11/1/99-00291

Draft Technical Memorandum

Ecological Risk Assessment Approach
Sites 2, 3, 4, and 5
St. Juliens Creek Annex
Chesapeake, Virginia

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Norfolk, Virginia

LANTDIV CLEAN II Program
Contract No. N62470-95-D-6007
CTOs-027 and 028

November 1999

Prepared by

CH2MHILL

CDM
Federal Programs Corporation

Draft Technical Memorandum - Ecological Risk Assessment Approach
Sites 2, 3, 4, and 5

St. Juliens Creek Annex
Chesapeake, Virginia

CTOs - 027 and 028
November 1999

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Under the

LANTDN CLEAN II Program
Contract N62470-95-D-6007

1.0 INTRODUCTION

The principal objective of this technical memorandum is to describe the technical approach to be used for conducting ecological risk assessments at Sites 2, 3, 4, and 5 on St. Juliens Creek Annex (SJC), Chesapeake, Virginia. A description of the environmental setting at the base and at each site is included to provide the necessary background information for developing the technical approach.

2.0 ENVIRONMENTAL SETTING

This section describes the environmental setting of St. Juliens Creek Annex and of Sites 2, 3, 4, and 5.

2.1 Environmental Setting of St. Juliens Creek Annex

The St. Juliens Creek Annex facility is a low-lying wedge of land between the Southern Branch of the Elizabeth River and St. Juliens Creek. Elevations range from sea level along the banks of the two bordering waterways, and along Blows Creek located in the northern part of the facility, to 15 feet above mean sea level (msl) northeast of Blows Creek. A northwest-southeast trending ridge generally bisects the area, dividing the St. Juliens Creek drainage basin to the southwest and the Blows Creek drainage basin to the northeast.

The majority of surface water runoff from the Annex flows into Blows Creek and St. Juliens Creek. Both creeks flow east to empty into the Southern Branch of the Elizabeth River. The remaining runoff from the Annex flows directly into the Southern Branch of the Elizabeth River, or is diverted into storm drains that empty either into the Elizabeth River or St. Juliens Creek. The Southern Branch of the Elizabeth River flows through a highly industrialized area, which includes oil storage and cresol facilities, and fertilizer plants. During the summer, many recreational boaters use the river, which is part of the intercoastal waterway. The river is used by larger commercial and naval craft throughout the year. The Southern Branch of the Elizabeth River flows north to discharge into the James River, which flows into the Chesapeake Bay. All of the surface waters downstream of SJC are tidally influenced.

The Commonwealth of Virginia has designated the watercourses in the area as IIB. This classification indicates water that is contaminated. Historical releases of kepone and sediment disposal from the manufacturing activities of a private company located several miles away were a major contributor to present day contamination. Class IIB waters may be used for bathing and fishing, but taking shellfish is prohibited. A water classification of IIB indicates that the fecal coliform bacteria count should not exceed the geometric mean of 200 colonies per 100 milliliters; tidal water should have a dissolved oxygen content of at least 4.0 milligrams per liter (mg/l); and have a pH range of 6.0 to 8.5

According to the 1983 National Flood Insurance Program flood maps, the 100-year flood level for at SJC is 8.5 feet above msl. The areas at the facility within the 100-year flood plain include those adjacent to St. Juliens Creek, Blows Creek, and the southern border of the South Branch of the Elizabeth River.

2.2 Site Background and Environmental Settings

The sites that will be addressed in this Ecological Risk Assessment include Site 2 (Landfill B), Site 3 (Landfill C), Site 4 (Landfill D), and Site 5 (Burning Ground). Additional information is available in the February 1998 *Work in Progress Screening Assessment.*

2.2.1 Site 2 - Landfill B

Landfill B is an inactive unlined landfill in the southwestern section of St Juliens Creek Annex. The landfill is approximately 1.5 acres in size. It is bounded to the north by a drainage ditch, parking lot and building 278/279, to the east by building 130 and a grass field, to the west by an intermittent stormwater runoff stream and Craddock Street and to the south by St. Juliens Road and St. Juliens Creek.

Operations began at the landfill in 1921 and continued until sometime after 1947. Refuse was burned onsite and used to fill in an adjacent swampy area. The refuse was reportedly comprised of garbage, acids, and waste ordnance. Blast grit from ship overhaul and repair operations was also reported disposed at this site. In 1942, an incinerator was installed and took the place of the open burning, and the landfill was closed sometime after 1947. The area has since become a swampy area that is covered with brush, trees, and grass.

