USACE is issuing this Proposed Plan in accordance with the public notification requirements under Sections 113(k)(2)(B), 117(a), and 121(f)(1)(G) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA); 42 United States Code (U.S.C.) 9613(k)(2)(B), 9617(a), and 9621(f)(1)(G); and Army Regulation 200-1, Chapter 9-11(b)(4).

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Crab Orchard National Wildlife Refuge

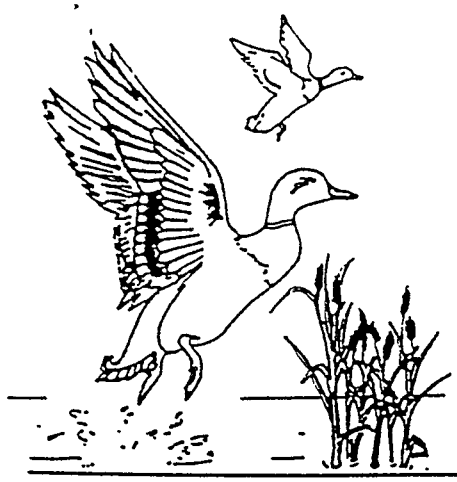
Explosives/Munitions Manufacturing Areas Operable Unit
RR 3, Box 328
Marion, IL 62959

PROPOSED REMEDIAL ACTION PLAN

00000320

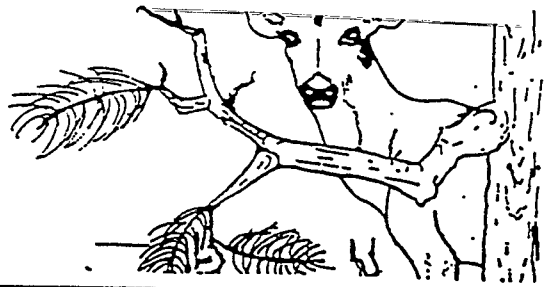
T.J.

ATTN: JUDY GIBSON
8 Pages



Crab Orchard National Wildlife Refuge

Explosives/Munitions Manufacturing Areas Operable Unit

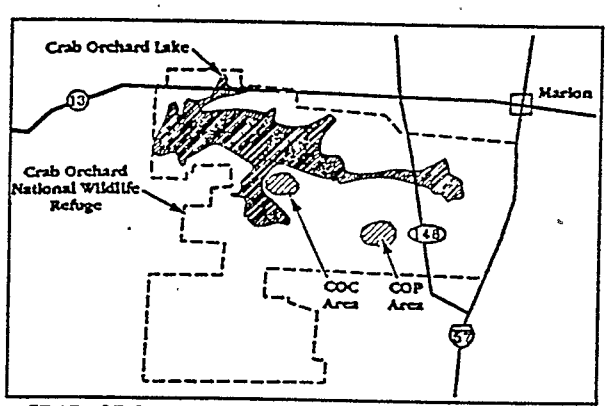


Fact Sheet *September 1995*

PROPOSED REMEDIAL ACTION PLAN

INTRODUCTION

This Proposed Plan identifies the Preferred Alternative for a final remedial action at the Crab Orchard National Wildlife Refuge (Crab Orchard NWR) Explosives/Munitions Manufacturing Areas Operable Unit (EMMA OU) National Priorities List (NPL) Site. However, no final decision will be made until public comments have been thoroughly reviewed and evaluated. This document is being issued by the U.S. Army Corps of Engineers (USACE), the lead agency for remedial activities at the EMMA OU, in consultation with the U.S. Environmental Protection Agency (USEPA), the Illinois Environmental Protection Agency (IEPA), and the U.S. Fish and Wildlife Service (USFWS).



CRAB ORCHARD WILDLIFE REFUGE SITE MAP

The objectives of this Proposed Plan are to:

- summarize relevant background information and environmental investigations;
- describe the remedial alternatives evaluated by USACE;
- identify USACE's Preferred Alternative;
- explain the rationale for selecting the Preferred Alternative;
- encourage the public to review and comment on each of the alternatives evaluated by USACE; and
- actively solicit community involvement in the final remedy selection. USACE relies on public input so that the alternative selected for the EMMA OU sites meets the needs and concerns of the community.

SITE BACKGROUND

The Crab Orchard NWR (the Refuge) was included on the NPL in 1987. The NPL is a list of USEPA's most serious hazardous waste sites identified for remedial action. The USFWS, an agency of the U.S. Department of the Interior (USDOI), manages the Refuge. The Refuge is currently divided into four separate operable units (OUs) and a removal action. The Water Towers project is the removal action. The OUs are the Polychlorinated Biphenyl Area (PCBA) OU, the Metals Area OU (MAOU), the Miscellaneous Area (MISCA) OU, and the EMMA OU.

The Crab Orchard NWR is located approximately 5 miles west of Marion, Illinois. The land that is now occupied by the eastern portion of the Refuge was transferred to the War Department for construction of the former Illinois Ordnance Plant (IOP), also known as the Crab Orchard Ordnance Plant. The ordnance plant was constructed in 1941 for the U.S. Army as part of its National Defense Program. Its major activity consisted of 2,4,6-trinitrotoluene

(TNT) melt-pour operations. Various munitions and munitions items, including 500-pound bombs, anti-tank mines, and 155-millimeter (mm) shells, were filled at the plant. The ordnance plant was closed in 1945, shortly after the end of World War II, and was transferred to the War Assets Administration (WAA). The plant was decontaminated, and a portion was leased to private industrial tenants. Ownership of the property was transferred to the USDOI in 1947 and is managed by the USFWS. According to the 1980 Archive Search Report (USATHAMA 1980), the private tenant uses were for production of electrical equipment, boats, corrugated boxes, plated metal parts, and explosives. The plant was decontaminated, and a portion was leased to private industrial tenants. Ownership of the property was transferred to the USDOI in 1947 and is managed by the USFWS.

