1216

United States Environmental Protection Agency Statement of Basis For Corrective Action At Solid Waste Management Unit #02/11 (Dye Burial Grounds) Naval Surface Warfare Center Crane, Crane, Indiana

Introduction

This Statement of Basis (SB) was prepared to satisfy requirements of the Resource Conservation and Recovery Act (RCRA) Corrective Action process. This process is designed to identify sites that are known to be, or may be, hazardous to human health and the environment and to propose and implement remedies for correcting unacceptable environmental conditions. This introduction describes the site to which this SB applies, the environmental conditions at the site, and the action that is proposed to ensure future protection of human health and the environment.

Facility Name and Description

This SB applies to the Dye Burial Grounds (DBG), located in the east central area of Naval Surface Warfare Center (NSWC) Crane (Figure 1). NSWC Crane is located in a rural, sparsely populated area in the south central region of the state of Indiana. Most of NSWC Crane is forested, and the surrounding area is wooded or farmed land.

NSWC Crane manufactures, renovates, and tests equipment, shipboard weapons systems, and ordnance for the United States Navy. More detailed physical and operational descriptions of NSWC Crane and the DBG are provided in Section 1.0 of the RCRA Corrective Measures Study (CMS) Report (TtNUS, 2005) and in the text below.

The DBG is listed as Solid Waste Management Unit (SWMU) #02/11 in the NSWC's RCRA permit. However, it is commonly referred to as SWMU 2 or the DBG (Figure 2).

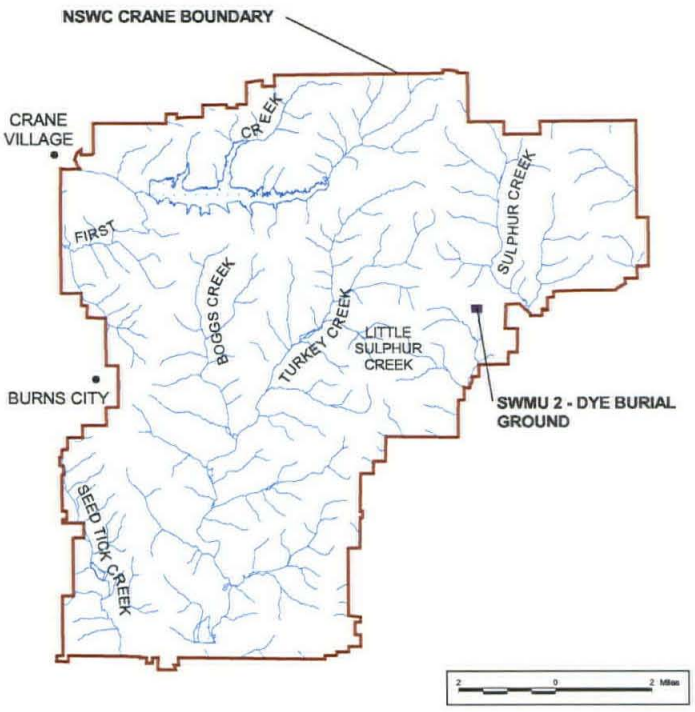

Figure 1: Location of DBG at NSWC Crane

Purpose of Document

This Statement of Basis:

- Is a mechanism and basis for gathering public comments for selection of a remedy to correct unacceptable environmental conditions that exist at the DBG.
- Summarizes information that can be found in greater detail in the RCRA Facility Investigation (RFI) and CMS reports and other documents contained in the Administrative Record for NSWC Crane.
- Describes DBG contaminants and the proposed RCRA Corrective Action remedy at NSWC Crane. The SB also explains the rationale for selecting this remedy from among other possible remedies.
- Describes all remedies evaluated in the process of selecting the proposed remedy.
- Provides information on how the public can be involved in the remedy selection process.