The types of habitats present onsite at Landfill B include a small tidal open water area, tidal wetlands, scrub/ shrub and non-contiguous forested areas. Managed lawns are directly adjacent to Landfill B and portions of the lawns may be within the area of past landfilling activities. Each of the habitats present at Landfill B is an isolated disturbed habitat. The tidal open water area, located in the central portion of Landfill B, is approximately 0.3 acre in size. An intermittent stream located northwest of the landfill and a perennial stream located northeast of the landfill feed into the tidal open water. The intermittent stream located northwest of the landfill was noted to contain water only during rainfall events. The tidal open water is connected to St. Juliens Creek to the south via a culvert, which passes underneath St. Juliens Road. The open water area and associated wetlands consist of approximately 0.7 acre, the scrub/shrub area consists of approximately 0.6 acre, and the non-contiguous forested areas and the managed lawns each consist of 0.1 acre.

The tidal pond and the wetland area make up an open water habitat and a small estuarine emergent wetland habitat. Very little submerged aquatic vegetation is present within the tidal pond. The emergent vegetation along the edges of the tidal pond, as well as both the intermittent and perennial streams, consists primarily of smooth cordgrass and common reed. The smooth cordgrass occupies the tidally influenced area while the common reed occupies the upper fringes of the tidally influenced area. The boundary between the wetlands and the scrub/shrub habitat contained high tide bush, wax myrtle, trumpet creeper, common grape, and poison ivy in varying densities.

Scrub/shrub areas are located around the tidal pond. The composition of the scrub/shrub areas varies with elevation and the proximity to the tidal pond. Wax myrtle, high-tide bush and eastern baccharis are present near or adjacent to the water. The dryer portions of the scrub/ shrub areas associated with Landfill B are dominated by blackberry, honeysuckle, and poison ivy with some planted vegetation adjacent to the parking lot and at the intersection of Craddock Street and St. Juliens Road.

The wooded areas associated with Landfill B are located east and west of the tidally influenced pond. The western wooded area is dominated by loblolly pine. Loblolly and sweet gum are apparent co-dominants in the eastern wooded area. American elm, white mulberry, and water oak were also present in the canopy in the eastern area. The sub-canopy species include black locust, choke cherry, willow oak, holly, and saplings of the canopy trees.

2.2.2 Site 3 - Landfill C

Landfill C is an inactive unlined landfill in the northeastern section of St. Juliens Creek Annex. The landfill is approximately 7.5 acres in size and is bounded to the north and east by a gravel patrol road and a chain-link fence and by open fields to the south and west.

The area was originally a mudflat that was used as a dredge spoils disposal area. Subsequently the area was used for the disposal and burning of refuse; the resultant ash was then used to fill in the area. Operation began in 1940 and continued until 1970. Refuse disposed at Landfill C reportedly included solvents, acids, bases, and mixed municipal waste. Two pits reportedly used for disposal of oils and oily sludge, as well as for periodic burning, were also located at the landfill.

Man-made features located at the landfill include a gravel road that cuts diagonally across the landfill and a radar testing complex, consisting of a radar control tower, building and associated asphalt parking lot, which is located along the central eastern edge of the landfill. These man-made features cover approximately 0.5 acres. The habitats present at Landfill C include isolated freshwater emergent wetlands and grass fields. In total, the wetland areas comprise approximately 1 acre of the landfill while the grassland accounts for the remaining 6 acres. Both the wetlands and fields present at Landfill C are managed by periodic mowing.

There are two distinct wetland vegetative communities associated with Landfill C. One is dominated by common reed and is located along a drainage channel in the western portion of the landfill. The second wetland community type is associated with areas of poor drainage and is characterized by a more diverse assemblage of grasses, sedges, and rush. This latter emergent wetland community occurs in the central and eastern portion of the landfill.

2.2.3 Site 4 - Landfill D

Landfill D (Site 4) is approximately 8.5 acres in size and is located in the northeast portion of the Annex, approximately 600 feet south of Site 3. The site was an unlined trench and fill landfill that operated from 1970 to 1981. The first trench was approximately 1,000 feet long and was located parallel to and approximately 500 feet north of Blows Creek. Soil from subsequent trenches was used to cover previous trenches. The total number of trenches dug in the landfill is not known. An eight to twelve foot vertical drop along the western and southern perimeter topographically defines the boundary of the landfill. Various construction debris is evident along the western and southern boundaries of the landfill.

Material disposed at Site 4 reportedly included drums of unknown wastes and polychlorinated biphenyls (PCBs). According to personnel at the public works department, the PCBs probably came from ballast containers for fluorescent light fixtures. Also, previous reports have indicated that several tanks with undetermined wastes were also once located in the area.