The Refuge currently comprises an area of approximately 43,500 acres of forested land, pine plantations, cultivated lands, and industrial areas. There are three lakes within the Refuge, including Crab Orchard Lake. Surface water from the EMMA OU sites eventually drains to Crab Orchard Lake. Fifteen individual sites were investigated within the EMMA OU. These sites are grouped into three discrete areas: ten sites are located in the Crab Orchard Cemetery (COC) area, so named due to the proximity of Hampton Cemetery; four of the sites are in the Crab Orchard Plant (COP) area, near the Group II load line and the former Ammonium Nitrate Plant; and one site is in the explosives storage bunker area.

EMMA OU REMEDIAL INVESTIGATION SUMMARY

A Remedial Investigation (RI) of the EMMA OU sites consisting of Phase I, Phase II, and ecological field sampling activities was completed to determine the nature and extent of contamination resulting from past munitions manufacturing activities.

The Phase I field investigation involved the excavation and sampling of 40 test pits; collection of over 200 surface soil, sediment, and surface water samples; drilling and sampling of 10 soil borings; and the installation and sampling of 14 monitoring wells. Samples were also collected from 10 previously existing monitoring wells. Samples were analyzed for volatile organic compounds (VOCs), base/neutral/acid extractables (BNAs), nitroaromatic compounds (TNT, 2,4-dinitrotoluene, RDX, HMX, nitrobenzene, and other explosives) metals, and total petroleum hydrocarbons (TPH). The Phase I field work was conducted from mid-August to mid-October 1991.

The Phase II field investigation was conducted in June, July, and September of 1993 and focused on 8 of the 15 EMMA OU sites, based on data gathered in the Phase I investigation. The Phase II investigation involved the collection of over 100 soil, surface water, and sediment samples; drilling and sampling of soil borings; the installation and sampling of two monitoring wells; and the collection of groundwater samples from the 27 existing monitoring wells including the 14 wells installed in Phase I. Samples were analyzed for metals, nitroaromatic compounds, VOCs, and BNAs.

A separate field effort was conducted in October and December 1993 based on the results of a Preliminary Ecological Risk Assessment. Small mammal trapping was conducted at Site COC-9 and a control site, to evaluate potential ecological effects at this site due to the presence of metals in surface soils. Surface water samples were collected for surface water toxicity testing from Site COC-6 to assess the potential for adverse effects on aquatic flora and fauna animals from surface water present at this site.

Based on the findings of the RI Report, environmental media (soil, sediment, surface water, or groundwater) at 13 of the 15 sites in the EMMA OU have been affected by IOP-related activities. These sites contain metals (such as lead) and nitroaromatic compounds in various media above background concentrations. Results of the chemical analyses indicate that Sites COC-3, COC-9, and COP-4 exhibit the greatest effects from IOP-related activities. These sites were subject to disposal activities and exhibit nitroaromatic compounds and metals (such as lead) concentrations in soil, sediment, surface water, and groundwater. Groundwater

data indicate that IOP-related chemicals are present at the EMMA OU in discrete, localized areas within defined boundaries. Results for the small mammal and surface water toxicity testing indicate that small mammals and water animals are not being adversely affected by site-related chemicals at the EMMA OU.

EMMA OU BASELINE RISK ASSESSMENT SUMMARY

The Baseline Risk Assessment (BRA) concluded that conditions at several of the EMMA OU sites do not pose an unacceptable potential risk to human health and the environment. The results of the BRA indicated that at Sites COC-1, COC-2, COC-5, COC-6, COC-7, COC-8, COC-9, COC-10, COP-1, COP-2, COP-3, and Bunker 1-3, the calculated excess carcinogenic site risk and the non-carcinogenic hazard index (HI) are below USEPA guidance levels and therefore are considered to pose no potential unacceptable risks to humans and animals. These USEPA guidance levels are excess cancer risks of one in 10,000 persons (1.0E-04) to one in 1,000,000 persons (1.0E-06) and non-carcinogenic human HI of 1. An HI greater than 1 indicates that the exposure level to contaminants could cause adverse noncarcinogenic effects. The BRA found that Sites COC-3 and COP-4 pose a potential unacceptable risk to human health due to elevated levels of nitroaromatic compounds and metals (such as lead) in the soils. The HI at COC-3 is 20, the excess cancer risk is 5.0E-05. The HI at COP-4 is 9, the excess cancer risk is 1.0E-4.

Additionally, potential ecological risks are associated with Sites COC-3, COC-4, COC-6, and COP-4. The potential for contaminants to pose unacceptable ecological risks were defined in the BRA using an Ecological Risk Index (ERI). The ERI is the ratio of the level of exposure, to the level of exposure that does not cause adverse effects to individual members of the species. For the EMMA OU, an ERI of greater than 1 is considered to indicate that there may be cause for concern for effects on the environment. Potential for adverse effects on the populations of animals at the refuge were not assigned a numerical value. Potential ecological risks are associated with white-tailed deer, small mammals, and bobwhite quail at Sites COC-3 and COP-4; the bobwhite quail at Site COC-4; and the bald eagle at Site COC-6. In order to avoid the application of order-of-magnitude uncertainty factors that result in risks being overestimated, ecological risks, if any, associated with Site COC-4 will be further evaluated. Potential ecological risks at Site COC-6 are limited to hypothetical exposure of the bald eagle to manganese in surface water based on bioaccumulation in fish. This hypothetical exposure assumes that a bald eagle would consume fish from the man-made depressions at Site COC-6. This is an unlikely event given the higher populations of fish and open water conditions of Crab Orchard Lake. Thus, it was concluded that no unacceptable risks exist for the bald eagle. Therefore, the evaluation of remedial actions intended to minimize potential risks to human health and the environment presented by the elevated concentrations of nitroaromatic compounds and metals in soils warranted at Sites COC-3 and COP-4. The remaining sites are addressed relative to the potential need for land use controls and groundwater monitoring.