Importance of Public Comment

The "public" includes the general public, the owner or operator of NSWC Crane, and other parties (e.g., public interest groups and regulatory agencies). Because of a

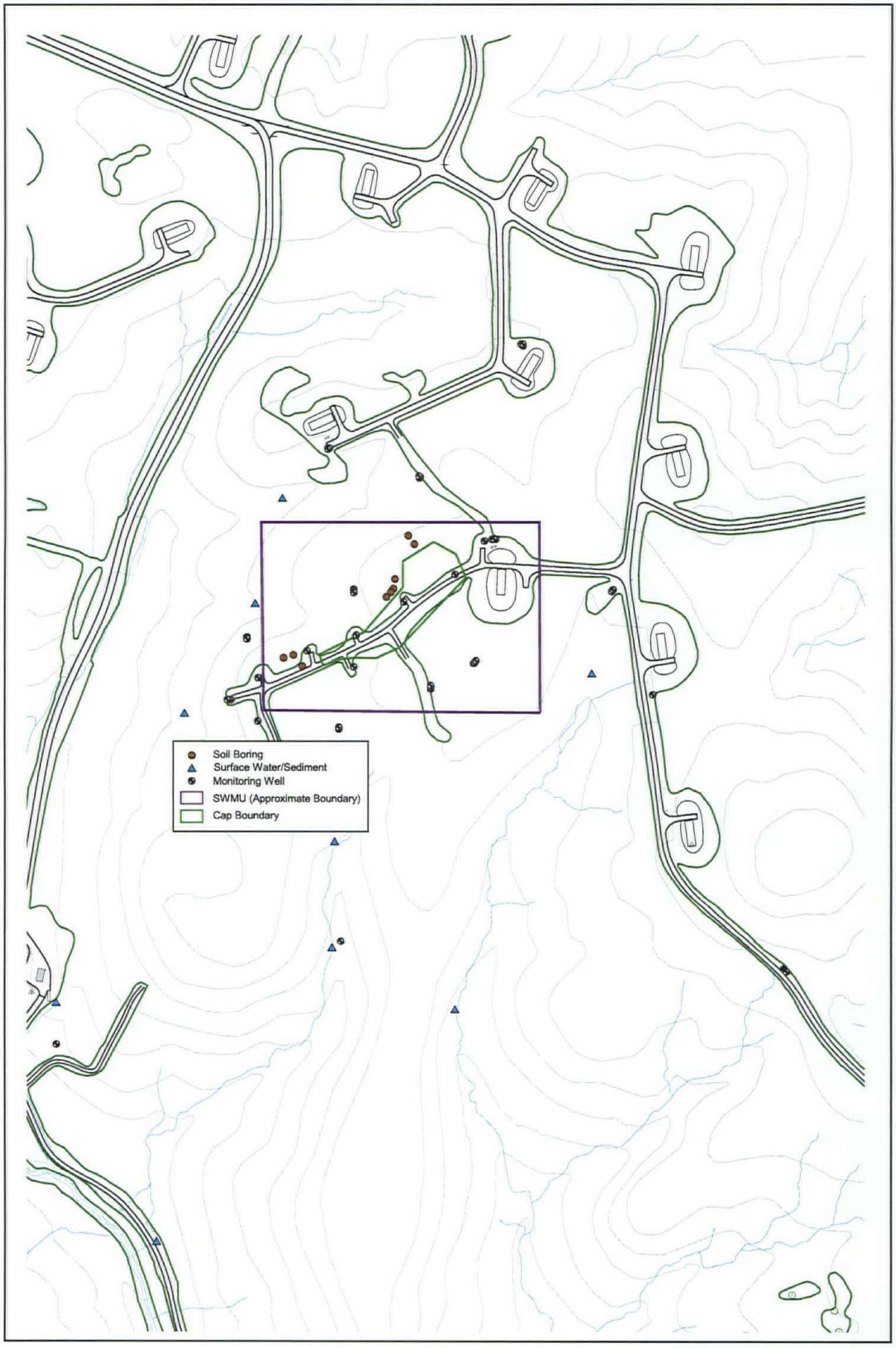

Figure 2: Dye Burial Grounds

slight potential for exposure of the public to DBG contaminants, the public may have an interest in understanding the environmental conditions at the DBG and the relationship of the proposed or alternate remedies to correcting the environmentally unacceptable conditions. The United States Environmental Protection Agency (EPA) may modify the proposed remedy or select another remedy based on new information or public comments. Therefore, the public is encouraged to review and comment on all alternatives.

