and 229.4; and 36 CFR Part *800)*

  Archeological resources encountered during excavation must be reviewed by Federal and Commonwealth archaeologists. Also applies to potentially historic buildings. Building 10 and Building 527 are World War II era buildings. The WPNSTA Yorktown Environmental Directorate and Draft Historic Preservation Plan for WPNSTA Yorktown should be contacted and reviewed prior to development of the Remedial *Action* Work Plan.

- Executive Order 11990 Protection of Wetlands

  (40 CFR 6, Appendix A; excluding Sections 6(a)(2), 6(a)(4), 6(a)(6); 40 CFR 6.302)

  Action to minimize the destruction, loss, or degradation of wetlands that could be impacted by a remedial action. Although no wetlands exist at Site 19, erosion from excavation activities could migrate to Lee Pond. An erosion control plan will be established as part of the Remedial Action Work Plan.

- **Clean** Water Act, Section **404, 33 U.S.C.** 1344

  **(40 CFR 230.10; 40 CFR 231 (231.1, 231.2, 231.7, 231.8))** .

  Action to prohibit discharge of dredged or fill material into a wetland without a permit if the discharge of dredge or fill is planned as part of the remedial alternative. No material taken from either Site 19 or removed from the biocell after biological treatment will be discharged into wetlands.

Virginia Wetlands **Regulation**

**(VR 450-01-0051/4 VAC 20-390-10 et seq.)**

Regulates activities that impact wetlands. The remedial action will be undertaken in such a way as to limit potential impacts on wetlands via erosion from Site 19 during excavation and reuse of treated soil at Site *22.*

Action-Specific ARARs

- Department of **Transportation Rules** for **Hazardous Materials Transport**

  *(49* **CFR** Parts 107 **and** 171.1-560)

  Regulates the transport of hazardous waste such as IDW including packaging, shipping, and placarding for any remedial action that requires off-site treatment and disposal. This ARAR applies only to hazardous wastes sent off-site for disposal such as IDW generated during confirmation sampling. This ARAR does not apply to the transportation of contaminated soil from Site 19 to Site *22.*

- **Resource Conservation and** Recovery Act **(RCRA) Subtitle C,**

  **(42 U.S.C. 6921-6939e)**

  Applicable to any action at WPNSTA Yorktown utilizing the Site 22 biocell and any action involving treatment, storage, or disposal of hazardous waste.

- Identification and Listing of Hazardous Waste
  (40 CFR Part 261)
  Wastes hazardous by characteristic must be identified as part of the remedial action. Site 19 soil contaminated with 2,4,6-TNT and RDX is not hazardous by listing.

  Releases from Solid Waste Management Units
  (40 CFR Part 264, Subpart F)
  All units on-site will comply with substantive requirements concerning potential releases.

  Use and Management of Containers
  (40 CFR Part 264, Subpart I)
  Regulates the use and management of containers being stored at all hazardous waste facilities. Remediation may generate containerized waste, such as IDW. Alternative 4 reduces the use of containers because Site 19 soil will be treated at the Site 22 biocell. As such, containerization prior to treatment is not necessary.

  Surface Impoundments
  (40 CFR Part 264, Subpart K)
  Regulates design, operating requirements, actions concerning leakage, rates, closure, and post-closure care of the biocell at Site 22. This ARAR applies to the Site 22 biocell, in particular the specifics concerning closure and post closure care.

  Closure and Post-Closure
  (40 CFR Part 264, Subpart G)
  Concerns the applicability of closure performance standards disposal, certification of closure, and post-closure care of the Site 22 biocell. Also concerns certification of completion of post-closure care at Site 22.

- Virginia Solid Waste Management Units

  (VR 672-20-10/9 VAC 20-80-10 et seq.)

  Regulates the disposal of solid wastes and could apply to the off-site disposal of nonhazardous waste associated with the dismantling of the conveyor belt at Site 19 and grubbing activities conducted prior to soil excavation.

- Virginia Hazardous Waste Management Regulations

  (VR 672-10-1/9 VAC 20-60-10 et seq.)

  Regulates the treatment, storage, and disposal of hazardous waste.