A variety of habitats including grass fields, scrub/shrub areas, wetlands, and forested areas are found at Landfill D. The wetland and forest habitats present within Landfill D are both parts of larger contiguous habitats. The habitats within Landfill D are disturbed areas. The grass field is located in the eastern central portion of the landfill and covers approximately 2.5 acres. The scrub/shrub areas encompass 4.5 acres and border the grass field and extend to the south and east. The wetlands are located along the southern and southeastern landfill boundary and cover approximately 0.5 acre. A sudden topographic change is evident between the scrub/shrub area and the wetlands associated with the landfill. The forested area encompasses approximately 1 acre and is located in the northwestern portion of the landfill adjacent to a man-made berm. The berm extends west from Landfill D and runs parallel to Blows Creek.

The grass fields within the landfill area dominated by pioneering grass including crab grass and deer tongue. The grass area is actively maintained via mowing.

The scrub/shrub area is the dominant habitat within the landfill. Apparent dominant plants include raspberry, poison ivy, honeysuckle, and Virginia creeper. Tree of heaven, red cedar, northern catalpa, white mulberry, and sweet gum saplings also occur in the scrub/shrub area. This vegetative community extends to the southern and southeastern edge of the landfill. The sudden topographic change along the southern and eastern landfill boundary gives way to wetland vegetation.

The wetlands within the landfill area are associated with a contiguous wetland habitat along Blows Creek. The portion of wetlands within the landfill boundary is dominated by common reed, with a few high-tide bush and wax myrtle present along the southern boundary. The contiguous wetlands along Blows Creek are dominated by smooth cordgrass with a few patches of black rush within the tidally influenced area and common reed above the tidally influenced area and along stream channels feeding into Blows Creek. Small isolated freshwater wetlands, similar to the wetlands identified at Landfill C, are located just north of Landfill D adjacent to monitoring wells MW-1S and MW-1D.

The forested area at Landfill D is a small portion of a larger contiguous forested area that extends west, parallel to Blows Creek. The vegetative communities along Blows Creek are influenced by a man-made berm located along the north side of Blows Creek. The berm is the dividing line between the wetland habitat adjacent to Blows Creek and the contiguous forested area. The canopy trees in the forested area, at and west of Landfill D include loblolly pine, sweet gum, and red oak. Sub-canopy species include black locust, black cherry, choke cherry, and silver maple. Greenbrier, poison ivy, Virginia creeper, honeysuckle, and saplings of the canopy and sub-canopy trees make up the majority of the groundcover.

2.2.4 Site 5 - Burning Grounds

The Burning Grounds (Site 5) includes the former drop tower and caged pit, all of which encompass approximately two acres. The Burning Grounds are located in the northern central portion of St. Juliens Creek Annex, approximately 600 feet west of Site 3; the area of the site which includes the former drop tower and caged pit are located approximately 400 feet west of Site 3. The majority of the site is comprised of a gravel parking lot. The vegetative communities found within and adjacent to the Burning Grounds include grass fields, wetlands, and scrub/shrub areas. Forested areas are also located adjacent to the Burning Grounds. The area is bordered to the north by grass fields, to the east by a wetland, to the south by scrub/shrub vegetation and to the southwest by woods. The gravel parking lot covers approximately 1.5 acres, the wooded area approximately 0.2 acre, the scrub/shrub area approximately 0.2 acre, and the wetlands approximately 0.1 acre. The combined acreage of the caged pit and the former drop tower is less than 0.1 acre.

The Burning Grounds are believed to have operated from the 1930s to the 1970s. In 1977, the surface of the area was burned with oil and straw, diced, and burned again, in an effort to decontaminate the soil. Wastes disposed at the Burning Grounds included ordnance materials such as black powder, smokeless powder, explosive D, Composition A-3, tetryl, TNT, and fuses. Non-ordnance materials reportedly included carbon tetrachloride, trichloroethylene (TCE), paint sludges, pesticides, and various types of refuse.

The caged pit (Site 6) is located within the investigative area of the Burning Grounds and was used as a pit to burn small arms (including igniters and fuses). No surface evidence of the existence of the pit currently remains.

The dominant physical feature of the site, the gravel parking lot, is located in the northern and central portion of the Burning Grounds. The scrub/shrub area surrounds the parking lot; the dominant vegetation of this area includes wax myrtle and black willow, with sweet gum and loblolly pine also being evident. The ground cover within the scrub/shrub area contains poison ivy, raspberry, greenbrier, and honeysuckle. Loblolly pine and sweet gum dominate the woods, which are located along the southwestern border of the Burning Grounds. Wetlands are located within the site along the eastern boundary and are dominated by common reed with some wax myrtle and black willow along the wetland boundary. Both the caged pit and the former drop tower are located in grass fields, similar to the vegetation described for Site 3, Landfill C.

