



DEPARTMENT OF THE NAVY
CRANE DIVISION
NAVAL SURFACE WARFARE CENTER
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N00164.AR.000996
NSWC CRANE
5090.3a

IN REPLY REFER TO
5090/S4.7
Ser 0592/5363
5 DEC 1991

U.S. Environmental Protection Agency, Region V
Waste, Pesticides, & Toxics Division
Waste Management Branch
Corrective Action Section
77 West Jackson Blvd.
Chicago, IL 60604

Dear Mr. Ramanauskas:

Crane Division, Naval Surface Warfare Center (NSWC Crane) submits the proposal for remedy streamlining as enclosure (1). The purpose of the proposal is to facilitate the Corrective Action process when, at the end of the investigative phase, the remedial options are limited and obvious, thereby expediting the remedy implementation. The permit required Certification Statement is provided as enclosure (2).

If you require any further information, my point of contact is Mr. Thomas J. Brent, Code 0592-TB, at 812-854-6160, email thomas.brent@navy.mil.

Sincerely,

JAMES M. HUNSICKER
Manager, Environmental Protection
By direction of the Commanding Officer

Enclosures: 1. Remedy Selection Process Streamlining Proposal
2. Certification Statement

Copy to:
ADMINISTRATIVE RECORD
SOUTHNAVFACENGCOM (Code ES31) (w/o encl)
IDEM (Doug Griffin)
TTNUS (Ralph Basinski) (w/o encl)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

SIGNATURE

Manager, Environmental Protection

TITLE

12/03/05

DATE

**PROPOSAL FOR STREAMLINING
REMEDY SELECTION PROCESS
FOR
SOLID WASTE MANAGEMENT UNITS
NAVAL SURFACE WARFARE CENTER CRANE, INDIANA**

NOVEMBER 2005

1.0 Background

- Naval Surface Warfare Center (NSWC) Crane is a fenced military installation controlled by the Navy.
- NSWC Crane survived the Base Realignment and Closure (BRAC) process and will remain a military installation for the indefinite future.
- Foreseeable uses of NSWC Crane land are military.
- Residential land uses are likely to pertain only in very limited areas, none of which are located in Solid Waste Management Units (SWMUs).
- Industrial land use predominates at NSWC Crane.
- Unique topography generally prevents future groundwater (GW) contaminant plume migration at NSWC Crane SWMUs.

2.0 RFI Investigations

Resource Conservation and Recovery (RCRA) Facility Investigations (RFIs) have been completed for several SWMUs at NSWC Crane. The human health risk assessments (HHRAs) and ecological risk assessments (ERAs) addressed the full spectrum of land uses and plausible receptors. In multiple cases recommendations were made for evaluation of remedial measures due to excess risks/hazards for receptors exposed as the result of one or more land uses. Examples are presented in Table 1. These evaluations consistently resulted in the following remedial recommendations:

- Implement land use controls to prevent exposure of human or ecological receptors to site contaminants.
- Institute groundwater monitoring to verify that site conditions do not change in a way that increases the identified levels of risk.

Furthermore, because of similarities among NSWC Crane SMWU geology, aquifer characteristics, contaminants, land uses, etc., it is expected that these same conclusions will be reached for other SWMUs.

3.0 EPA Expectations Regarding Remedy Selection

EPA Region 5 has published a document titled "*Risk Management Strategy for Corrective Action Projects EPA Region 5 RCRA*" (EPA, 2005). Section 3 of that document addresses remedy selection to achieve site-wide risk management goals. Attachment 3 describes EPA's expectations for corrective action remedies. These expectations are summarized as follows:

- (1) Use treatment and address principal threats wherever practical and cost effective.
- (2) Return usable groundwater to maximum beneficial use wherever practicable. Where not practicable plume migration should be minimized/prevented.
- (3) Use engineering controls for wastes which can be reliably contained, pose relatively low long-term risks, or for which treatment is impracticable.
- (4) Use a combination of methods (e.g. treatment, engineering and institution controls) to achieve protection of human health and the environment.
- (5) Institutional controls are primarily a supplement to engineering controls and not often the sole remedial action.
- (6) Consider the use of innovative technologies.
- (7) Remediate contaminated soils to prevent or limit direct exposure of human and environmental receptors and prevent transfer of unacceptable contaminant concentrations to other media.

The EPA guidance calls for a two-part remedy evaluation phase. The first part is screening against threshold criteria (protectiveness of human health and the environment, attainment of media cleanup standards (MCSs), source control, and compliance with all other applicable standards). The second part is evaluation of long-term reliability and effectiveness, reduction of toxicity, mobility, or volume of wastes; short-term effectiveness, implementability, cost, community acceptance, and state acceptance.