Facility Background

Description of NSWC Crane Dye Burial Grounds

Figure 1 shows the location of the DBG, which is approximately 12.4 acres in size and surrounded by hilly terrain. The DBG lies approximately 500 feet southwest of the crest of a north-northwest trending ridge that separates Sulphur Creek from Little Sulphur Creek (LSC). Sulphur Creek and LSC are two of seven primary creeks that carry surface water from the NSWC Crane facility and eventually drain into the East Fork of the White River and then to the Wabash River to the southwest. No aquatic habitats have been identified at SWMU 2. The closest NSWC Crane property boundary is approximately one-half mile to the east of the DBG.

An estimated 25 tons of military smoke dyes and dye-contaminated materials (e.g., magnesium, boxes, and rags contaminated with dyes) were deposited in trenches at the DBG from 1952 to 1964. To prevent the spread of contaminants caused by rain percolating through the buried waste, a 4.2-acre multilayered cap of engineered materials and soil was constructed over the trenched portion of the DBG from 1996 to 1998 as an interim remedial measure.

Natural unconsolidated overburden materials and fill comprise the shallow subsurface at the DBG. Silt and clay mixtures underlie this fill or exist at the ground surface where fill is absent. The maximum fill thickness is approximately 10 feet, and fill extends downward to the bedrock surface. Groundwater at SWMU 2 is not currently being used.

Various species of mammals (e.g., white-tailed deer, coyotes, rabbits, and mice) and various bird species (e.g., ducks, geese, wild turkey, and American robins) live or forage at the DBG. The DBG bird population may include a number of threatened species, endangered species, or species of special concern although direct evidence of these species inhabiting the DBG has not been found to date. These species include the bald eagle, osprey, sharp-shinned hawk, red-shouldered hawk, broad-winged hawk, black and white warbler, hooded warbler, and the worm-eating warbler (TtNUS, 2005). The Indiana bat, an endangered species, may live or forage at SWMU 2.

Investigations Conducted at the DBG

Various investigations were conducted at the DBG from 1981 to 1986 as part of multi-SWMU investigations. The Initial Assessment Study (IAS) began in April 1981. The IAS concluded that the DBG did not present an immediate human health or environmental threat; however, further study at the DBG was recommended (NEESA, 1983). An RFI Phase II Groundwater Assessment was performed from 1987 to 1990 (U.S. ACE, 1991). The RFI Phase III groundwater release characterization commenced in October 1990. In 1991, a geophysical investigation was conducted to delineate the boundaries of the dye burial trenches and to identify buried anomalies. These investigations culminated with the installation of the multilayered cap to prevent migration of contaminants caused by infiltrating rain water (Figure 3). During cap construction, outlying disposal trench/waste areas were excavated and placed under the capped area. Figure 4 (page 4) depicts the burial trench locations relative to the approximately 4.2-acre capped area.

Figure 3: Dye Burial Ground Cap

In late 1997 during cap construction, dye-contaminated water was observed in the cap construction area, primarily in the northeastern and northwestern areas. This seepage, caused by inadequate controls for managing precipitation runoff, is no longer a problem now that the cap is in place. The dye-impacted water was determined to be non-toxic and the water was collected and then discharged into a sanitary sewer manhole located in the east central portion of the facility.

In 2001, additional RFI Phase III field activities were conducted at SWMU 2 with objectives as follows:

- To refine estimates of the nature and extent of contamination.
- To evaluate human health risks.