The offsite area surrounding the Burning Grounds includes grass fields with freshwater emergent wetlands to the north, a wetland dominated by common reed to the east, and a forested area to the south and east. The latter forested area is the western portion of the forested area described in *Subsection 2.2.3 Site 4 - Landfill D*. The vegetative structure of the grass fields and freshwater emergent wetlands north of the Burning Grounds are similar to those previously described for Landfill C. The most evident difference between the wetlands in these areas is that the wetlands north of the Burning Grounds occur along stormwater drainage channels, rather than just depressions. East of the reed-dominated wetland is another wooded area dominated by loblolly pine. The understory vegetation included choke cherry, white mulberry, sassafras, red oak, sweet gum, and red maple. This forested area is contiguous with the forested area adjacent to Blows Creek.

3.0 PRELIMINARY CONCEPTUAL MODEL

Figure 1 provides a preliminary conceptual model for Sites 2, 3, 4, and 5. This model outlines potential sources of contaminants, transport pathways, exposure media, potential exposure routes, and potential receptor groups. This conceptual model will be used to structure the screening Ecological Risk Assessment (ERA) and will be revised, as appropriate, during the screening ERA (Steps 1 and 2). It may also be revised during any other subsequent steps of the ERA process (e.g., Steps 3a and 3b through Step 7, USEPA 1997, US Navy 1999, and Olson 1999)