4.0 Proposal for Streamlining the Remedy Selection Process at NSWC Crane

NSWC Crane has completed or is in the process of completing several CMSs. This process is time and resource consuming and could be accomplished in a more efficient manner given the unique circumstances of NSWC Crane. EPA allows for compressing the RFI/CMS processes into a shorter time period than that required to complete separate RFIs and CMSs (EPA, 1998). The intent is to maximize efficiencies of site characterization and remedy selection while still being protective of human health and the environment (EPA, 1998).

A proposal for streamlining the remedy selection process is described below to meet the following objectives:

- Establish reasonable uses for SWMUs
- Prevent exposure of human or environmental receptors to unacceptable risk levels where possible
- Prevent/minimize contaminant plume migration where a GW contaminant plume exists
- Prevent/minimize migration of contaminants from soils to groundwater
- Restore aquifers to beneficial uses where possible
- Identify measures necessary to attain uses and meet objectives

Establish reasonable uses for SWMUs: The RFI process is based on the assumption that a full panoply of uses may occur including residential. As discussed previously, NSWC Crane is a military facility, has survived the BRAC process, and will remain a military facility for the foreseeable future. At the SWMUs being evaluated only industrial uses will occur. Residential uses will not occur. Therefore, the only uses are those necessary for industrial / military purposes. These include the industrial worker, construction worker, trespasser, and in the case of surface water bodies, off-site use as a drinking water source.

Prevent exposure of human or environmental receptors to unacceptable risk levels: Remedies must prevent unacceptable exposure. Unacceptable exposures can be prevented by actions such as source removal, treatment, and LUCs.

Prevent/minimize contaminant plume migration where a GW contaminant plume exists: In almost all cases plumes at NSWC Crane have migrated as far as physically possible. In most cases this occurs as a result of topography because the contaminant sources are located on topographic highs and groundwater discharges to surface water bodies downgradient of these sources. Hydraulic pressure gradients prevent migration beyond streams. The major issue in regards to plumes is whether the plume is adversely impacting uses of surface water bodies.

Prevent/minimize migration of contaminants from soils to groundwater: It is reasonable to consider source removal in cases where it is known with some degree of confidence that soil sources impacting groundwater can be identified. However, in some cases at NSWC Crane (e.g. Ammunition Burning Grounds) it has not been possible to determine the distribution of contamination between the soil overburden and the bedrock. In such cases the effectiveness of source removal cannot be determined. Also, the existence of karst systems and fractured bedrock, virtually precludes any effective in-situ treatment of sources in bedrock. Contaminated

material and soil and removal and construction of engineered controls has already been accomplished at NSWC Crane in numerous locations. Examples include the following

- SWMU 1 (Mustard Gas Burial Grounds) – Pre-RCRA removal of buried material
- SWMU 2 (Dye Burial Grounds) – Construction of cap
- SWMU 3 (Ammunition Burning Grounds) – Prior to implementation of the IR program, the ash pile was removed, the dewatering units and associated USTs were removed, and the burning process was changed from burning directly on the ground and in open trenches to burning in lined pans and on pads.
- SWMU 7 (Old Rifle Range) – Voluntary Interim Measure for removal of TNT-contaminated soils
- SWMU 10 (Rockeye) – Treatment of explosive-contaminated soils.
- SWMU 12 (Mine Fill A) – Treatment of explosive-contaminated soils
- SWMU 12 (Mine Fill A Battery Disposal Site) – Removal of lead-contaminated soils.
- SWMU 13 (Mine Fill B) – Removal of explosive-contaminated soils.
- SWMU 16 (Cast High Explosive Fill / B-146 Incinerator) – Removal of incineration residuals and other contaminated soils

Restore aquifers to beneficial uses where possible: Restoration of aquifers to beneficial uses should be considered in cases where the beneficial use may actually occur. However as noted above, beneficial uses of groundwater at NSWC Crane SWMUs will not occur because of the military / industrial uses which will be occurring for the foreseeable future. In several cases the contaminated groundwater could not be used for drinking water because of low yields. Dry or slow recharge wells have been a consistent problem during groundwater monitoring at NSWC Crane. In most cases, it is not realistically possible to restore aquifers to beneficial uses, within a reasonable time frame or costs because of unknown contaminant distribution between overburden and bedrock and the matrix bedrock at NSWC Crane. The ABG is a classic example. The eastern edge of the site exhibits solution enlarged fracture flow. The central and western portions of the MTA has flow components in small fractures in the bedrock. The Army Corps of Engineers attempted to install pump and treat wells but was unable to produce enough flow in the wells to pursue an effective pump and treat system.

Identify measures necessary to attain uses and meet objectives: Remedy evaluations will be conducted to protect the reasonable uses that are identified.

4.1 Discussion

The following discussion points indicate for each of the objectives listed above how a standardized strategy can be used to address many NSWC Crane sites.