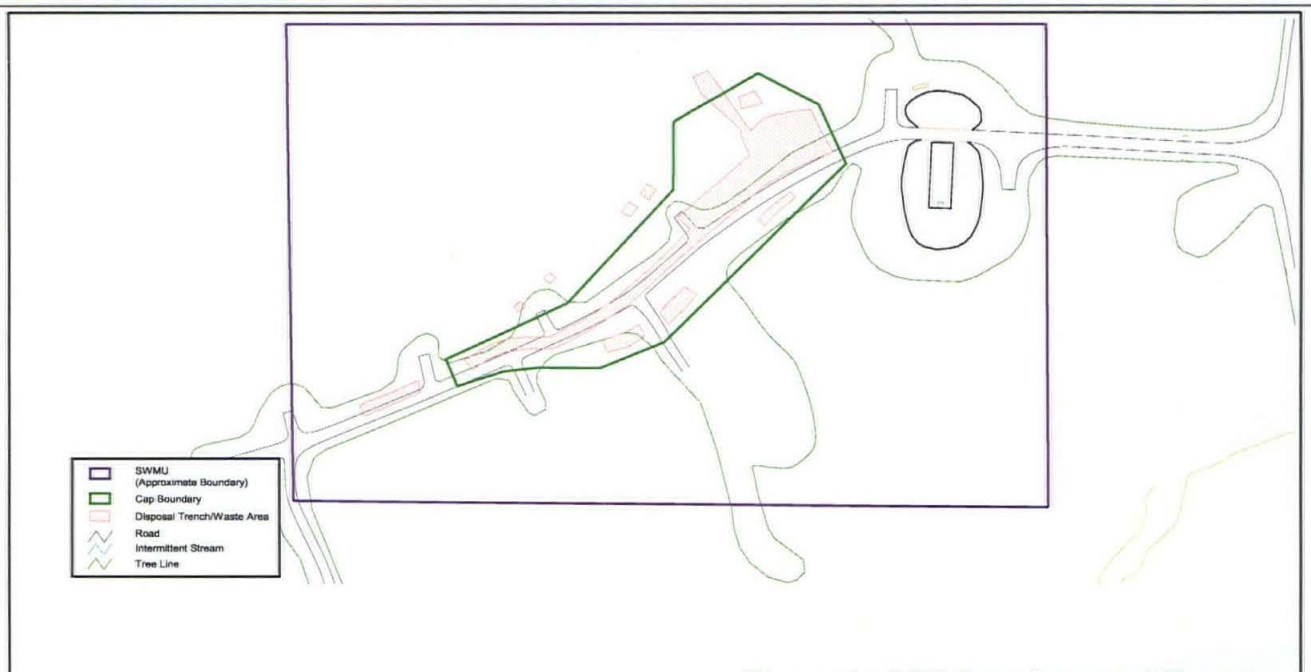

Figure 4: DBG Boundary and Trenches

- To estimate risks to the environment.
- To determine whether the cap placed over the trenches is preventing chemical contaminant migration.

At the outset of the RFI, an analytical method was developed specifically to detect dyes known to have been buried at the DBG and to quantify the dye concentrations in soil and water. Samples of soil, surface water, sediment, and groundwater were collected from outside the perimeter of the cap. Groundwater samples were also collected from below the capped region. An RFI report (TtNUS, 2004) was completed to describe the nature and extent of contamination and the results of the human health and ecological risk assessments. Dyes were not detected in any of the surface soil, groundwater, surface water, or sediment samples collected during RFI Phase III sampling in 2001. Two organic dyes (Acid Orange 10 and Acid Yellow 23) were detected in 6 of 20 subsurface soil samples collected at depths ranging from 3 feet to 11 feet below ground surface (bgs) outside of the capped area. All dye concentrations detected in subsurface soil samples were less than 12 milligrams per kilogram (mg/kg). This is low compared to concentrations that would represent a potential problem, as is described below. The available data indicate that SWMU 2 has had little impact on environmental media with respect to dyes. An absence of dye detections in groundwater samples demonstrates that dyes are not migrating in detectable concentrations from subsurface soils. The cap has evidently prevented migration of dyes from underneath the cap to areas outside the cap by preventing precipitation from percolating through the capped soil.