SCOPE AND ROLE OF THE REMEDIAL ACTION

This Proposed Plan addresses the final remedy for Sites COC-3 and COP-4. The remaining EMMA OU sites are addressed relative to the potential need for land use controls and groundwater monitoring. The remedial actions determined to be necessary at Sites COC-3 and COP-4 are:

- minimize the potential risks identified by implementing institutional controls (land use controls and groundwater monitoring); and
- removal of soils containing levels of nitroaromatic compounds greater than practical quantitation limits and lead above 450 parts per million to a five foot depth, replacement with clean soil and reseeding.

The studies undertaken at the EMMA OU have identified potential human and ecological risks associated with nitroaromatic compounds and lead in soil at Sites COC-3 and COP-4. The remedial objective for the EMMA OU is to

minimize potential human health and ecological risks associated with the affected soil at Sites COC-3 and COP-4. USACE's overall response strategy is to eliminate the ability for humans and animals to come into contact with nitroaromatic compounds in soil at Sites COC-3 and COP-4 while monitoring the EMMA OU shallow groundwater for chemicals over time.

POTENTIAL REMEDIATION GOALS

Potential remediation goals are a subset of remedial action objectives and are specific chemical concentrations that are protective of human health and the environment. These goals are based on chemical-specific applicable or relevant and appropriate requirements (ARARs) or risk-derived values protective of human health and the environment. These goals are identified for those exposure pathways determined in the BRA to present a potential unacceptable risk to human health and the environment. These exposure pathways are direct contact and ingestion.

Potential remediation goals were developed in the Feasibility Study (FS) Report using health based "To Be Considered" criteria for both human health and animals. These criteria are the calculated contaminant concentrations that if left exposed on the site to direct contact and ingestion by humans and the refuge species of concern will not pose unacceptable risks. Elimination of these contact pathways by a remedial alternative may allow adjustment of these goals. To be protective of human health, concentrations of 61.2 parts per million (ppm) trinitrotuluene (TNT) and 6.12 ppm 1,3,5-trinitrobenzene (TNB) are acceptable. No other contaminants on the sites posed a potential risk to human health.

Levels of nitroaromatic compounds that would cause no concern for potential environmental effects were below analytical detection levels (in the parts per billion range) and not accurately measurable by current laboratory instrumentation. Therefore these potential remediation goals were established at the laboratory practical quantitation limit (PQL), which is the level that can be verified by laboratory equipment. These levels are: TNT - 2.11 ppm; 1,3,5-TNB - 2.25 ppm; HMX - 4.19 ppm; and RDX - 4.13 ppm. The potential remediation goal for lead is the same that was used for the Metals Operable Unit, it is 450 ppm. The recommended remedial alternative is designed to meet these goals.

SUMMARY OF REMEDIAL ALTERNATIVES

The public is invited to comment on the Preferred Alternative and the other remedial alternatives evaluated in the FS Report and this Proposed Plan. The seven alternatives presented in this Proposed Plan were analyzed in the FS Report for their ability to protect human health and the environment, comply with legal requirements, and be cost-effective. Evaluations of capital costs, operation and maintenance (O&M) costs, net present worth costs, and implementation times presented below are estimates. Each of the alternatives, except the No Action alternative, will include a provision for land use controls at every EMMA OU site, whether remedial activities take place or not. The land use controls will restrict the placement of drinking water wells in the shallow groundwater.

A present worth analysis is used to evaluate costs that occur over different time periods by discounting future costs to the current year. This allows the costs of the remedial action alternatives to be compared on the basis of a single number representing the amount of money that, if invested now, would be sufficient to cover all costs associated with the remedial action over its planned life. A 30-year life is assumed for the present worth analysis for each alternative. A discount rate of 5 percent is used.

Comments were received from the USFWS on the draft Proposed Plan report expressing concern that all of the alternatives studied required nearly consistent levels of institutional controls and perpetual maintenance on the sites. By agreement with USFWS, USACE evaluated a modified version of Alternative 4 which was intended to produce a site less dependant of engineered barriers and institutional controls. USFWS had previously provided information to

USACE indicating that burrowing animals would be a threat to the integrity of cap and soil covers. This threat was addressed in the FS by including in all alternatives a special fence designed to keep those animals out of the sites. The FS solution carries a never ending requirement to maintain that fence.

In the modified version of Alternative 4, the removal of non-reactive contaminated soil was increased from two feet below existing grade to five feet below grade. The contaminated soil will be disposed of in a landfill as described in the FS. The contaminated soil will be replaced with clean soil as before. This change provided a soil barrier sufficiently thick to preclude damage from burrowing animals and eliminated the need to fence the animals out of the site. It maintained the existing grade and drainage at the site. The modified version also allows more alternatives for restoration of site vegetation and may eliminate the need to mow the site.

ALTERNATIVES DESCRIPTION

Alternative 1 - No Action
The No Action alternative leaves the EMMA OU sites in their current condition. Monitoring will not take place under this alternative. No remedial actions that result in the treatment, containment, or removal of affected soil are implemented under Alternative 1. The National Contingency Plan (NCP) requires the consideration of a No Action alternative. The No Action alternative is also used as a baseline for comparison with other remedial alternatives.

Alternative 1	
Capital Costs	$0
Present Worth O&M	$0
Total Present Worth Costs	$0
Time to Construct	0

Alternative 2 - Removal/Fencing/Land Use Controls/Groundwater Monitoring
Soil at Sites COC-3 and COP-4 with concentrations of nitroaromatic compounds greater than 100,000 ppm [approximately 270 cubic yards (cy)] will be excavated and transported offsite to a commercial incinerator. Soil with concentrations of nitroaromatic compounds greater than 100,000 ppm may be reactive and pose a potential safety hazard ("Explosives Safety", U.S Army Technical Center for Explosives Safety, June 1995). This soil will be rendered non-reactive prior to excavation and transport offsite. As a result of this action, soil containing greater than 100,000 ppm nitroaromatic compounds will not remain at either site.