- Prevention of exposures to contaminants can easily be accomplished through land use controls in many cases.
- In general, groundwater plumes are topographically and hydraulically limited in extent. Past investigations have shown that GW contaminant plumes at many sites are not expanding or cannot expand beyond streams or other barriers, thus limiting the extent of environmental impact.
- Soils have been removed at several sites to limit or remove the potential for continued transfer of contaminants from soil to groundwater.
- NSWC Crane GW aquifers are expected to return to usable condition over an extended time period because natural attenuation has been shown to be occurring. The rates of natural attenuation vary from site to site but continued monitoring can be used to ensure that contaminant concentrations continue to decrease.
- Reasonable land uses for NSWC Crane SWMUs are expected to remain industrial. Exposure of off-site receptors is possible in some cases but this is evaluated on a SWMU by SWMU basis. In most cases off-site receptors are not exposed to SWMU contaminants or the exposure is incidental and very limited (e.g., for trespassers).
- The measures necessary to attain identified land uses and meet objectives or any remedial strategy can be attained through land use controls and, where effective and practicable, continued monitoring.

4.2 Proposal

The Navy proposes to evaluate NSWC Crane SWMUs to determine whether they meet the conditions implied by the discussion points in Section 4.1. In particular, the following criteria will be evaluated for each site. If the preponderance of data indicates that the site meets all or most of the criteria, the site will be considered amenable to an accelerated remedial action process involving land use controls and, if warranted, continued monitoring:

- The site is controlled by the Navy and will continue to be controlled by the Navy for the foreseeable future (i.e., at least 10 years).

- Offsite impacts from site-related contaminants are negligible or can be controlled through interim measures (IMs) and/or land use controls (LUCs).
- Migration of contaminants can be controlled through interim measures or other short-term remedies and/or land use controls (LUCs)
- LUCs can be used to prevent or limit to acceptable levels any exposure of current receptors under the identified plausible land use scenarios.
- Based on current scientific knowledge, site conditions will not change in the foreseeable future to cause an increase in human health or ecological risks.
- If GW monitoring is deemed to be warranted, such monitoring can be implemented.
- If at any time the Navy plans to relinquish control of a SWMU property and contaminant levels are projected to be unacceptable at the time of transfer, or a monitoring program indicates that increased levels of risk are likely to occur to any plausible receptor under the identified land uses, the Navy will re-evaluate the remedial strategy.
- Sites where contaminant removal has occurred, especially in contaminant source areas, will be favored for this remedial strategy.

Three examples are provided to illustrate how the streamlined approach is proposed to be applied for SWMUs 3, 5, and 7. Table 2 provides a summary of remedy evaluation process for SWMU 3. Attachment 1 provides a summary of the remedy evaluation process for SWMU 5 (Old Burn Pit). Table 3 provides a summary of the remedy evaluation process for SWMU 7.

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5.0 References

EPA. 1996. Presumptive Response Strategy and Ex-situ Treatment Technologies for Contaminated Groundwater At CERCLA Sites, Final Guidance, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, DC 20460, Directive 9283.1-12, EPA 540/R-96/023PB96-963508, October.

EPA, 1998. RCRA, Superfund, and EPCRA Hotline Training Module, Introduction to: Superfund Accelerated Cleanup Model, updated February.

EPA, 2005. Risk Management Strategy for Corrective Action Projects EPA Region 5 RCRA Program, United States Environmental Protection Agency Region 5 Waste, Pesticides, and Toxics Division. May.

ATTACHMENT 1

SYNOPSIS OF RFI / REMEDY EVALUATION PROCESS

OLD BURN PIT (SWMU 5)

NSWC CRANE

SYNOPSIS OF RFI / REMEDY EVALUATION PROCESS
NOVEMBER 29, 2005
OLD BURN PIT (SWMU 5)
NSWC CRANE

1: SWMU 5 RFI

The SWMU 5 RFI considered the full spectrum of uses, media, and receptors, without consideration as to the reasonably anticipated current and future land uses (and associated receptors). Overall the SWMU 5 RFI:

- Evaluated all of SWMU 5
- Considered all media
- Considered current receptors (industrial, trespasser, and ecological)
- Considered future receptors (construction worker, recreational user, maintenance worker, and resident)
- Contained the following recommendations for no further action (NFA)
 - Future Maintenance Worker – NFA
 - Future Recreational User – NFA
 - Current / Future Trespassers (Adolescent) – NFA
 - Mammals and Birds (surface water and sediment) – NFA
 - Aquatic Organisms (surface water and sediment) – NFA
- Contained the following recommendations for further action (proceeding to CMS)
 - Future Construction worker (soil) - CMS to evaluate hot spot removal of soil (Sb)
 - Future Adult Resident (surface soil, surface water, and sediment) - Proceed to CMS for soil (Sb) and ground water (dioxins/furans and Mn)
 - Future Child Resident (surface soil, surface water, and sediment) – Proceed to CMS for soil (Sb and Fe) and groundwater (dioxins / furans and Mn)
 - Terrestrial Plants / Invertebrates – Proceed to CMS for surface soils (Sb, Ba, Cd, Cr, Cu, Fe, Pb, Ag, Sn, and Zn)
 - Mammals and Birds - Proceed to CMS for surface soils (dioxins, Cd, Cr, Cu, Pb, Hg, Ag, and Zn)

In summary, the RFI recommended that the CMS address potential risks to future residents, future construction workers, and current / future ecological receptors. The ecological risk assessment was based upon determination of risk to individual organisms rather than determination of risk to ecosystems.