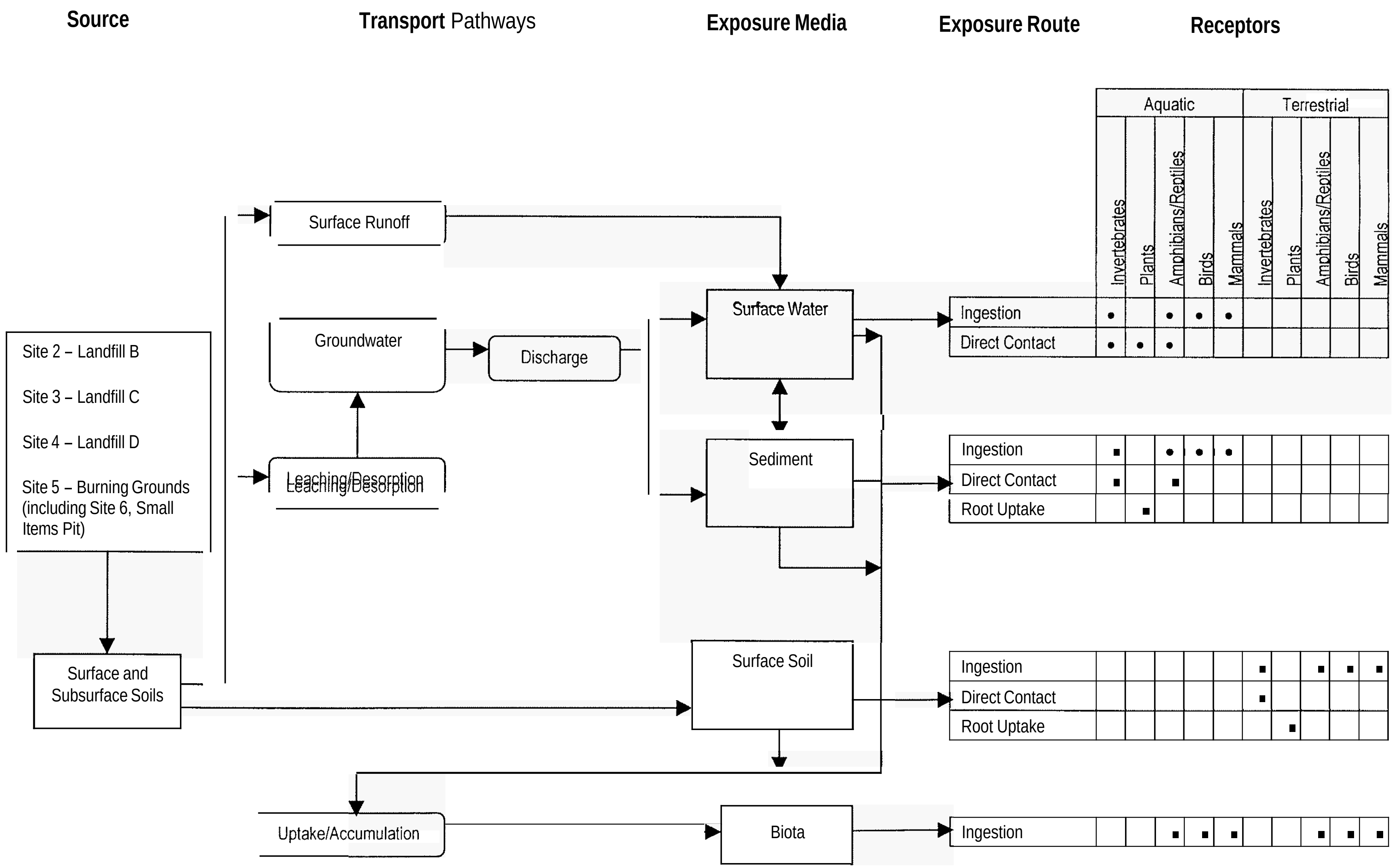

FIGURE 1- PRELIMINARY CONCEPTUAL MODEL
St. Juliens Creek **Annex** – Landfills B, C, and D and Burning Grounds

that may be necessary at an individual site. Endpoints will be developed to augment this model as part of the screening ERA.

At present, all of the sites have potentially complete exposure pathways to ecological receptors (Figure 1) that will require at least a complete screening ERA (Steps 1 and 2 of the process).

4.0 SUMMARY OF SITE ECOLOGICAL ACTIVITIES

Remedial Investigation (RI) of the sites was conducted in 1997. The resultant Draft RI reports were submitted to LANTDIV in February 1998, as was the *Work In Progress* document for the ecological risk assessments for the sites. The *Work In Progress* document was subsequently reviewed by EPA Region III and VaDEQ. The document included tables presenting the results of the screening exposure estimates and risk calculations that were performed.

In December 1998 representatives of the Navy, EPA Region 111, the National Oceanographic and Atmospheric Administration (NOAA), and the U.S. Fish and Wildlife Service (US FWS) participated in a meeting in which the findings to date and proposed future activities were discussed. Supplemental work plans, designed to assist in defining the nature and extent of contamination at the sites, were discussed.

As a result of the meeting it was determined that sediment and surface water samples from St. Juliens Creek and Blows Creek would be collected from reference locations to allow for the determination of contamination gradients in the water bodies. It was also agreed that the proposed onsite supplemental investigations, with refinements to the sampling locations, should proceed and that a more detailed ecological risk assessment framework should be developed for review.

Based on the findings presented in the Draft RI Reports and the *Work In Progress,* as well as the discussions in the December 1998 meeting, additional sampling of the sites was conducted in the late Spring and early Summer of 1999. Additional surface water sampling is scheduled to be completed in Fall 1999.

The *Work In Progress Screening Assessment* included "direct screening" and bioaccumulation exposure screening. In the direct screening for each site the maximum detected chemical concentrations in each media sampled during the RI were compared to the EPA Region III BTAG Screening Levels (August 9,1995 Revision). If the maximum concentration detected in the site media was greater than the most conservative applicable BTAG screening value, or if no screening value existed, the chemical was retained and evaluated in a bioaccumulation exposure screening. The bioaccumulation exposure screening was performed utilizing highly conservative inputs in an exposure model that resulted in a maximum potential exposure. The exposure values were subsequently compared to conservative toxicological thresholds to evaluate whether a chemical posed a potential risk and should be retained for further evaluation. The results of the screening assessment are summarized below.

4.1 Results of Screening for Site 2

The direct screening for Site 2 resulted in the identification of metals, pesticides/PCBs, and semivolatile organics in surface soils, subsurface soils, and sediment at levels of potential concern. Screening of the surface water results indicated the presence of inorganic compounds and bis (2-ethylhexyl)phthalate at levels of potential concern; groundwater screening analysis indicated the presence of only inorganics at levels of potential concern.

Subsequent bioaccumulation exposure screening of the Site 2 data indicated that both the maximum and mean concentrations of the contaminants detected on site posed potential risk to a variety of receptor species. The receptor species that were evaluated for Site 2 included the muskrat, bullfrog, short-tailed shrew, robin, great blue heron, red-tailed hawk, bass, woodcock, raccoon, red fox, and deer mouse. As indicated by Hazard Quotient (HQ) values greater than one, all of the species evaluated, except for the bass, faced potential risk due to the maximum concentrations of the compounds detected in onsite samples. In general, the majority of the risk was attributable to the presence of the metals and pesticides. PAHs were also relatively significant contributors to the risk to the raccoon.

4.2 Results of Screening for Site 3

The direct screening for Site 3 indicated the presence of metals, pesticides/PCBs, and semivolatile organics in surface soils and sediment at levels of potential concern. In the subsurface soils, this screening indicated potential risk associated with only metals and semivolatile organics.