This alternative also consists of:
- magnetic surveys;
- the construction of fencing (consisting of 8 ft high chain link, 2 ft of which will be buried to intercept burrowing activity) around the remaining affected soil at Sites COC-3 and COP-4;
- groundwater monitoring (for estimating purposes, sampling and analysis of 27 wells is assumed);
- implementation of land use controls to reduce potential future exposure to the remaining affected soil and restrict the construction of drinking water wells in the EMMA OU; and
- a detailed review of site conditions every five years.

Alternative 2:	
Capital Costs	$2,973,000
Present Worth O&M Costs	$2,854,000
Total Present Worth	$5,827,000
Time to Construct	4 months

Alternative 3 - Removal/Fencing/Land Use Controls/Groundwater Monitoring/Capping
Soil at Sites COC-3 and COP-4 with concentrations of nitroaromatic compounds greater than 100,000 ppm (approximately 270 cy) will be excavated and transported offsite to a commercial incinerator. This soil will be rendered non-reactive prior to excavation and transport offsite. As a result of this action, soil containing greater than 100,000 ppm nitroaromatic compounds will not remain at either site.

This alternative also consists of:
- magnetic surveys;
- the construction and maintenance of clay and soil covers (Alternative 3A), multimedia (RCRA) caps (Alternative 3B), or

composite-barrier (RCRA-type) caps (Alternative 3C) over the remaining affected soil areas at Sites COC-3 and COP-4;
- the construction of fencing (consisting of 8 ft high chain link, 2 ft of which will be buried to intercept burrowing activity) around the remaining affected soil at Sites COC-3 and COP-4;
- groundwater monitoring (for estimating purposes, sampling and analysis of 27 wells is assumed);
- implementation of land use controls to reduce potential future exposure to the remaining affected soil and restrict the construction of drinking water wells in the EMMA OU;
- a detailed review of site conditions every five years.

Clay and Soil Covers (Alternative 3A)
The clay and soil covers consist of (from the top down) topsoil to retain moisture and promote the growth of grass; clay-rich soil to reduce percolation of rainwater; and random fill to shape the base of the cover. The total thickness of the covers (36 inches) and fencing should adequately prevent humans and animals from reaching affected soil.

Multimedia Caps (Alternative 3B)
The multimedia caps will be a three-layer system and will consist (from the top down) of topsoil; clay-rich soil; a drainage layer consisting of stones sandwiched between two layers of impermeable material; a synthetic liner; and fill material placed over the existing ground surface as a shaping layer. The caps will prevent the contact of rainwater with the remaining affected soil by diverting it through the drainage layer. The combination of the grass layer and drainage layer will adequately protect the synthetic liner from being compromised due to frost action, and prevent contact with remaining affected soil.

Composite-barrier Caps (Alternative 3C)
The composite-barrier caps are comprised (from the top down) of topsoil to promote the growth of grass; clay-rich soil; a drainage layer consisting of cobbles (3 to 6 inches in diameter) sandwiched between two layers of impermeable material; a synthetic layer (first impermeable barrier); and clay (second impermeable barrier). The caps will prevent the contact of rainwater with the remaining affected soil by diverting it through the drainage layer. The combination of the grass layer and drainage layer will adequately protect the synthetic liner from being compromised due to frost action and burrowing animals, and prevent contact with remaining affected soil.

Alternative 3A:	
Capital Costs	$3,503,000
Present Worth O&M Costs	$2,911,000
Total Present Worth	$6,414,000
Time to Construct	8 months
Alternative 3B:	
Capital Costs	$3,854,000
Present Worth O&M Costs	$2,950,000
Total Present Worth	$6,804,000
Time to Construct	8 months
Alternative 3C:	
Capital Costs	$3,895,000
Present Worth O&M Costs	$2,950,000
Total Present Worth	$6,845,000
Time to Construct	8 months

Alternative 4 - Removal/Land Use Controls/Groundwater Monitoring/Excavation/Off-Site Disposal/Backfill Clean Soil/Restoration
Soil at Sites COC-3 and COP-4 with concentrations of nitroaromatic compounds greater than 100,000 ppm (approximately 270 cy) will be excavated and transported offsite to a commercial incinerator. This soil will be rendered non-reactive prior to excavation and transport offsite. As a result of this action, soil containing greater than 100,000 ppm nitroaromatic compounds will not remain at either site.

Alternative 4 also includes:
- magnetic surveys;
- excavation of remaining affected soils at Sites COC-3 and COP-4 to a depth of 5 ft (8,870 cy);
- stockpiling and mixing of these soils for ease of handling;
- transportation of these soils to an offsite permitted special waste landfill;

- groundwater monitoring (for estimating purposes, sampling and analysis of 27 wells is assumed);
- implementation of land use controls to reduce potential future exposure to the remaining affected soil and restrict the construction of drinking water wells in the EMMA OU; and
- a detailed review of site conditions every five years.

This alternative assumes that a local special waste landfill will accept the soil for disposal. The excavated soils will be mixed at the soil staging area will be mixed to ensure safe transportation of the affected soil. After mixing, the soil will be stockpiled in a soil staging area. The soil will be transported offsite by a licensed special waste transporter to a permitted special waste landfill. The excavated areas will then be backfilled with clean soil, covered with topsoil and reseeded.