2: Corrective Measures Study

NSWC Crane is an operating Navy facility and will continue to be an operating Navy facility for the indefinite future (BRAC has been successfully navigated). As an operating Navy facility only industrial uses will be occurring both currently and in the future. Residential uses will not take place. Therefore, the CMS focused on corrective measures necessary to protect industrial uses (construction worker, industrial worker, and trespasser) and ecological uses.

The SWMU 5 topography consists of a flat area and an area which is deeply incised by a gully. The flat area is the general location where open burning of rubbish took place. Residual ash and metallic materials were buried in the gully area. Flat areas, which are relatively rare at NSW Crane, have general potential as locations for industrial activities. Therefore, steps necessary to evaluate industrial use risk were considered. The first step consisted of re-evaluating human health and ecological risks for each area. The re-evaluation of ecological risk was based on the protection of the overall contiguous ecosystem. Following is an outline of the risk re-evaluation (The details are provided in Section 2 of the CMS).

Human Health and Ecological Risk Assessments

- Divided SWMU 5 into two areas
 - Constructible (flat area)
 - Non-constructible (gully area)

Note: CMS contains an aerial photograph that shows the delineation of these areas.

- Established uses for each area
 - Constructible (residential and industrial)
 - Non-constructible (forested area)

Note: The residential receptor was evaluated for the constructible area to determine what, if any remedial action would be required to achieve the NFA status for residential land use.

- Identified following receptors for each area
 - Constructible (residential, construction, maintenance, and ecological)
 - Non-constructible (terrestrial plants / invertebrates and mammals / birds)
- Re-evaluated Ecological risks for Constructible and Non-Constructible Areas
 - Considered risk to ecosystem rather than individuals
 - Concluded for terrestrial plants / invertebrates – NFA
 - Concluded for mammals / birds – NFA

Note: The re-evaluation of ecological risk was based upon protection of the overall contiguous ecosystem. This approach was utilized based upon on conversations with U.S. EPA Region 5 staff during June 2004 and on recent published literature. Details and references are provided within the CMS.

- Constructible Area Human Health Risk Re-evaluation
 - Future Construction worker (soil, and groundwater) - NFA
 - Future Resident (Adult) - NFA for soils
 - Future Resident (Child) – NFA for soils

Note: Groundwater at SWMU 5 is not withdrawn and will not be withdrawn under any existing or future use scenarios.

- Overall Recommendations
 - Constructible area – NFA for all media
 - Non-Constructible Area - Proceed to evaluate very limited alternatives (No action and LUC) for all media

3: Focused Corrective Measures Study for Non-Constructible Area

Results of the remedy evaluation for the Non-Constructible Area are highlighted below.

- Any active remedial alternatives at the gully area, including capping, excavation, aesthetic removal, etc., would involve extensive habitat destruction.
- Active alternatives at the gully area would result in a net detriment to the ecology due to habitat destruction.
- Based on the above, no screening or detailed evaluation of soil remediation alternatives including aesthetic debris removal was conducted.
- Identifies NFA with land use control (LUC) as recommended alternative(s).
- NFA with LUC only alternative for which costs are presented.

Note: The only current and future use for the non-constructible (gully area) is forest land. For the most part, the gully area has existing trees, most of which appear to be several decades old. There are no risks to ecological receptors when the overall contiguous ecological system is considered. Because residential uses will not occur there is no need to evaluate alternatives to protect residential receptors. Potential exposure to industrial workers will be controlled through administrative (LUCs) or engineering controls (i.e. fence or signs). In addition any active alternative would have to result in some degree of habitat destruction, which would result in a net detriment to the ecology. Based on these factors (no human exposure and net detriment to the ecology) active alternatives were not evaluated.

Although active alternatives were not evaluated, it is necessary to ensure that, however unlikely, the gully area is not used for residential purposes and that the SWMU groundwater is not *withdrawn for potable use without proper treatment*. Therefore, the no action and land use control alternatives were identified for evaluation and costing. Detailed screening / evaluation of alternatives were *not conducted because the use of the non-constructible area is not expected to occur*.

The gully area has visible metallic debris. Removal of debris for aesthetic purposes was considered. However, this would not reduce the risk to human or ecological receptors. Due to the generally heavy forest cover and steep topography, debris removal would result in habitat destruction, without any identified offsetting benefit to human health or the environment.