  Identification and Listing of Hazardous Waste

  (VR 672-10-1, Part III)

  Applies to determining waste types by characteristic. Soil at Site 19 is not considered to be hazardous by listing, but may apply to IDW generated as part of the conformational sampling for aluminum, 2,4,6-TNT and RDX at Site 19.

  Releases from Solid Waste Management Units

  (VR 672-10, Part X, Section 10.5)

  Applies to owners/operators of facilities that treat hazardous waste. Regulates potential releases from all onsite solid waste management units.

  Closure and Post-Closure

  (VR 672-10, Part X, Section 10.6)

  Applies to the closure and post-closure care at the Site 22 biocell to prevent escape of hazardous waste to the environment.

  Use and Management of Containers

  (VR 672-10, part X, Section 10.8)

  Applies to Site 19 where the IDW associated with confirmational sampling may be containerized before being disposed of offsite.

Surface Impoundments

(VR 672-10, Part X, Section 10.10)

Applies to the Site 22 biocell where Site 19 soil will be treated. The Site 22 biocell should comply with substantive design and containment requirements to prevent the release of waste to the surrounding environment. Currently, the biocell is double-lined to prevent releases to the environment. Expansion of the biocell (if necessary) should also include a double liier to prevent releases from occurring.

**Virginia Erosion and** Sediment Control Regulations

**(VR 625-02-00)**

Applicable for remedial actions involving land disturbing activities. Activities including the excavation at Site 19 will have an erosion control plan submitted to Atlantic Division, Naval Facilities Engineering Command (LANTDIV) for approval.

### 2.11.3 Cost Effectiveness

Of the four "treatment" alternatives, Alternative 4 is the most cost effective. It provides maximum long-term protection of human health and the environment and short-term protection of human health and the environment with the least expenditure of funds.

### 2.11.4 Use of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected remedy is a permanent solution and uses treatment technologies to the maximum extent practicable. Contaminated Site 19 soil will be treated at the Site 22 biocell using a carbon source and microbes to destroy 2,4,6-TNT, RDX and degradation products of nitramine compounds. Clean soil will then be taken from the Site 22 biocell and used as fill at Site 22.

## 2.12 Documentation of Significant Changes

The Proposed Plan presents the selected remedy as the preferred alternative. No significant changes to the remedy have been made.

## 30 RESPONSIVENESS *SUMMARY*

The final component of this Record of Decision is the Responsiveness Summary. The purpose of this section is to provide a summary of the public's comments, concerns, and questions about Sites 9 and 19.

During the public comment period, written comments, concerns and questions were solicited. A public meeting was held on July 21, 1997 at the York County Recreational Services Building to formally present the Proposed Plan and to answer questions and receive comments. The transcript of this meeting is presented in Appendix A of this Record of Decision. All comments and concerns *concerning* the remedy have been considered by the DoN and USEPA in the selection of the remedial alternatives for Sites 9 and 19.

The responsiveness summary is divided into the following d o n s :

- Overview
- Background on community involvement
- Summary of comments received during the public comment period

### 3.1 Overview

No action is necessary at this time to protect human health and the environment at Site 9. At the time of the public meeting, the DoN endorsed a no action remedy for Site 9. The community agreed with the no action remedy.

At the time of the public meeting, the DoN also endorsed a preferred alternative for the cleanup of explosives-contaminated soil under the conveyor belt at Site 19, WPNSTA, Yorktown. The alternative required a dismantling of the conveyor belt and proper disposal and excavation of soil contaminated with 2,4,6-TNT and RDX at concentrations above RLs of 15 mg/kg and 5 mg/kg, respectively. This soil would be treated at the Site 22 biocell using a carbon source and microbes to biologically degrade 2,4,6-TNT and RDX. USEPA Region III and the Commonwealth of Virginia concurred with the preferred alternative.

The community also agrees with the preferred alternative for Site 19. An important factor in community approval is on-site treatment of contaminated soil rather than off-site disposal.