Metals concentrations in DBG surface and subsurface soil were found to be similar to background concentrations and thus indicate that SWMU 2 operations have not caused metal concentrations in soil to increase. While some elevated metal concentrations were detected in SWMU 2 groundwater (at one well only), the available evidence indicates that groundwater is not contaminated with metals as result of SWMU 2 operations. Some of this evidence the lack of physical connection between the elevated groundwater concentrations and the organic dyes that were disposed at SWMU 2. Additional evidence is the knowledge that the highest metals concentrations were observed at the monitoring well that had the lowest pH measurement. The low pH conditions, which were concluded to be naturally occurring, result in dissolution of naturally occurring metals, thus increasing their concentrations. The elevated metal concentrations were therefore not attributed to site operations (TtNUS, 2005).

Summary of DBG Risks

Human health and ecological risk assessments were performed to quantify non-cancer and cancer risks posed by site contaminants to humans and other organisms (TtNUS, 2004). No significant cancer-related risk was identified for humans, and no significant risk at all was identified for plants or animals. The cancer-related human health risks were within the EPA acceptable risk range of 1×10^{-6} to 1×10^{-4} incremental lifetime cancer risk. The worst non-cancer-related risks (3.8 for a hypothetical future adult resident and 13 for a hypothetical future child resident) exceeded the E acceptable Hazard Index (HI) range of 0.0 to 1.0 but other non-cancer risks were within the acceptable range. Although dyes were detected in soil, the elevated

non-cancer health hazard would be caused primarily by exposure to aluminum, cadmium, cobalt, and nickel when drinking the groundwater. The elevated metals concentrations appear to be the result of natural leaching of metals from bedrock. Discounting the elevated metal concentrations in the well that had the lowest pH and, especially, preventing domestic groundwater use, would result in acceptable levels of non-cancer risk. Based on this and after consideration of likely land use scenarios, the actual risks posed by DBG metals are estimated to be very low. The implementation of land use controls to prevent exposure to groundwater will ensure that the actual risks are acceptable.

Scope of Corrective Action

Based on the conclusion that the elevated metals concentrations are believed to be naturally occurring and that groundwater beneath SWMU 2 would not be used as a potable water source in the future, the metals aluminum, cadmium, cobalt, and nickel were removed from the list of chemicals of concern (COCs) for SWMU 2. As a result, the only remaining COCs at SMWU 2 are the military dyes.

Remediation objectives for contaminated soils are as follows:

- Prevent human and ecological exposure (ingestion, dermal contact, and dust inhalation) to dye contaminated soils having concentrations greater than the United States EPA) Preliminary Remediation Goals (PRGs).
- Prevent leaching of contaminants to groundwater.
- Comply with chemical-specific, location-specific, and action-specific limits and guidance.

For some dyes, it was possible to calculate preliminary soil concentrations (i.e., Risk-Based Target Levels, or RBTLs) that represent the lower limit of concentrations that cause unacceptable risks. The calculated values, adopted as media cleanup standards (MCSs) for SWMU 2 are shown in Table 1. For other dyes, similar values could not be computed because there is not enough information about the dyes to support such calculations. These dyes have "—" in place of numerical values in Table 1. Of the two detected dyes, Acid Yellow 23 has an MCS of 49,000,000 µg/kg and the maximum concentration was much less (i.e., 12,000 µg/kg); the Acid Orange 10 maximum concentration was 4,200 µg/kg which is much less than the 150,000 mg/kg MCS. Consequently, the dye-contaminated soil is considered not to cause unacceptable risk. Bulk dyes have a greater potential toxicitiy than dyes adsorbed to soil because they have a higher dye concentration. The bulk dyes, however, are expected to remain under the cap with the dye-contaminated soil and will only migrate to other locations if carried by water. The bulk dyes are protected from water by the cap and much of the dyes are in containers (e.g., drums).