Modeled exposure doses to the short-tailed shrew, robin, red-tailed hawk, woodcock, raccoon, red fox, and deer mouse were subsequently calculated utilizing the Site 3 data. The comparison of these values to comparable toxicological threshold values indicated that both the maximum and mean concentrations of the contaminants detected on site posed potential risk to the receptor species. In general, the majority of the risk was attributable to the presence of the metals. DDT was also a contributor to the risk to the avian receptors.

4.3 Results of Screening for Site 4

The direct screening for Site 4 resulted in the identification of metals, pesticides/PCBs, and semivolatile organics in surface soils and sediment at levels of potential concern. Screening of the surface water results also indicated the presence of inorganic compounds at levels of potential concern.

Bioaccumulation exposure screening of the Site 4 data indicated that both the maximum and mean concentrations of the contaminants detected on site posed potential risk to a variety of receptor species. The receptor species that were evaluated for Site 4 included the muskrat, short-tailed shrew, robin, red-tailed hawk, bass, woodcock, raccoon, red fox, and deer mouse. As indicated by Hazard Quotient values greater than one, all of the species evaluated faced potential risk due to the maximum concentrations of the compounds detected in onsite samples. In general, the majority of the risk was attributable to the presence of the metals. For the shrew Aroclor-1260 and several PAHs (fluoranthene, phenanthrene, and pyrene) also contributed to the risk. Aroclor-1260 was also a contributor to the risk posed to the raccoon, fox, and mouse. Fluoranthene and pyrene were also minor contributors to the risk posed to the mouse.

It should also be noted that screening analysis of the analytical results from a sample taken from a monitoring well located downgradient of Sites 3 and 4 indicated presence of copper and bis (2-ethylhexyl)phthalate at levels of potential concern.

4.4 Results of Screening for Site 5

The direct screening for Site 5 resulted in the identification of metals, DDD, DDE, DDT and semivolatile organics in surface soils, subsurface soils, and sediment at levels of potential concern. Screening groundwater results indicated the presence of a limited number of inorganics (copper, lead, nickel, silver and zinc) at levels of potential concern.

Subsequent bioaccumulation exposure screening of the Site 5 data indicated that both the maximum and mean concentrations of the contaminants detected on site posed potential risk to a variety of receptor species. The receptor species that were evaluated for Site 5 included the short-tailed shrew, robin, red-tailed hawk, woodcock, raccoon, red fox, and deer mouse. As indicated by Hazard Quotient values greater than one, all of the species evaluated, faced potential risk due to the maximum concentrations of the compounds detected in onsite samples. In general, the majority of the risk was attributable to the presence of the metals. DDD, DDE, and DDT were also relatively sigruficant contributors to the risk to the robin, red-tailed hawk, and woodcock.

5.0 TECHNICAL APPROACH TO THE ERA

This section documents the technical approach to the ERA. The approach outlined below addresses both the screening ERA (Steps 1 and 2 of the ERA process) and the baseline ERA (Steps 3 through 8 of the ERA process). A baseline ERA will be conducted at an individual site only if the results of the screening ERA warrant (US Navy 1999).

As discussed in Section 4, screening assessments have been conducted for Sites 2, 3, 4, and 5 at SJC. The results of these assessments were presented in the February 1998 *Work In Progress Screening Assessment* Subsequent to the submittal of this document, supplemental investigations were proposed, approved, and are currently being implemented. The data from these investigations, along with the RI data utilized for the *Work In Progress Screening Assessment*, will be used for the ERA.

5.1 Screening ERA

The screening ERA will include site descriptions, nature and extent of contamination, contaminant fate and transport mechanisms, mechanisms of toxicity, exposure pathway evaluation, revised preliminary conceptual model (including endpoints and potential receptors), exposure estimates (food chain), and screening-level risk calculations. A discussion of the uncertainties associated with the screening ERA will also be included in the screening ERA report as will site-specific conclusions based on the results of the screening ERA.

5.1.1 General Objectives of the Screening ERA

The general objectives of the screening ERA are:

- To screen individual sites to determine if additional ecological risk assessment is warranted (beyond Steps 1 and 2 of the USEPA ERA guidance) or to eliminate specific sites from further consideration.
- To screen the receptors, media, and chemicals at individual sites to determine if additional evaluation is warranted or to eliminate them from further consideration.

- To identify any data gaps that may require the collection of additional data.

5.1.2 General Methodology for the Screening **ERA**

The proposed approach to achieve these objectives is as follows:

- Individual sites will be evaluated in separate screening ERA documents which will be performed concurrently. The screening ERAs for individual sites will be consolidated for reporting purposes; any additional data collection deemed necessary will also be coordinated among sites as appropriate. However, individual sites may follow different schedules after completion of the screening ERA as appropriate to the results and recommendations of each screening ERA and the resulting risk management decisions.