## 3.2 Background on Community Involvement

Nearby communities have a good working relationship with WPNSTA Yorktown because the Station maintains a good neighbor policy through the Public Affairs Office. WPNSTA Yorktown participates in community events and celebrations to foster close ties with the community. As part of the ongoing Community Relations Program (CRP), community interviews were conducted in 1991 to inform the community of the IR Program and solicit feedback on the listing of WPNSTA Yorktown as an NPL site. The community expressed concern about three issues: water resources, cleanup funding, and information availability/validity. This public openness has been maintained by the Public Affairs Office and the Environmental Directorate at WPNSTA Yorktown through the CRP and resulted in the formation of the RAB. The WPNSTA RAB is comprised of agency representatives, technical and business persons, and members of the community at large. The RAB meets regularly and progress at sites such as Sites 9 and 19 is discussed from the work plan stage to selection of the remedial alternative (if necessary). Preliminary Site 9 and 19 results were discussed at past and at the most recent RAB meetings. No significant comments were received for either site at these meetings.

## 3.3 Summary of Comments Received During the Public Comment Period

The Public Comment Period closed on August 13,1997. No additional comments on the proposed remedy were received by WPNSTA Environmental Directorate personnel or LANTDIV personnel and no additional comments were received during the July 21,1997 Public Meeting.

# APPENDIX A
# PUBLIC MEETING MINUTES

PUBLIC MEETING FOR THE

PROPOSED REMEDIAL ACTION FOR

SITES 9 AND 19

NAVAL WEAPONS STATION YORKTOWN

YORKTOWN, VIRGINIA

Presentation by Richard Hoff

July 21, 1997

York County Recreation Center. Meeting Room
301 Goodwin Neck Road
Yorktown, Virginia

ORIGINAL

1 PIS. PHILLIPS: Ladies and gentlemen,
2 we're going to call to order the Public Meeting to
3 review the Proposed Remedial Action for Sites 9 and
4 19 at Naval Weapons Station, Yorktown, as part of
5 their ongoing cleanup procedures, and this is under
6 the leadership of Mr. Jeff Harlow, and the contractor
7 is Baker, and our speaker is Mr. Rich Hoff.
8 MR. HOFF: Thank you. I'm not going
9 to tell you anything that you don't know. First of
10 all, I appreciate the opportunity to come down, and
11 talk to you, I'm glad the Navy and Jeff and Rick
12 asked me to come down, and glad to be here,
13 Tonight's meeting is to inform the
14 public about potential risks, and the proposed
15 remedies for Sites 9 and 19. We're trying to elicit
16 comments from the public about the proposed remedy,
17 and address any concerns that the public might have.
18 This is about the halfway point in
19 the public comment period. To that extent, we're
20 going to provide a fact sheet for the remedy at Sites
21 9 and 19. We're also going to provide a fact sheet
22 for the remedial action at Site I2 to let you-all
23 know that remediation of Area A is imminent. That
24 should be happening within the next couple of months,
25 I'll give you a little brief

1 loading operations. TNT and other explosives were
2 released to surrounding soil as either dust, or by
3 the routine spraying of the interior of the belt.
4 When dust built up inside there, it was sprayed with
5 water, and this water was allowed to drip to the
6 underlying soil.
7 Aluminum powder -- I have a typo
8 here; I tried to correct it -- was also used in the
9 loading process. Aluminum was handled and added to
10 the line at Building 527, and those buildings are
11 also outlined on the figures on the board.
12 There was an undocumented quantity
13 of soil removed, and I assume this was a voluntary
14 removal performed by the Station in 1973, 1974 prior
15 to any of the documentation processes that we use
16 currently under the IR Program.
17 MR. MARKWITH: We don't know where
18 it went, right, Rich?
19 MR. HOFF: I have no information.
20 MR. THOMPSON: County landfill.
21 MR. MARKWITH: We'll hear about that
22 later, I'm sure.
23 MR. HOFF: Just to give you an idea
24 of the investigations that have taken place at Sites
25 9 and 19, I think we have a pretty good handle on

1 After the Treatability Study
2 Characterization, we had the Round Two Remedial
3 Investigation; and the Round Two Remedial
4 Investigation focused on those areas that were
5 identified in the Round One in a Treatability
6 Characterization Sample as needing additional
7 investigation.
8 After the Round Two RI, there was
9 still some concerns about the data, being that we
10 knew we had composite samples with relatively high
11 hits, but we weren't seeing the same high hits in
12 discrete samples that we took for the Round Two RX.
13 This is simply the nature of explosives contaminated
14 media. It's sort of hit and miss-
15 Subsequent to the Round Two Remedial
16 Investigation, we then went back out with test kits
17 that delineate site areas of concern, At that time
18 we got underneath the conveyor belt. We went to
19 those areas that were hot spots in both Round One and
20 where some composites showed some potential problems
21 during the Treatability Characterization Sampling.
22 I'm going to start with the Round
23 Two Remedial Investigation. I'm not going to take
24 you back to the Round One. Some of the Round One
25 data was used for baseline risk assessment. The