TABLE 1

MEDIA CLEANUP STANDARDS FOR MILITARY DYES ANALYZED IN SOIL
SWMU 2 - DYE BURIAL GROUNDS
NSWC CRANE
CRANE, INDIANA

Dye	Preliminary Risk-Based Target Levels - Human Health[1] (µg/kg)	Preliminary Risk-Based Target Levels - Ecological[1] (µg/kg)
Acid Blue 1	760,000	10,000
Acid Blue 9 -	380,000,000	1,630,000
Acid Blue 45	380,000,000	1,630,000
Acid Red 64	---	---
Acid Yellow 3	3,100,000	129,000
Acid Yellow 23	49,000,000	11,475,000
Acid Yellow 73	950,000	2,000
Acid Orange 10	150,000	6,460
Basic Violet 10	950,000	12,000
Basic Yellow 2	100,000	1,300
1-Aminoanthraquinone	14,700	---
2-Aminoanthraquinone	14,700	---
Disperse Blue 14	490,000	42,000
Disperse Red 9	490,000	42,000
Disperse Violet 1	490,000	42,000
Solvent Green 3	125,000	108,000
Solvent Orange 3	1,000,000	129,000
Solvent Orange 7	1,200,000	52,000
Solvent Red 1	1,200,000	52,000
Solvent Red 24	1,200,000	52,000
Solvent Yellow 2	110	26,000
Solvent Yellow 3	130	---
Solvent Yellow 14	760,000	3,230
Solvent Yellow 33	3,100,000	129,000

[1]Values taken from TtNUS, 2004.

Action Alternatives Evaluation Process

Corrective action evaluations began with a relatively large number of possible technologies that might be applicable at the DBG. The list of technologies was rapidly reduced to a "short list" of actions considered to be practical and cost-effective. These remaining actions were evaluated in detail. All corrective actions that were considered are described in the CMS report (TtNUS, 2005). The "short-listed" actions are:

Alternative No. 1 – No Action. The No Action alternative maintains the site as is and is retained to provide a baseline for comparison to other alternatives. This is not an active action that would reduce contaminant concentrations.

Alternative No. 2 - Land Use Controls and Groundwater Monitoring. This alternative includes two main components: (1) Land Use Controls (Site Monitoring, Institutional Controls, and Engineering Controls) and (2) Groundwater Monitoring. Site monitoring would be conducted through regular inspections to check the continued compliance with institutional and engineering controls and to verify the proper operation and/or continued integrity of whatever remedial system or structure might be in place. Institutional controls would consist of formulating and implementing site-specific controls that would prohibit disturbance of the existing cap, control future site development, and restrict groundwater use. Engineering controls would consist of installing and maintaining a fence to control site access and maintaining the existing cap. Groundwater monitoring would consist of collecting and analyzing groundwater samples from monitoring wells located upgradient and downgradient of the existing burial ground cap as well as within the capped area itself. The analytical data would be used to evaluate site conditions, especially contaminant concentrations. The controls and inspections would be implemented and enforced by NSWC Crane with oversight from the Indiana Department of Environmental Management (IDEM). NSWC Crane would be responsible for submitting regularly scheduled reports on site conditions to EPA. The objective of this corrective action would be to warn of groundwater contamination from dyes underneath the cap and to protect the public and the environment by prohibiting groundwater use and inappropriate use of the site.

Alternative No. 3 - Excavation and Off-Base Disposal. An area of soil approximately 1.6 acres in size that is contaminated with dyes in excess of the MCSs would be excavated to a depth of 6 to 12 feet bgs. This corresponds to a total volume of approximately 31,000 cubic yards of material to be excavated, including approximately 16,000 cubic yards of cap material and 15,000 cubic yards of contaminated soil and fill material beneath the cap. The excavated material, which would be likely to contain drums of dyes, drainage pipes, and other such debris, would be transported to an off-base permitted facility for disposal. It is assumed that the excavated soil would be non-hazardous and would be disposed in a RCRA Subtitle D type landfill. Samples of the excavated material would be collected and analyzed to ensure that it complies with the landfill permit.

Cost Evaluation

There is no cost associated with Alternative 1; comparative estimated costs (in terms of what they are worth today) for Alternatives 2 and 3 are presented in the following table:

Cost Item	Alternative 2	Alternative 3
Present-Worth[1]	$119,000	$2,609,000

[1]The present value (or worth) of an investment is the total amount that a number of future payments is worth now, in today's dollars.

Consideration was given to factors such as the level of effort required to monitor and evaluate the monitoring data, as well as the cost of excavating and disposing of excavated material. Brief details of the evaluation process and the factors that were considered are presented below, and greater details are provided in the CMS Report (TtNUS, 2005).