Alternative 4:	
Capital Costs	$4,586,000
Present Worth O&M Costs	$2,754,000
Total Present Worth	$7,340,000
Time to Construct	8 months

Alternative 5 - Removal/Fencing/Land Use Controls/Groundwater Monitoring/Excavation/ Composting/Backfill of Composted Soil/Capping
Soil at Sites COC-3 and COP-4 with concentrations of nitroaromatic compounds greater than 100,000 ppm (approximately 270 cy) will be excavated and transported offsite to a commercial incinerator. This soil will be rendered non-reactive prior to excavation and transport offsite. As a result of this action, soil containing greater than 100,000 ppm nitroaromatic compounds will not remain at either site.

Alternative 5 includes:
- magnetic surveys;
- excavation to a depth/ of 5 feet (8,870 cy) of soil from Sites COC-3 and COP-4 for Alternative 5A;
- excavation to a depth of 2 feet (3,550 cy) of soil from Sites COC-3 and COP-4 for Alternatives 5B and 5C;
- subsequent treatment of this soil by composting to degrade the nitroaromatic compounds;
- backfilling of treated soils with site restoration;
- the construction and maintenance of multimedia (RCRA) caps (Alternative 5B), or composite-barrier (RCRA-type) caps (Alternative 5C) over the remaining affected soil areas at Sites COC-3 and COP-4;
- the construction of fencing (consisting of 8 ft high chain link, 2 ft of which will be buried to intercept burrowing activity) around the remaining affected soil at Sites COC-3 and COP-4;
- groundwater monitoring (for estimating purposes, sampling and analysis of 27 wells is assumed);
- implementation of land use controls to reduce potential future exposure to the remaining affected soil and restrict the construction of drinking water wells in the EMMA OU; and
- a detailed review of site conditions every five years.

Site restoration will consist of removal of the treatment equipment and structures and covering the area with topsoil and seeding (Alternative 5A). Options that may be included are multimedia capping (Alternative 5B) and composite-barrier capping (Alternative 5C).

Alternative 5A:	
Capital Costs	$5,151,000
Present Worth O&M Costs	$6,778,000
Total Present Worth	$11,929,000
Time to Construct	3 years

Alternative 5B:	
Capital Costs	$6,817,000
Present Worth O&M Costs	$5,253,000
Total Present Worth	$12,070,000
Time to Construct	2 years

Alternative 5C:	
Capital Costs	$6,920,000
Present Worth O&M Costs	$5,253,000
Total Present Worth	$12,173,000
Time to Construct	2 years

Alternative 6 - Fencing/Land Use Controls/Groundwater Monitoring/Excavation/ Onsite Incineration/Backfill Incinerated Soil/Restoration

Soil at Sites COC-3 and COP-4 with concentrations of nitroaromatic compounds greater than 100,000 ppm (approximately 270 cy) will be excavated and transported offsite to a commercial incinerator. This soil will be rendered non-reactive prior to excavation and transport offsite. As a result of this action, soil containing greater than 100,000 ppm nitroaromatic compounds will not remain at either site.

Alternative 6 involves:

- magnetic surveys
- excavation of 3,550 cy of affected soil to a depth of 2 feet;
- incineration of this soil in a mobile onsite incineration unit;
- backfill of the incinerator ash onsite;
- the construction of fencing (consisting of 8 ft high chain link, 2 ft of which will be buried to intercept burrowing activity) around the remaining affected soil at Sites COC-3 and COP-4;
- groundwater monitoring (for estimating purposes, sampling and analysis of 27 wells is assumed);
- implementation of land use controls to reduce potential future exposure to the remaining affected soil and restrict the construction of drinking water wells in the EMMA OU: and
- a detailed review of site conditions every five years.

The mobile incineration unit will be transported in modular sections and then fully assembled at the EMMA OU. Following incineration and destruction of the nitroaromatic compounds in the excavated soil, the residual ash will be tested to verify that it is non-reactive and non-hazardous, prior to using it as backfill material. Should the ash be characterized as a hazardous waste, it will be managed as a hazardous waste by a licensed transporter and disposed of properly. It is assumed that the residual ash will not be characterized as a hazardous waste.

Alternative 6:	
Capital Costs	$8,172,000
Present Worth O&M Costs	$2,947,000
Total Present Worth	$11,119,000
Time to Construct	10 months

Alternative 7 - Fencing/Land Use Controls/ Groundwater Monitoring/Excavation/Offsite Incineration/Backfill Clean Soil/ Restoration

Soil at Sites COC-3 and COP-4 with concentrations of nitroaromatic compounds greater than 100,000 ppm (approximately 270 cy) will be excavated and transported offsite to a commercial incinerator. This soil will be rendered non-reactive prior to excavation and transport offsite. As a result of this action, soil containing greater than 100,000 ppm nitroaromatic compounds will not remain at either site.

Alternative 7 includes:

- magnetic surveys;
- excavation of 3,550 cy of affected soil to a depth of 2 feet;
- subsequent mixing of this soil for ease of handling;
- transportation of the soil to an offsite incinerator for incineration;
- the construction of fencing (consisting of 8 ft high chain link, 2 ft of which will be buried to intercept burrowing activity) around the remaining affected soil at Sites COC-3 and COP-4;
- groundwater monitoring (for estimating purposes, sampling and analysis of 27 wells is assumed);
- implementation of land use controls to reduce potential future exposure to the remaining affected soil and restrict the construction of drinking water wells in the EMMA OU: and
- a detailed review of site conditions every five years.

The soil will be transported offsite by a licensed transporter to a permitted waste incinerator.

Alternative 7:	
Capital Costs	$10,574,000
Present Worth O&M Costs	$2,853,000
Total Present Worth	$13,427,000
Time to Construct	8 months

EVALUATION OF ALTERNATIVES

In accordance with the provisions set forth in CERCLA/SARA and the NCP, each of the alternatives was evaluated against nine established criteria. Overall protection of human health and the environment and attainment of ARARs are threshold criteria and the primary objectives of a remedial action. In addition, the selected remedial alternative must reflect the best balance among criteria such as reduction of mobility, toxicity, and volume of the nitroaromatic compounds; short- and long-term effectiveness; implementability; and cost.