4: Miscellaneous

- Details of re-evaluations of risk provided in "CMS" report.

TABLE 1

EXAMPLE LAND USES, RECEPTORS, AND PRINCIPAL CONTAMINANTS AT NSWC CRANE SWMUs

SWMU	Primary Media/Uses	Primary Receptor(s)¹	Principal Contaminant(s)	RFI/CMS Conclusion	Recommended Action
1	GW as DW	Hypothetical future residents, const. wrkr	VOCs	Unacceptable risks for select hypothetical residents and const. wrkrs	LUCs & LTM of groundwater
2	GW as DW	Hypothetical future residents	Dyes	No current unacceptable risks; potential risk from exposure to dyes in soils.	LUCs & LTM of groundwater
3 (MTA)	GW as DW	Hypothetical future residents	RDX, TCE	No current unacceptable risks.	LUCs & LTM of groundwater
3 (MTA)	Soils	Const. wrkr	Lead	No current unacceptable risks.	
3 (OJT)	GW as DW	Hypothetical future residents	RDX, TCE	No current unacceptable risks.	
3 (OJT)	Soils	Const. wrkr		No current unacceptable risks.	
3 (LSC)	SW as DW	Off-Site Resident	RDX	No current unacceptable risks.	

* DW = drinking water; SW = surface water

const wrkr = construction worker

1 Future land uses will be addressed at the time of site closure.

**TABLE 2
REMEDY EVALUATION PROCESS SUMMARY
AMMUNITION BURNING GROUND (SWMU 3) MAIN TREATMENT AREA, OLD JEEP TRAIL, AND LITTLE SULPHUR CREEK
NSWC CRANE, IN**

INVESTIGATION PHASE				REMEDIAL ACTION EVALUATION PHASE		
Main Treatment Area	Document	Findings / Evaluations	Conclusion	Considerations	Evaluation Conclusions	Remedy
Soils (Human Health):						
Explosives (RDX)	USACE Phase III Study, Part 2	RDX, HMX, TNT detected in soils	Conduct further investigations	<ul style="list-style-type: none"> Future uses (residences, park visitor) addressed at closure and not evaluated Current uses / receptors (industrial / site and construction workers & trespasser) for soil Unable to determine proportion of explosives source in overburden versus bedrock Unable to determine whether soil remediation would remove significant portion of explosives source Groundwater not used and soils not evaluated for protection of groundwater MTA not evaluated for ecological impacts because use as OB unit eliminates ecological habitat 	<ul style="list-style-type: none"> No risk from explosives to current receptors was identified. NA & LUC only remedial actions evaluated No detailed screening evaluation - No risk was identified for current uses / receptors 	<ul style="list-style-type: none"> LUC recommended remedial action to prevent non-industrial uses
	CCCRA	HRA and ERA conducted	No explosives identified as COCs			
	CMS Field Investigation (April 2004)	RDX sporadically detected mostly in surface and near-surface soils.	<ul style="list-style-type: none"> Unable to establish link between soil sources of explosives and groundwater contamination 			
VOCs (TCE)	USACE Phase III Study, Part 2	Minor concentrations detected	Conduct further investigations	<ul style="list-style-type: none"> Future uses (residences, park visitor) addressed at closure and not evaluated Current uses / receptors (industrial / site and construction workers & trespasser) for soil were evaluated Unable to determine proportion of VOCs source in overburden versus bedrock Unable to determine whether soil remediation would remove significant portion of groundwater contamination source Groundwater not used and soils not evaluated for protection of groundwater Not evaluated for ecological impacts because use as OB unit eliminates ecological habitat 	<ul style="list-style-type: none"> No risk to current receptors was identified. No detailed screening evaluation - No risk was identified for current uses / receptors NA & LUC only remedial actions evaluated 	<ul style="list-style-type: none"> LUC recommended remedial action to prevent non-industrial uses
	CMS Field Investigation (April 2004)	Detected in subsurface soils.	Relationship established between soil sources of VOCs and groundwater			
	CCCRA	HRA and ERA conducted	No VOCs identified as COCs			
Metals (barium, lead, manganese)	USACE Phase III Study, Part 2	Several metals found in excess of background concentrations	Coordinate with regulatory agencies	<ul style="list-style-type: none"> Future uses (residences, park visitor) addressed at closure and not evaluated Current uses / receptors (industrial / site and construction workers & trespasser) for soil were evaluated Groundwater not used and not evaluated Not evaluated for ecological impacts because use as OB unit eliminates ecological habitat 	<ul style="list-style-type: none"> Lead identified as COC for construction worker No detailed screening evaluation - No risk was identified for current uses / receptors NA & LUC only remedial actions evaluated 	<ul style="list-style-type: none"> LUC recommended remedial action to prevent non-industrial use and to prevent construction at location impacted by metals
	CCCRA	HRA and ERA conducted	Zinc identified as COC for human health			
	CMS Field Investigation (April 2004)	Various metals detected	Unable to establish link between soil sources of explosives and groundwater contamination			
Groundwater (Human Health):						
Explosives (RDX)	CMS Field Investigation (April 2004)	Detected	RDX detected	<ul style="list-style-type: none"> Future uses (residences, visitor) addressed at closure Current uses / receptors (industrial / site and construction workers & trespasser) for soil Groundwater not used 	<ul style="list-style-type: none"> No risk to current receptors was identified because groundwater is not used. No remedial actions evaluated – No risk was identified to current receptors 	<ul style="list-style-type: none"> LUC / LTM recommended remedial action to prevent use of groundwater and LTM to determine whether explosives are naturally degrading
	Routine Groundwater Monitoring Program	Statistical comparisons to background and to RBTLs.	Detected in statistically significant concentrations above RBTL			
	CCCRA	HRA conducted	RDX identified as COC			
	USACE Phase III Study	Explosives contamination found in groundwater	Conduct risk assessment to establish action levels and proceed to CMS			
VOCs (TCE)	CMS Field Investigation (April 2004)	Detected		<ul style="list-style-type: none"> Future uses (residences, visitor) addressed at closure Current uses / receptors (industrial / site and construction workers & trespasser) for soil Groundwater not used 	<ul style="list-style-type: none"> No risk to current receptors was identified because groundwater is not used. No remedial actions evaluated – No risk was identified to current receptors 	<ul style="list-style-type: none"> LUC / LTM recommended remedial action to prevent use of groundwater and LTM to determine whether VOCs are naturally degrading
	CCCRA	HRA conducted	Various VOCs identified as COCs			
	USACE Phase III Study	VOC contamination found in groundwater	Conduct risk assessment to establish action levels and proceed to CMS			
	Routine Groundwater Monitoring Program	Detected in statistically significant concentrations above RBTLs				
Metals	Routine Groundwater Monitoring Program	Statistical comparisons to background and to RBTLs.	Barium consistently detected in statistically significant concentrations above RBTLs. Other metals only sporadically detected in statistically significant concentrations above RBTLs.	<ul style="list-style-type: none"> Barium concentrations compared to MCL. All barium concentrations below MCL. 	NFA	None required
	CCCRA	HRA conducted	Several metals (Al, Sb, As, Ba, Cr, Mn, Ni) identified as COCs			
	USACE Phase III Study	Barium contamination found in groundwater	Conduct risk assessment to establish action level and proceed to CMS			