Other Considerations

Cleanup standards tend to change over time and so does the availability of new technologies that are more effective than current technologies for cleaning up contaminants. Other factors such as land use may also change. Therefore, the details of monitoring such as the actual monitoring concentration limits will be established during the design of the final remedy that is accepted by EPA and the public. These details will be incorporated into the Corrective Measures Implementation work plan. This is where the design of the remedy and the measures by which it is judged to be effective will be described.

Evaluation of Proposed Remedy and Alternatives

The process used to evaluate the three alternative corrective actions is described below.

Remedy Evaluation Criteria

The alternative corrective actions were evaluated using specific criteria set forth by the EPA, (EPA, 1996) as follows:

- Protection of human health and the environment
- Attainment of MCSs
- Control of release sources
- Compliance with applicable standards for waste management
- Other factors including:
  - Long-term reliability and effectiveness
  - Reduction in toxicity, mobility, and volume of wastes
  - Short-term effectiveness
  - Implementability
  - Cost

In addition, the following criteria were evaluated.

- Potential for regulatory acceptance
- Potential for community acceptance

Details of these evaluations are provided in the CMS Report (TtNUS, 2005).

Proposed Remedy and Rationale for Selection

Alternative 1 would not be sufficiently protective of human health and the environment because it would not prevent potential future exposure to contaminated soils under the cap. Additionally, Alternative 1 would not warn of potential migration of groundwater contaminants. This alternative, however, is always evaluated during a CMS as required by EPA to provide a point of reference for evaluating the cost-effectiveness of other alternatives.

Alternative 2 would be protective of human health and the environment because it would prevent potential future exposure to contaminated soil and warn of potential migration of soil contaminants to groundwater.

Alternative 3 would be more protective than Alternative 2 by completely eliminating rather than merely controlling the potential future exposure to contaminated soil and potential migration of soil contaminants to groundwater. Alternative 3 would also be more protective because this alternative alone would attain the cleanup goals. However, Alternative 3 would merely relocate contaminated soil rather than treating and destroying the contamination, and there would also be a risk of spreading dyes that would have to be addressed through special containment measures. Treating and destroying the contamination were evaluated as part of Alternative 3 but these options were found to be infeasible or too costly to be of practical value.

After considering the criteria presented above, the proposed Corrective Action remedy is to continue monitoring site conditions at the DBG and implement land use controls at the site. This remedy will ensure that controls are in effect to prevent human exposure to site contaminants. With these controls in place, exposure potential is extremely low. The regular collection of additional data will monitor whether contaminants are migrating from soil to groundwater. In the unlikely event that contaminants are migrating, their movement will be detected, and additional corrective measures can be taken, if necessary. The monitoring data will provide information useful for ensuring that land use controls remain effective.

There are two approaches for controlling exposure to residual chemical contamination - engineered controls and institutional controls, collectively referred to as land use controls. Engineered controls include fences and caps (such as pavement or building slabs) that prevent exposure or access to contaminated areas. Institutional controls are non-physical legal mechanisms that control land use and activities. The purpose of an institutional control can be two-fold - to prevent damage to engineered controls or remedies and/or to prevent adverse human or environmental interaction with residual contamination.

The proposed remedy was selected for the following reasons:

- Unacceptable risks were identified only for hypothetical future residents of the DBG; however, residential land use at the DBG is unlikely in the foreseeable future. The DBG is part of NSWC Crane, which has a history of more than 50 years as a military base, and is expected to remain a military base for decades into the future. Therefore, the estimated unacceptable risks are minor and do not require additional immediate action. The risks can be controlled under the proposed remedy.

- The proposed remedy is a cost-effective means of protecting human health and the environment while gathering more data to assess future site conditions to verify that the implemented remedy is protective of human health and the environment.

The proposed remedy (Alternative 2) would require long-term land use controls and monitoring. Furthermore there would be no immediate threat to human health and the environment, and costs would be much less than those for Alternative 3. Because the foreseeable land use will not change from the current use and because risks are manageable through land use controls, Alternative 2 is the most cost-effective remedy. If, at any time, it is determined that the existing burial ground cap, land use controls, and monitoring are not sufficient to effectively protect human health and the environment, a more active approach such as that presented and evaluated as Alternative 3 would be considered.