1 Round Two Remedial Investigation was really the
2 backbone of the data that was used in the
3 assessments, They were conducted in September and
4 October of 1995. It's the most recent data *that* we
5 have,
6 We collected surface soil,
7 subsurface soil data, groundwater data at both Sites
8 9 and 19. At Site 9 we also collected surface water
9 and sediment from the ditch. The samples were
10 analyzed for the full sweep of contaminants. The
11 target compound list organics, TAL, or Target Analyte
12 List, inorganics, the nitromines/nitroaromatics, or
13 explosives, and cyanide. We also obtained benthic
14 macroinvertebrate samples from the sediment of the
15 Site 9 drainage area.
16 Because of the nature of that area,
17 the data was somewhat equivocal. The ditch dries up
18 from time *to* time; and as such, it really doesn't
19 provide a great habitat for collecting benthic
20 organisms. It would really depend on the time ~£. the
21 year, and we compromised with EPA about how to
22 prevent this fish sampling. We usually straddle the
23 later summer when it's a *so-so* time for both fish and
24 benthic to be present-
25 Again, Lee Pond was not

1 investigated, And most importantly, with the Round
2 Two investigation, we did a quantitative baseline
3 risk assessment that evaluated both human health and
4 ecological evaluations.
5 The Baseline Risk Assessment
6 utilized data from Round One and Round Two RIs. We
7 evaluated human receptors, both current and future
8 potential human receptors, including residents.
9 These were considered, both from an additive
10 standpoint, and individually, in that we evaluated
11 children and adults living on site; and again, we
12 also considered the most likely use of the property,
13 the commercial or industrial property use scenarios,
14 Potential residents, or future
15 potential residential exposure considered both a
16 potable use of groundwater, and a nonpotable or
17 beneficial use of the underlying aquifer. The reason
18 being that through the investigative work that we've
19 done at the Station, and also some of the work that
20 USGS has done out there, the aquifers that are
21 directly undexneath most of our sites, and those
22 would be from primarily Cornwallis Cave and Yorktown
23 Eastover, are not of sufficient quality that they can
24 be used for potable purposes without some sort of
25 pretreatment. And when I say the Upper Yorktown, I'm

1 talking about Yorktown and counties directly below
2 that clay between Cornwallis Cave and the Yorktown
3 Aquifer, probably about 30, 35 feet in depth.
4 As we go down through the Yorktown
5 Eastover, we encounter a tightening of the matexials,
6 and also yield becomes a problem in that aquifer. I
7 think if you, at least from the Station's standpoint,
8 have to go somewhat deeper to ever really want to use
9 water potability from that system.
10 In general, we considered Exposure
11 at Sites 9 and 19, there was no unacceptable human
12 health risks associated with Site 9 soil, surface
13 water, or sediment.
14 Again, from the groundwater
15 standpoint, beneficial use scenarios did not really.
16 pose unacceptable human health risks because when we
17 assume a beneficial use, we're looking at something.
18 like lawn watering, washing of cars. We don't have
19 that ingestion of two liters per day fox 25 years,
20 350 days per year. So if we do evaluate the potable
21 use of groundwater, we do have unacceptable human
22 health xisks associated with it. There are some
23 relatively low levels of explosives and volatile
24 compounds in the shallow. These attenuate somewhat
25 as we go down.