**TABLE 2
REMEDY EVALUATION PROCESS SUMMARY
AMMUNITION BURNING GROUND (SWMU 3) MAIN TREATMENT AREA, OLD JEEP TRAIL, AND LITTLE SULPHUR CREEK
NSWC CRANE, IN**

Old Jeep Trail	Document	Findings				
Soils (human health):						
Explosives (RDX and TNT)	OJT/LSC RFI Report - T1NUS	RDX and TNT identified as COCs for future resident	Proceed to CMS	<ul style="list-style-type: none"> No risks identified for current uses / receptors (industrial / site and construction workers & trespasser) NSWC Crane is military facility and residential use will not occur Base need for corrective measures on plausible uses 	<ul style="list-style-type: none"> No detailed screening evaluation - No risk was identified for current uses / receptors NA & LUC only evaluated 	<ul style="list-style-type: none"> LUC recommended remedial action to prevent residential use
Metals (lead)	OJT/LSC RFI Report - T1NUS	Lead identified as COC for future resident	Proceed to CMS			
VOCs (TCE and degradation product)	OJT/LSC RFI Report - T1NUS	No VOCs identified as COCs	NFA			
Groundwater (human health):						
Explosives (RDX, TNT, 2A-DNT and 4A-DNT)	OJT/LSC RFI Report - T1NUS	RDX, TNT, 2A-DNT and 4A-DNT identified as COCs for future resident	Proceed to CMS	<ul style="list-style-type: none"> No risks identified for current uses / receptors (industrial / site and construction workers & trespasser) NSWC Crane is military facility and residential use will not occur Base need for corrective measures on plausible uses 	<ul style="list-style-type: none"> No detailed screening evaluation - No risk was identified for current uses / receptors NA & LUC only remedial actions evaluated 	<ul style="list-style-type: none"> LUC recommended remedy to prevent residential use LTM also recommended to determine if explosives and VOCs are naturally degrading.
VOCs (TCE and degradation product)	OJT/LSC RFI Report - T1NUS	TCE and degradation products identified as COC for future residents	Proceed to CMS			
Metals	OJT/LSC RFI Report - T1NUS	No significant risk identified	NFA			
Soils (Ecological):						
Mammals and birds	OJT/LSC RFI Report - T1NUS	Surface soil and surface water evaluated	NFA	None required	NA	NA
Terrestrial plants and invertebrates		Surface soils	NFA	None required	NA	NA
Little Sulphur Creek						
Surface Water (Human Health):						
Explosives (RDX, (2A-DNT and 4A-DNT)	USACE Phase II Study	Site-related contaminants (RDX, HMX, and 2,4-DNT) were detected	Conduct Phase III study	Development of alternate water quality criterion in accordance with IDEM water quality regulations	<ul style="list-style-type: none"> All concentrations of explosives in LSC below calculated criteria 	<ul style="list-style-type: none"> LTM in LSC to verify that concentrations of explosives remain below alternative water quality criteria Period reviews to determine whether new public water supply intakes are located above Shoals, IN. Evaluations to verify that concentrations of explosives are below applicable criteria at any new public supply intakes.
	OJT/LSC RFI Report - T1NUS	RDX, (2A-DNT and 4A-DNT) identified as COCs for resident	Proceed to CMS			
	Routine Groundwater Monitoring Program	Statistical comparisons to background and to RBTLs.	RDX detected in statistically significant concentrations above RBTLs in Springs A and C			
VOCs (TCE and degradation products)	USACE Phase II Study	No significant detections.	NFA	None	<ul style="list-style-type: none"> TCE volatilizes in karst system and is not present in Springs A or C 	<ul style="list-style-type: none"> LTM in LSC to verify that concentrations of TCE remain below MCL
	OJT/LSC RFI Report - T1NUS	No significant detections.	NFA			
	Routine Groundwater Monitoring Program	No significant detections.	NFA			