Remedial action must also consider support agency and community acceptance. Alternatives 1 through 7 are compared under the various evaluation criteria, profiling the performance of the alternatives against the nine criteria. During this comparison, no one criterion is considered more important than the others. A summary of this comparison is provided in Table 1.

Overall Protection of Human Health and the Environment

No active remediation processes are implemented under Alternative 1 (No Action). Alternative 1 provides limited protection to human health and the environment through natural processes (i.e., leaching, dilution, and chemical and biological degradation), also known as natural attenuation. Alternative 2 provides greater protection to human health and the environment than Alternative 1 through removal of soil with nitroaromatic compound concentrations greater than 100,000 ppm and implementation of land use controls and fencing to limit onsite activities and physical access to the remaining affected soil. However, soils containing concentrations of contaminants associated with carcinogenic risks above 1.0E-04, HI above 1, and unacceptable ecological risks will remain at COC-3 and COP-4, and would be accessible for direct contact and ingestion by humans and animals if fencing is breached.

Alternative 3 provides greater protection than Alternative 2 by providing cover over soils that contain contaminants above the potential remediation goals, and construction of fencing to limit access to the sites by humans and animals. The remedial action objective prohibiting contact with contaminated soils by humans and wildlife would be met by using a combination of fencing and soil covers.

Alternatives 4 and 5A provide protection to human health and the environment with greater certainty and permanence than Alternative 3 by removing site soils containing contaminants above potential remediation goals to a depth of five feet and replacing it with clean soil. The depth of excavation will insure that pathways to contaminated soils are not opened in the future by wildlife, including burrowing animals. It must be noted however, the likelihood of the contaminated soils ever being exposed to surface in such quantities to pose unacceptable risks is extremely remote when covers are placed over the areas containing contamination as in Alternatives 3, 5B and 5C.

Alternatives 5B-7 provide protection to human health and the environment by removal of soils containing contaminants above potential remediation goals to a depth of two feet and replacing it with treated soil or clean backfill. Lead is not treated with these technologies, but overall risk remaining from lead would be very low as its detection on the sites was sporadic and it only posed a potential risk to ecological receptors. Fencing designed to prohibit entry to the sites by burrowing animals will help to prevent them from potentially opening pathways to contaminated soils, but cannot be relied upon to provide the same permanence as complete removal to the depth that are known to burrow (as deep as 5 feet). Alternatives 5B and 5C provide further protection through construction of caps over treated soils.

Residual, nonquantifiable risk will remain to deer and quail as small quantities of soil containing nondetectable amounts of nitroaromatic compounds may remain exposed at the edges of the sites in Alternatives 3-7. But these small areas of soil containing very low contaminant concentrations, taken together with the areas of clean soil at the surface that would be present at the sites through these Alternatives would very likely reduce any

potential for environmental risks to an acceptable level.

It may be necessary to take out existing trees during implementation of Alternatives 3 through 7. Every effort will be made not to cut trees during paternity season for residential and migratory wildlife. Any cutting of trees and restoration of lost habitat will be done in consultation with USFWS.

Compliance with ARARs
Compliance with chemical-specific ARARs, specifically 35 IAC Part 620 (Illinois Groundwater Quality Standards), will be achieved by each of the alternatives because concentrations of chemicals in shallow groundwater are not above these standards. Although IEPA calculated health advisories for nitroaromatic compounds for the FS, these health advisories are not ARARs. Because shallow groundwater at the EMMA OU is not currently used for drinking water, nor is it expected to be used in the foreseeable future, there is no unacceptable risk to human health and the environment. Therefore, Part 620 has been complied with. Those alternatives that include covers or caps (Alternatives 3A, 3B, 3C, 5B, and 5C) will also reduce or prevent continued infiltration of rainwater through affected soil into groundwater, thereby further reducing the potential for nitroaromatic compounds to reach the shallow groundwater. Location-specific ARARs will be attained by each of the alternatives considered. Actions taken as part of the active treatment alternatives (Alternatives 3 through 7) will comply with the corresponding potential action-specific ARARs. Additional treatment of residual waste streams may be required in order to comply with land disposal restrictions. A complete listing of ARARs is provided in Section 2.0 of the FS Report. The FS Report is available at the information repositories identified at the end of this fact sheet.

Long-Term Effectiveness
Because no treatment technologies have been proposed under Alternatives 1 and 2, nitroaromatic compounds and lead will be present above potential remediation goals in soil for some time. In all alternatives, the nitroaromatic compounds will degrade over time due to natural processes (natural attenuation). The extent to which natural processes will reduce potential risks is unknown, and difficult to monitor. Land use controls and fencing in Alternative 2 will restrict the use of the EMMA OU sites and potential access to the remaining nitroaromatic compounds.

Alternative 3 provides a greater degree of long-term effectiveness by further reducing the potential for access to nitroaromatic compounds in soil through construction of covers or caps over the affected areas. Alternative 4 will provide a greater degree of long-term effectiveness than Alternative 3 because more nitroaromatic compounds will be excavated and removed from the site, and barriers such as fencing and covers will not need to be relied upon.

Alternatives 1 through 4 do not meet the statutory requirements for treatment as a preferred alternative. Alternatives 5, 6, and 7 provide the highest degree of long-term effectiveness because these alternatives will destroy or degrade nitroaromatic compounds to below potential remediation goals. However, some uncertainty exists regarding the treatment levels that Alternative 5 can achieve. Therefore, treatability studies would need to be performed to establish the effectiveness of this alternative. Additional protection could be realized through capping as presented in Alternatives 5B and 5C.