1 Again, groundwater around this area
2 will be reevaluated as we investigate the pond,
3 because one of our concerns is this groundwater could
4 discharge from Lee Pond, and we haven't adequately
5 evaluated the ecological impact associated with that.
6 Site 19 soil produced unacceptable
7 human health risks to both workers and future
8 residents. Those are the soils under the conveyor
9 belt, and also one smaller area of concern on the
10 other side of Building 97. And we're assuming just
11 from past operations, the offloading and so forth,
12 that TNT dust was able to get into that area and it
13 appears to be limited to the top six inches or so of
14 soil.
15 The Economical Risk Assessment was
16 actually conducted twice. The first time we used a
17 method that we had established sometime ago in the
18 Master Work Plan, and most recently through formal
19 partnering. We have been in consultation with the
20 EPA Biological Technical Assistance Group. We've
21 worked out new procedures for evaluating the
22 ecological risks. What we've done is we've gone back
23 to the basics, gone backs to the Draft Ecological
24 Risk Assessment Guidance, It's a 1994 document where
25 you use a very conservative screening approach with

1 relatively low numbers to evaluate your chemicals of
2 concern, and then you take a look at all the
3 potential receptors, not only terrestrial, but
4 aquatic receptors if necessary. You break ant those
5 receptors in terms of trophic development, and then
6 you conduct very conservative modeling. And so
7 you'll find this Risk Assessment in Appendix B of the
8 Final FS.
9 The kind of breakdown, the types of
10 receptors we were looking at, we looked at
11 terrestrial receptors, which included the soil
12 invertebrates; plants; robins; red-tailed hawks, and
13 short-tailed shrews; and meadow voles.
14 The aquatic receptors really applied
15 to Site 9, and it was a little bit of a stretch
16 because of the nature of the ditch. We looked at
17 fish, including the catfish. We evaluated fox
18 sediment benthic macroinvertebrates. From the
19 standpoint of comparative criteria, we didn't
20 evaluate the benthic data that we had. That data is
21 in the Final Remedial Investigation Report, but we
22 did not evaluate that in the Final FS report,
23 We use that from the standpoint of
24 evaluating what we had out there, what we expected to
25 see, but the screening for the aquatic receptors was

1 done using a comparative criteria approach, We
2 evaluated bullfrogs, and then finally the great-blue
3 herons, Again, these receptors were selected to
4 represent various trophic levels, or the food chain,
5 if you will.
6 The result of the Ecological Risk
7 Assessment indicated the presence of lead and
8 vanadium in Site 9 soils produced unacceptable risk
9 to robins and shrews. Aluminum, iron, lead and TNT
10 in Site 19 soils produced risks to the robin and
11 shrew, Aluminum also produced risk to the vole.
12 There was also one detection of iron in the Site 9
13 drainage-way that gave BTAG some concern, but that
14 sample was in one location at the bottom of the
15 drainage-way. It was also at a depth; it was at the
16 4 to 8-inch depth level. As we talked about it, the
17 concerns became less and less -- less and less
18 apparent, because we feel that at the 4 to 8-inch
19 depth interval, you're really precluding the type of
20 exposure that the model was run for, and that was the
21 model of the great-blue heron.
22 To summarize the Site 9 and 19
23 Baseline Risk Assessment, at Site 9 there were no
24 unacceptable human health risks, There was a limited
25 economical risk; and the reason we say limited is

1 that the presence of the inorganics were detected
2 sporadically. There wasn't a real source area we
3 could get our hand around and identify. And there's
4 also the limited nature of the type of exposure, The
5 iron in the sediment was deep, so the receptor that
6 was posing a risk; i.e, the heron, we don't feel
7 could really be exposed to iron at that particular
8 depth.
9 At Site 19, there were unacceptable
10 risks to both human health and the environment posed
11 by the soils underneath the conveyor belt- Aluminum
12 and lead contributed to the unacceptable ecological
13 risk. Aluminum was used again at Building 527, and
14 so along the sides of Building 527 you had some
15 aluminum hits that were greater than 95 percent UCL,
16 upper confidence level, of station-wide background.
17 And because of this, we identified that as a
18 potential area of concern in the FS.
19 The lead wasn't broken out because
20 lead really existed in the presence of the 2, 4, 6
21 TNT, and there were two or three locations along the
22 belt where the TNT was pretty high, and you also had
23 the lead. We felt that was not really a significant
24 source of lead at the site, other than the paint that
25 might have come off the conveyor belt,