- Site assessments will consider on-site and perimeter data first; evaluations will continue downgradient as results warrant. Results that may indicate the need to proceed further downgradient include downgradient samples that exceed screening values and / or a trend of increasing contaminant concentrations.

- Sites may be considered collectively in later stages of the assessment if they are sources to similar downgradient areas. This will be decided on a case-by-case basis.

- The data table will include reporting limit range, frequency of detection, maximum contaminant concentration detected, sample ID of maximum concentration detected, arithmetic mean, standard deviation, screening values, frequency of exceedance, and maximum hazard quotient. This table will be formatted similar to the tables developed for the Tier II Ecological Workshop.

5.1.3 Media and Existing Analytical Data Considered in the Screening **ERA**

The media and analytical data to be considered in the screening ERA are described in the following subsections.

5.1.3.1 Media

- The media to be included in the assessment are surface soil (0 - 6 inches), groundwater, surface water, and surface sediment.

5.1.3.2 Analytical Data

- Analytical data are expected to be available for each site and all of the media noted above. TCL / TAL metals data will be available for all environmental samples. Dioxin data is also available for representative samples collected in areas where burning activities occurred historically. All of this data will be used in the screening ERA.

- All data to be used in the screening ERA are validated. Where warranted, unvalidated data may be considered on a qualitative basis.

- In general, only data from the remedial investigation sampling conducted at a site for each chemical group will be considered. For groundwater and surface water, samples from the most recent one-year period will be considered to account for potential seasonal variation. Data from geoprobe sampling and temporary groundwater wells will not be considered.

- Surface soil or sediment data collected prior to any major physical disturbance (such as capping or dredging) will not be used in the screening ERA.
- For surface soil, samples collected from depths up to 6 inches will be used preferentially. Data from deeper depths (e.g., 0 to 12 inches) will be considered if surface soil data are limited.
- For sediment, samples from depths of 0 to 6 inches are preferred. Samples from depths of 0 to 12 inches will be considered if shallower data are unavailable or limited.
- For surface water and groundwater, total (unfiltered) metal concentrations will be used during the initial screening.
- The rationale for selecting the specific samples used in the assessment of each site will be provided. The locations of the selected samples will be shown on figures included in the draft screening ERA report.
- Data gaps will be identified on a site-by-site basis and additional data collection activities will be proposed where data gaps exist.

5.1.4 Step 1 Screening Values

The screening values proposed for use in Step 1 of the screening ERA are described below.

- Medium-specific screening values will be used during Step 1 of the screening ERA based on the following hierarchy:
  - LANTOPS Alternate Screening Values developed as part of the Norfolk Naval Ship Yard (NNSY) assessment, as tentatively approved by the EPA Region III BTAG, will be used as part of the screening ERA. BTAG approval of these values will be confirmed prior to their use.
  - LANTOPS Alternate Screening Values developed for this assessment as replacements for a specific BTAG Region III Screening Level or for chemicals for which BTAG Region III Screening Levels are unavailable. The rationale for the use of the alternate screening values will be provided.
  - BTAG Region III Screening Levels will be considered where available for specific media and analytes.
- If available prior to the beginning of the screening ERA, the revised set of BTAG Screening Levels (currently under development by USEPA) will be considered for use.
- All screening values that differ from Region III BTAG Screening Levels and which have not been previously approved by the regulators will be submitted (along with the rationale for their use) to the regulators for concurrence prior to their use in the screening ERA.

- Screening values will be adjusted, where appropriate, based on modifying factors such as hardness or total organic carbon.
- Where appropriate, total undiluted groundwater concentrations in perimeter wells will be compared to surface water screening values to provide a conservative assessment; the surface water screening values to be used (freshwater or marine) will be matched to the type of water body to which the groundwater would likely discharge to. Dilution factors and dissolved concentrations (for metals) may be considered in subsequent steps of the ERA to provide a more realistic estimate of exposure.

5.1.5 Step 2 (Food Chain Model) Considerations

- Not all detected chemicals will be evaluated in Step 2 of the ERA (food chain exposures). Only chemicals which exceeded the Step 1 screening values will be evaluated in this step. A separate technical memo will be provided outlining this "Step 2" list of chemicals and the rationale for its derivation.
- Exposure estimates for Step 2 (food chain) will be based on conservative bioaccumulation factors developed from the literature. A default factor of 1.0 will be used when data are unavailable for a chemical in the literature.
- The receptor species used in the screening ERA will be selected to represent only complete exposure pathways identified in the conceptual model. No effort will be made to evaluate all possible pathways. It is anticipated that the receptor species evaluated in the *Work In Progress Screening Assessment* will be re-assessed utilizing the 1999 supplemental RI data.
- Only conservative assumptions will be used (i.e., area use factor of one, maximum ingestion rate, minimum body weight, maximum media concentration).