Reduction of Mobility, Toxicity, and Volume
Alternative 1 does not include any removal, containment, or treatment actions. Therefore, no reduction in Mobility, Toxicity, or Volume will be attained. Alternatives 2 through 7 will reduce the volume of nitroaromatic compounds through the completion of the removal of soils with nitroaromatic compound concentrations greater than 100,000 ppm. Alternative 4 will have a greater reduction in toxicity due to an increased volume of the nitroaromatic compounds and lead at Sites COC-3 and COP-4 being removed and disposed of in an offsite landfill. The toxicity and volume will not be reduced, but simply transferred to an off-site landfill. Implementation of Alternative 3 and 4 will also prevent access by humans and animals

to remaining nitroaromatic compounds in soil, and reduce the migration of these compounds through the prevention of contact with surface water runoff and rainwater. Alternative 5 will reduce the mobility, toxicity, and volume of nitroaromatic compounds in the soil by an active biodegradation process, and has been demonstrated to destroy nitroaromatic compounds to near the potential remediation goal levels. A removal of soils with nitroaromatic compound concentrations greater than 100,000 ppm, would be required with Alternative 5 due to poor biodegradation of larger crystalline nitroaromatics (chunks) and increased safety hazards. Composting is considered a permanent and irreversible treatment process. The overall volume of this Alternative will increase due to addition of locally obtainable amendments (wood chips, sawdust, manure, etc.) used to enhance biodegradation. Alternatives 6 and 7 will achieve the greatest reduction in mobility, toxicity, and volume in comparison to the other alternatives. Incineration of the materials will permanently reduce or eliminate the mobility, toxicity, and volume of nitroaromatic compounds. Thermal destruction of nitroaromatic compounds via incineration is considered an irreversible process and has been demonstrated to destroy nitroaromatic compounds to levels over 99.99 percent. Alternative 5 through 7 will require additional analysis for metals. If metals, specifically lead, is present at concentrations above unacceptable concentrations, the soil or waste stream (specifically ash) will require additional treatment and disposal in a special waste or hazardous waste landfill.

Alternative 1 will have soils remaining on site in excess of the 100,000 ppm nitroaromatics. For Alternatives 2 through 7, any soils remaining onsite, that if removed for any reason in the future, would not be considered as a characteristically hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). This will be ensured through the collection of confirmatory sampling and analysis during the excavation activities.

Short-Term Effectiveness

Since no active treatment technologies are employed in Alternative 1, there are no safety concerns associated with the implementation of this alternative. Implementation of Alternative 1 is not considered to increase the potential risk to the community. This alternative presents the least amount of potential exposure to workers, the community, and the environment during remedial activities.

Implementation of Alternatives 2 through 7 is likely to result in potential exposure of remedial workers to nitroaromatic compounds and metals in soil and dust particles. However, proper safety procedures are expected to ensure that the workers and the community are not subjected to any unnecessary risk from exposure to airborne chemicals. The significant distance that exists between the EMMA OU sites and the Crab Orchard NWR property line will help to ensure that airborne chemicals do not affect the local human population. Cattle farmers will still have access to pastureland adjacent to the sites. Handling of the site soils will potentially present safety hazards to onsite workers due to the presence of nitroaromatic compounds. This will be addressed through use of magnetic surveys in combination with a hazards analysis of equipment and procedures prior to excavation, capping, or treatment activities. Prudent safety procedures, the use of appropriate personal protective gear, use of a hazards analysis, and the development and implementation of a site safety and health plan will be sufficient to protect workers during remedial operations.

Alternatives 2, 3, 4, 5, and 7 present an increased exposure to the community due to the necessity for hauling affected soil through surrounding areas for offsite disposal. Alternative 2 is anticipated to have the greatest short-term effectiveness because they do not involve repeated handling of the affected soil. Alternatives 5 and 6 have lesser short-term effectiveness due to the extensive onsite soil handling required and the remedial action time frames.

Implementation

Alternative 1 employs no active remedial measures and, therefore, has no technical

difficulties associated with it. Land use controls, groundwater monitoring during the 5-year site review, and fencing in Alternatives 2 through 7 would be easily implemented. However, land use controls may limit management options at the Refuge.

The implementability of Alternatives 2, 3, 4, 5, and 7 are negatively affected by the necessary transport of affected soil through the surrounding community. Construction activities in Alternative 3 and 4 are expected to occur without technical difficulties as materials and equipment necessary for clean backfill, cover and cap construction are readily available. Alternative 5 will require special equipment and operators to implement the composting treatment process for the remaining soils. However, personnel, equipment, and materials are available from vendors. Alternative 5 may also present the most difficulty with regard to soil handling due to the greater manipulation of soil. Implementation of Alternative 6 will require trial burns which can be time consuming. Each of the alternatives involving excavation of soil may potentially present technical difficulties due to the clayey nature of the EMMA OU site soils. Clays and silts will tend to clog equipment and impair equipment activity, and may also result in longer treatment times due to extended handling activities.

Cost

The costs of the alternatives were evaluated. Alternatives 1 and 2 are the least costly of the alternatives. However, Alternative 1 provides no active remediation processes. Alternative 2 consists of the excavation of soil with greater than 10 percent nitroaromatic compounds. Of the remaining alternatives that do provide for active remediation processes (Alternatives 3 through 7), Alternatives 4, 5A, 5B, and 5C are similar in cost. The cost for Alternatives 3, 6, and 7 increases with each alternative. Alternative 7 (Offsite Incineration) is the most costly of the alternatives.

Overall present worth costs for alternative 2 through 7 are conservatively based on 27 wells being sampled as part of O&M. The final determination of the number of wells to be tested will be determined during pre-design activities. It is likely that the costs for O&M in alternatives 2 through 7 will decrease.

State Acceptance

This criterion will be addressed in the Record of Decision (ROD) once comments on this Proposed Plan and the recommended alternative are received from IEPA.