1 Using the results of the Baseline
2 Risk Assessment, we went into the selection of the
3 preferred alternative, and that's what we're here
4 tonight to present and to solicit comments from
5 you-all.
6 When you do this, you go through the
7 results of the Baseline Risk Assessment, you
8 summarize those results, and then you develop some
9 general response actions, and the response actions
10 are usually broad-based evaluations of medium
11 specific responses that would satisfy remedial action
12 objectives.
13 In this case, based on the Baseline
14 Risk Assessment and formal partnering, we believe
15 that the Remedial Action Objective of Sites 9 and 19
16 is mitigating human health and ecological risks
17 associated with Site 19 soil. We call that Operable
18 Unit 6. We believe that no action is necessary to
19 mitigate risks at Site 9. One, because of the fact
20 there was no human health risk, either current or
21 future potential risk. Two, the ecological risks
22 were from the sporadic detection of inorganic
23 constituents- There was no real source area. And
24 after talking with the engineers, we felt that
25 remediation of the Site 9 soil supposed that

1 ecological risk might be more detrimental to the
2 overall environment.
3 Building off the general response
4 actions, we began to apply five general actions at
5 the Site 19 soil. One was no action. We're required
6 to evaluate that. One was institutional controls,
7 Another response action is containment. A fourth was
8 in situ treatment, and that fell. by the by for a
9 number of reasons. And the fifth was
10 removal/treatment/disposal. And you see that I've
11 sort of grouped these, because what we did, we
12 evaluated a lot of these process options using a
13 matrix approach, and that is available in the Final
14 Requests Report.
15 It shouldn't be any surprise, then,
16 that the remedial action alternative developed for
17 Site 19 were very similar to the objectives that we
18 proposed. Again, no action, because we're required
19 to evaluate no action in a baseline scenario. The
20 second remedial action alternative, or RAA 2, was no
21 action with institutional controls. The third is
22 capping. The fourth is excavation, biological
23 treatment, and then reuse or recycle of those soils.
24 The fifth was excavation, soil washing, incineration
25 of residuals that would be associated with soil

1 washing, and then reuse and recycle of the washed
2 soil, and the fifth was the gross excavation,
3 off-site incineration; i.e., the hog and haul,
4 As part of the FS, we then evaluated
5 each one of the Remedial Action Alternatives using
6 threshold criteria, balancing criteria, and modifying
7 criteria. The threshold criteria really evaluates
8 the protectiveness. You look for ARARs, applicable
9 relevant appropriate requirement, on the books out
10 there ,that would force you to take an action and
11 address it. If not, then we always look at
12 protection of human health, and then finally, last
13 but not least, the environment. Is it protective of
14 the environment.
15 Balancing criteria is sort of the
16 engineering-type of criteria, short and long-term
17 effectiveness, two, reduce the toxicity through the
18 use of the remedy. Can we implement? What's the
19 time to implement? And how much does it cost?
20 And modifying criteria, that's what
21 we're here tonight for, is to get the community
22 acceptance in our selection of the remedy, and also
23 seek state acceptance.
24 When we evaluate the threshold
25 criteria, it becomes very apparent that RAAs 3, 4, 5

1 and 6 comply with protectiveness, or we can attain
2 remediatian levels, because there are no real ARARs
3 to the soil, we developed remediation levels backing
4 *out* the baseline risk, and we used *both* the
5 ecological goals, the literature values for .toxicity
6 that were available, and also back calculation from
7 'the human health risk assessment to come up with our
8 Remediation Levels.
9 It should be no surprise that RAAs 1
10 and *2* do not really comply with threshold criteria.
11 You're not taking an action, you're precluding
12 contact with an institutional control by putting a
13 fence up or telling people don't go there, but it
14 doesn't really do anything to mitigate the overall
15 xisk that's associated with the site, specifically
16 not the ecological receptors.
17 The balancing criteria, RAA 1, *2* do
18 not result in reduction of toxicity, mobility or
19 volume of the chemicals left on site. Pence doesn't
*20* keep precipitation from infiltrating and moving
21 things around, · And they would not be effective in
*22* the short-term and the long-tern.
23 RAA 3, the capping alternative, does
24 not xesult in reduction of toxicity or volume, but it
*25* does preclude exposure. The long-term effectiveness