5.1.6 Results of the Screening Process

The results of the screening ERA will be used to evaluate the status of each individual site in terms of potential ecological risk. Following the screening ERA, possible decision points are (1) no further action is warranted; (2) further action is warranted; (3) further data are required; or (4) take remedial action. These possible decision points are described in more detail below.

- No further action is warranted. This decision is appropriate if the screening ERA indicates that sufficient data are available on which to base a conclusion of no unacceptable risk.
- Further evaluation is warranted. This decision is appropriate if the screening ERA indicates that there is the potential for unacceptable risks for some pathways, receptors, and chemicals. In this instance, the ERA would progress to Step 3 wherein the risk estimates would be refined based on more realistic and site-specific assumptions and data.
- Further data are required. This decision is appropriate if the screening ERA indicates that there are insufficient data on which to base a risk estimate. This decision may also be appropriate if the potential for unacceptable risks is identified

following the screening ERA and additional data to refine these estimates (e.g., additional analytical data, measures of bioavailability, etc.) are needed for Step 3.

- Take remedial action. This decision may be appropriate for sites in which the potential for unacceptable risks was identified following the screening ERA but these potential risks could best be addressed through remedial action (e.g., presumptive remedy, soil removal) rather than additional study.

Recommendations pertaining to these possible decisions will be made for each site as part of the draft screening ERA report.

5.2 Baseline ERA

If the results of the screening ERA suggest that further ecological risk evaluation or data collection is warranted for a particular site, the ERA process would proceed to the baseline ERA which is a more detailed phase of the ERA process (Steps 3 through 8).

5.2.1 General Methodology for the Baseline ERA

The first activity of the Baseline ERA is the refinement of the risk estimates from the screening ERA (Step 3a). Potential risk estimates will be refined using a focused conceptual model based on more realistic and site-specific exposure assumptions, site-specific data, and/ or detailed literature review. The focused conceptual model will include refined assessment endpoints, exposure pathways, and risk questions or hypotheses. The Step 3a evaluation may also include considerations of background and sample detection frequency. At the conclusion of Step 3a, data are evaluated for each assessment endpoint to determine if the uncertainties associated with the refined risk estimates for the site are acceptable to proceed to risk characterization (Step 7) or whether the uncertainties are unacceptable and require site-specific studies (Steps 4 through 6).

The specific actions that would need to be taken to continue the development of the baseline ERA based on the refined risk estimate are not known at this time and will not be known until the completion of the refined assessment. If it is decided that site-specific studies are required, these studies will be identified during the completion of Step 3 (Step 3b), the project planning and study design / verification phase of the Baseline ERA. During this phase the required elements of Steps 4 through 6 will be developed.

Step 7 (Risk Analysis, Characterization, and Conclusions) consists of the documentation and synthesis of the information and data identified in Steps 1 through 6. In this step, risk is evaluated and characterized using both quantitative and qualitative methods. Conclusions are made on whether or not there is a reasonable potential for unacceptable ecological risk at the site, and if there is a potential for ecological risk, the magnitude of that risk.

5.2.2 Results of the Baseline ERA Process

Possible decision points based on the results of the baseline ERA are evaluated in Step 8 of the process and involve risk management decisions. Possible decision points include:

- No further action is warranted. This decision is appropriate if the baseline ERA indicates that there is no reasonable potential for unacceptable ecological risk within acceptable uncertainty.

- Evaluate the need for remedial action. This decision is appropriate if the baseline ERA indicates that there is a reasonable likelihood for unacceptable ecological risks within acceptable uncertainty. Whether or not remedial actions are taken will depend upon a number of risk management factors such as the results of any human health risk assessments and the potential impact of the remedial action itself on the habitats and biota present on the site.

Recommendations pertaining to these possible decision points will be made for each site as part of the draft baseline ERA report for those sites for which a baseline ERA is warranted.

6.0 REFERENCES

Olson, D.L. (Department of the Navy, Office of the Chief of Naval Operations). 1999. Letter to H. Sokolowski of the U.S. Environmental Protection Agency, Philadelphia, Pennsylvania. 22 June.

US. Environmental Protection Agency (USEPA). 1997. *Ecological risk assessment guidance for Superfund: process for designing and conducting ecological risk assessments.* Interim Final. EPA/540/R-97/006.

U.S. Navy / U.S. Environmental Protection Agency Region III BTAG (US Navy). 1999. *Tier II Summary Sheet of Navy Ecological Risk Assessment Process.* June.