The remedial design document will describe in detail the remedy performance criteria and decision framework for concluding that the proposed remedy is effective or not within acceptable timeframes. In addition, land use controls implementation details will be described in the design document.

Land Use Control Objectives

In conjunction with Alternative 2, it will be necessary to protect human health by implementing land use controls. The land use control objectives are as follows:

- Prevent access to and/or use of groundwater within the SWMU boundary until MCSs (cleanup goals) are met.
- Maintain the integrity of any current or future remedial system or monitoring system (cap and monitoring wells).
- Prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds.

Public Participation

Comments on this Statement of Basis (proposed remedy) will be taken for 30 days. The commencement and conclusion date of the 30-day comment period will be posted on the NSWC Crane website (www.crane.navy.mil/newscommunity/Envir_RAB_default.asp). Members of the public may submit written comments to the U. S. EPA regarding the proposed remedy. Comments may either be submitted by email to CRAN_RAB@navy.mil or by mail to:

Peter Ramanauskas
United States Environmental Protection Agency – Region 5
77 West Jackson Boulevard (DW-8J)
Chicago, IL 60604

Written comments concerning this proposal should include the name and address of the writer and the supporting relevant facts upon which the comments are based. Written comments received will be summarized and responses provided to all persons on the facility mailing list. Written comments should be submitted via email or postmarked by the end of the comment period.

A copy of this Statement of Basis, which is part of the NSWC Crane Administrative Record, is available at the following locations indicated in the table at the top of the next column.

Persons interested in reviewing the RFI report, the CMS report, or report summaries, and the justification for the proposed remedy (recorded in this Statement of Basis), may view these documents at the U. S. EPA office listed above or on compact disk at the Bedford Public Library.

Location	Hours of Operation
United States Environmental Protection Agency – Region 5 77 West Jackson Boulevard 7th Floor File Room Chicago, IL 60604	8:00 AM to 4:00 p.m. Monday - Friday (excluding federal holida[illegible] By appointment: (312) 886-6173
Bedford Public Library 1323 K Street Bedford, IN 47421 (812) 275-4471	9:00 AM to 8:00 PM Monday -Thursday 9:00 AM to 5:00 PM Friday and Saturday 1:00 PM to 5:00 PM Sunday

In addition, text only versions of the Statement of Basis, along with the text of the Executive Summaries from the RFIs and CMS reports are available at the NSWC Crane web site.

References

NEESA (Naval Energy and Environmental Support Activity), 1983. Initial Assessment Study of Naval Weapons Support Center, Crane, Indiana, NEESA 13-003, May.

TtNUS (Tetra Tech NUS, Inc.), 2004. Resource Conservation and Recovery Act (RCRA) Facili[illegible] Investigation (RFI) Report for SWMU 2 - Dye Bur[illegible] Grounds, Naval Surface Warfare Center, Crane Division, Crane, Indiana, October

TtNUS, 2005. Resource Conservation and Recovery Act Corrective Measures Study Report for SWMU 2 - Dye Burial Grounds, Naval Surface Warfare Center, Crane Division, Crane, Indiana Revision 2, February.

U.S. ACE (United States Army Corp of Engineers), 1991. Draft Geology, Hydrology, and Phase III Ground-Water Quality Assessment of the Dye Burial Grounds, Naval Weapons Support Center, Crane Indiana. Prepared by U.S. Army Engineer, Waters Experiment Station for the Department of Navy, Northern Division, Naval Facilities Engineering Command, Philadelphia, PA. IN5 170 023 498, January 11, 1991.

U.S. EPA (United States Environmental Protection Agency), 1996. Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater At CERCLA Sites, Final Guidance, Guidance Document 9902.3-2A, RCRA Corrective Action Plan, Office of Solid Waste and Emergency Response (OSWER), U.S. Environmental Protection Agency, Washington, DC 20460, EPA 540/R-96/02[illegible] PB96-963508, October.