1 can be problematic, particularly for Jeff on the
2 station in that it's only as good as the operation
3 and maintenance of the cover, If the cover is
4 allowed to become compromised, if it's not
5 maintained, then it isn't a very protective
6 alternative.
7 RAAs 4, 5, and 6 obviously will
8 result in reduction of toxicity because we're going
9 to pick that soil up and move, we're going to take it
10 out of there, With 5 and 6, the implementability is
11 somewhat of a question because any incineration
12 technology depends on the availability of a permanent
13 facility to accept your waste. Then there's always
14 the problem of transporting the waste to that
15 location.
16 We believe that RAA4 is the most
17 implementable and cost effective because we have
18 biocell on site- We've proven through the bench
19 scale treatability studies that were conducted by
20 West, and the pilot scale treatability study that we
21 completed last year, that this is an effective
22 alternative, and cost effective as well.
23 With RAA 1 or 2, we don't believe we
24 could get the buy-in from the public. Certainly once
25 the public has read the Risk Assessment, I don't

1 think many would want us to leave the soils under the
2 conveyor belt at Site 19.
3 And Remedial Action Alternative 2,
4 putting up a fence is not going to prevent the
5 ecological risk associated with the explosives
6 contaminated soil, and it's also not going to
7 preclude the ability of these contaminants to move.
8 They can move by overland runoff and certainly
9 infiltrate the background water.
10 Again, we'll be evaluating Lee Pond
11 later on in this year. I think it would be --
12 wouldn't be very prudent to leave a potential source
13 at Site 19 and then do an investigation at Lee Pond
14 if, in fact, this could be a potential source of
15 groundwater, and ultimately an Ecological Assessment
16 needs to be done.
17 We weren't too suxe about the
18 Commonwealth of Virginia and community acceptance of
19 RAA 3. I don't think that the state would want a
20 bunch of landfills at Weapon Station, nor do I think
21 Jeff wants to be in the business of managing caps and
22 covers for the rest of his life; and, again, toxicity
23 is not reduced, and the long-term effectiveness is
24 dependent on the O & M.
25 Another problem for us with RAA 5

1 and 6 is getting any type of public buy-ins for
2 incineration technology. There is just a stigma
3 behind incineration that -- it's not insurmountable,
4 but I think when you have biological treatment, like
5 we do on-site, we can evaluate these alternatives,
6 and we can see whether or not they are cost effective
7 for us. In this case, they're not. I would say that
8 both RAA 5 and 6 were anywhere from two and-a-half
9 times to five times as costly as the alternative,
10 which is RAA 4.
11 And again, the time to implement RAA
12 4 -- well, as soon as we can get the funding done and
13 get the work plans done, we can begin to take an
14 action; whereas, with 5 and 6, we would have to,
15 again, be on-line with an off-site incinerator
16 facility that is permitted to accept the waste.
17 Again, the preferred alternative is
18 RAA 4. We're hoping we can get the buy-in from the
19 Commonwealth and from the public at large. It is
20 protective of human health, We believe it meets all
21 ARARs. And it's permanent in terms of removing
22 contaminants. We remove the toxicity by removal of
23 contaminants. It's a destruction technology. You're
24 not going to leave any residues. Even the byproducts
25 of the biodegradation are themselves degraded with

1 time. And it's implementable, and we believe it's
2 cost effective.
3 And again, to touch base, and let
4 you know the fact sheet for the Proposed Remedial
5 Action is available, as well as the Site 12 Remedial
6 Action. The public comment for this remedy at Site 9
7 and 19 closes August 13, 1997.
8 I thank you fox your time, and I'll
9 take any questions that you might have.
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1 COMMONWEALTH OF VIRGINIA
2 COUNTY OF YORK, TO-WIT:
3
4 I, ANNA M. FOX, a Notary Public in and for
5 the Commonwealth of Virginia at Large, do hereby
6 certify that the foregoing deposition was duly taken
7 and sworn to before me at the time and place in the
8 caption mentioned, and that the deposition is a true
9 record of the testimony given by the witness.
10 I further certify that I am neither
11 attorney or counsel for, nor related to or employed
12 by, any of the parties to the action in which this
13 deposition is taken, nor am I a relative or employee
14 of any attorney or counsel employed by the parties
15 hereto, nor am I financially interested in this
16 action.
17 IN WITNESS WHEREOF I have hereunto set my
18 hand and affixed my notarial seal this 25th day of
19 August, 1997.
20
21
22 Anna M. Fox
Anna M. Fox, Notary Public
23
24
25 My term of office expires: January 31, 2000,