Metals	US ACE Phase II Study	Site-related metals (Al, Ba, Mn, Mg, Cr, Cd, Cu, Pb, and Zn) were detected	Conduct Phase III study	<ul style="list-style-type: none"> MCL for barium of 2,000 ug/l established as cleanup goal 	<ul style="list-style-type: none"> All Spring A and C and LSC barium concentrations below 2,000 ug/l 	<ul style="list-style-type: none"> LTM in LSC to verify that concentrations of barium remain below MCL
	OJT/LSC RFI Report - T1NUS	No metals identified as COC	NFA			
	Routine Groundwater Monitoring Program	Statistical comparisons to background and to RBTLs.	<ul style="list-style-type: none"> Barium consistently detecting in statistically significant concentrations above RBTLs Other metals only infrequently present in statistically significant concentrations 			
Ecological:						
Aquatic Organisms	OJT/LSC RFI Report - T1NUS	Surface water and sediment evaluated	NFA	None required because no significant ecological risk was identified	NA	NA
Mammals and birds						

**TABLE 2
REMEDY EVALUATION PROCESS SUMMARY
AMMUNITION BURNING GROUND (SWMU 3) MAIN TREATMENT AREA, OLD JEEP TRAIL, AND LITTLE SULPHUR CREEK
NSWC CRANE, IN**

Document Acronym	Document					
USACE Phase III Study, Part 2	Albertson, P., J.H. May, J.S. Nohrstedt, R.W. Magee, and P. Payonk, 1998. Final Report: RCRA Facility Investigation, Part 2 Phase III Soils Study, Ammunition Burning Ground, SWMU 03/10, Naval Surface Warfare Center Crane, Indiana, prepared by U.S. Army Corps of Engineers, Waterways Experiment Station, Technical Report, GL-98-23, May.					
CMS Field Investigation (April 2004)	TINUS, 2004. Corrective Measures Study (CMS) Field Investigation. April.					
HHRSE	Tetra Tech NUS, Inc. (TINUS), 2005. Human Health Risk Screening Evaluation for SWMU 3. Naval Surface Warfare Center Crane, NSWC Crane. October.					
USACE Phase III Study	Murphy, W.L., 1994. Final Report, RCRA Facility Investigation, Phase III, SWMU 03/10, Ammunition Burning Ground, prepared by United States Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi, Technical Report GL-94-15, May.					
Groundwater Monitoring Program	SAIC, 2002a, 2002b, 2003a, and 2003b. Annual Groundwater Monitoring Reporting for Ammunition Burning Grounds, Old Rifle Range, and Demo Range, CY 2000 (December 16, 2002), CY 2001 (December 16, 2002), CY 2002 (October 31, 2003), and CY 2003 (October 31, 2003), respectively, Naval Surface Warfare Center, Crane Division, Crane, Indiana.					
T/LSC RFI Report - TINUS	TINUS, 2005. Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report for SWMU 03 - Old Jeep Trail/Little Sulphur Creek, Naval Surface Warfare Center, Crane Division, Crane, Indiana prepared by TINUS for Southern Division, Naval Facilities Engineering Command, North Charleston, South Carolina, January.					
US EPA March 23, 2005 comments	U.S. EPA Comments of March 23, 2005 on the draft Conceptual Site Model (February, 2005) and RFI Report Ecological (January, 2005) for SWMU 3 - Ammunition Burning Grounds. NSWC Crane. Crane, Indiana.					
CCCCRA	B&R Environmental (Brown and Root Environmental), 1997. Current Contamination Conditions Risk Assessment (CCCCRA). SWMU #03/10 (Ammunition Burning Ground), SWMU #07/09 (Old Rifle Range), SWMU #06/09 (Demolition Range), November.					
Not Referenced	Halliburton NUS, 1992a. RFI Phase I, Environmental Monitoring Report, SWMUs 19/00, 08/17, 12/14, 13/14. Navy Northern Division, CTO 15. August.					
Not Referenced	Murphy, W.L., 1996. Letter Report: Preliminary Assessment of Geology, Ground Water Hydrology, and Ground Water Contaminant Distribution of Jeep Trail 25 Area, Ammunition Burning Ground, Crane Naval Surface Warfare Center, Crane, Indiana, prepared by United States Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi, for the Department of Environmental Management, Crane Naval Surface Warfare Center, Crane, Indiana, May.					

**TABLE 3
REMEDY EVALUATION PROCES SUMMARY
OLD RIFLE RANGE (SWMU 7)
NSWC CRANE**

Old Rifle Range	INVESTIGATION STAGE			REMEDIAL ACTION EVALUATION PHASE		
	Document	Findings/Evaluations	Conclusions	Considerations	Evaluation/Conclusions	Remedy
Human Health (Groundwater):						
Explosives (DNT, TNT, and RDX)	CCCRA	Excess risk from DNT, TNT, and RDX	Conduct further evaluations	<ul style="list-style-type: none"> Groundwater not used TNT present only in one well (MW06C15) TNT degradation is occurring MW06C15 located near location where VIM was conducted Data indicates that plume is stable (limited to one well) 	<ul style="list-style-type: none"> No risk to current receptors was identified. NA and LUC / LTM only remedial actions evaluated. 	<ul style="list-style-type: none"> LUC / LTM to prevent use of groundwater and to determine whether TNT is naturally degrading
	Routine Groundwater Monitoring Program	Statistical comparison to background and RBTLs	TNT and daughter products in well 06C15 are only explosives detected			
Pesticides (heptachlor epoxide)	CCCRA	Excess risk for future park visitor (Beech Creek Aquifer)	Conduct further evaluations	<ul style="list-style-type: none"> Heptachlor epoxide not present in groundwater) 	<ul style="list-style-type: none"> None required 	<ul style="list-style-type: none"> NFA
	Routine Groundwater Monitoring Program	Not detected	Not detected			
Metals (Ag, As, Ba, Cd, Mn, Pb, Se, and Zn)	CCCRA	excess risk from As and Be	Conduct further evaluations	<ul style="list-style-type: none"> Groundwater not used Risk screening showed As to be only metal exceeding risk thresholds or MCLs 	<ul style="list-style-type: none"> No risk to current receptors was identified. NA and LUC only remedial actions evaluated. 	<ul style="list-style-type: none"> LUC to prevent use of groundwater
	Routine Groundwater Monitoring Program	Statistical comparison to background and RBTLs	Ag, As, Ba, Cd, Mn, Pb, Se, and Zn exceeds RBTL			
Human Health (Soils):						
Explosives (TNT)	CCCRA	HHRA and ERA conducted for TNT	NFA	<ul style="list-style-type: none"> No evaluation necessary 	<ul style="list-style-type: none"> None required 	<ul style="list-style-type: none"> NFA
	Phase III Soils RFI	1 AOC for TNT identified	Proceed to VIM for 2 highest TNT areas (07SB16/07SB47)	<ul style="list-style-type: none"> VIM conducted 	<ul style="list-style-type: none"> No risk for explosives 	<ul style="list-style-type: none"> NFA
Metals (As)	Phase III Soils RFI	Excess risk (As) for industrial worker and future resident at ORR	Defer until closure of unit	<ul style="list-style-type: none"> Limited area of contamination 	<ul style="list-style-type: none"> Risk presented to industrial and residential worker Residential use will not occur Industrial use does occur 	<ul style="list-style-type: none"> Conduct limited removal action
	Phase III Soils RFI - Addendum 1	Excess risk for three metals Cu, Pb, and Sb. PB was the risk driver.	Conduct further evaluation			
PAHs [B(a)A, B(a)F, B(a)P, DBA, and IP]	CCCRA	Excess risk from ingestion of B(a)P, B(a)F, DBA, and IP	Conduct further evaluations	<ul style="list-style-type: none"> None required 	NA	NFA
	Phase III Soils RFI	41 grab / composite samples collected for PAH analysis	NFA			