Community Acceptance

Implementation of Alternative 6 is anticipated to be difficult due to public concerns regarding onsite incineration, as expressed in the public reaction to proposed use of onsite incineration at the Crab Orchard NWR PCBA OU. This criterion will be addressed in more detail in the ROD once comments on this Proposed Plan and the recommended alternative are received from the public.

PREFERRED ALTERNATIVE

Based on careful consideration of the technical, environmental, institutional, public health and cost criteria and in keeping with the overall response strategy, the preferred alternative is Alternative 4. Alternative 4 consists of implementing magnetic surveys, soil removal to a depth of five feet, backfilling with clean soils, marking the boundaries of the affected area, land use controls, and performing periodic groundwater monitoring. The excavation and backfill depth will prevent both human and wildlife contact with nitroaromatic compound remaining in the soil. Because of the depth of cover over remaining contamination, this Alternative requires the least amount of perpetual maintenance and institutional controls.

While Alternatives 3 through 7 all provide essentially the same level of protection from the contaminated soil remaining on site, Alternative 4 is not dependant on perpetual maintenance and periodic replacement of a fencing system. The integrity of the five foot soil cover would not be breached by burrowing animals so there is no need to preclude them from the site. This Alternative allows humans and wildlife free access to the site so it can be utilized for the purpose of providing refuge to wildlife.

Table 1. Remedial Alternative Evaluation Summary

	1	2	3A	3B	3C	4	5A	5B	5C	6	7
Protective of Human Health and Environment			✓	✓	✓	✓	✓	✓	✓	✓	✓
Complies with ARARs				✓	✓	✓	✓	✓	✓	✓	✓
Long-Term Effectiveness			✓	✓	✓	✓	✓	✓	✓	✓	✓
Reduction of Mobility			✓	✓	✓	✓	✓	✓	✓	✓	✓
Reduction of Toxicity							✓	✓	✓	✓	✓
Reduction of Volume							✓	✓	✓	✓	✓
Short-Term Effectiveness		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Implementability	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cost ($M)	0.0	5.8	6.4	6.8	6.8	7.3	11.9	12.1	12.2	11.1	13.4
Public Acceptance	?	?	?	?	?	?	?	?	?	?	?
State Acceptance			?	?	?	?	?	?	?	?	?

Although this Alternative has a higher capital cost than Alternative 3. it was chosen because the total implementation costs of this Alternative are likely to be lower than Alternative 3. There are numerous costs such as design, contracting, supervision and administration, and the cost of obtaining funding each year associated with implementation of any of these Alternatives which are not included in the cost figures presented in the FS. It is anticipated that all Alternatives with the exception of Alternative 4 would require annual contracting efforts to assure that the protective measures are still intact. With Alternative 4 the only contracting requirement would be for groundwater monitoring which would be performed once every five years after the first five year period. Because Alternative 4 does not change the contours of the site and does not rely on engineered protective caps and fences, the design costs of this Alternative will be lower than Alternatives 3, 5, 6, & 7. The cost of implementing institutional controls will also be lower for this Alternative because fewer controls are required.

Alternative 4 will satisfy the remedial objectives by minimizing the potential human health and ecological risks associated with nitroaromatic compounds and metals present in the soil. Exposure to site nitroaromatic compounds and metals will be effectively eliminated through the implementation of this alternative. With proper maintenance, this remedy will provide adequate protection of human health and the environment by preventing human and animal contact with nitroaromatic compounds and metals. In addition, the removal of nitroaromatic compounds reduce the movement of these compounds into the shallow groundwater.

CERCLA Section 120(h)(3)(B), requires that if the property is sold or transferred, each deed contain language stating that action to protect human health and the environment has been taken before the date of property transfer. Implementation of groundwater monitoring at locations chosen to provide early indication of changing conditions will provide an early warning system in case of shallow groundwater migration.

COMMUNITY PARTICIPATION

USACE relies on public input so that the remedial alternative selected for the Crab Orchard NWR EMMA OU meets the needs and concerns of the community. To ensure that the community's concerns are being thoroughly addressed, the Proposed Plan will have a public comment period as required by CERCLA. During this time, the public is encouraged to submit comments on the Proposed Plan to USACE. USACE, in consultation with USEPA, IEPA, and USFWS, may modify the Preferred Alternative, select another response action, or develop another alternative, if warranted by public comments and/or presentation of substantial new information.

The public is encouraged to review and comment on all the remedial alternatives in the Proposed Plan Report. Although USACE has recommended a Preferred Alternative, no final decision will be made until all public comments have been thoroughly reviewed and evaluated. The final alternative selected will be documented in a Record of Decision (ROD), which contains a detailed description of the final remedial action, outlines the decision-making process, and thoroughly responds to community input solicited during the formal comment period.

Administrative Record

Information presented in this Proposed Plan is based on the results and findings of the RI, BRA, and FS Reports. These documents, as well as the site-related data used to support the Preferred Alternative, are contained in an Administrative Record File. The Administrative Record File is the official legal file for the Superfund activities at this site. The Administrative Record File can be viewed at the following locations:

Southern Illinois University
Morris Library
Fifth Floor
Carbondale, IL 62901
Contact: Reference Librarian
(618) 453-2683

USEPA - Region V
77 West Jackson Boulevard., 7th Floor
Chicago, IL 60604-3590
Contact: Eileen Deamer
(312) 886-1728

Department of Justice
Marion Federal Penitentiary
Bureau of Prisons
RR 5, Little Grassy Road
Marion, IL 62959
Contact: Legal Office
(618) 964-1441

Information Repositories
Four information repositories have been established where the public may review documents on the EMMA OU sites. These repositories contain copies of the laws that apply to these activities, copies of the RI, BRA, and FS Reports, and other supporting documents. The information repositories can be viewed at the following locations:

Marion Carnegie Public Library
206 South Market Street
Marion, IL 62959
(618) 993-5935

Carbondale Public Library
405 West Main Street
Carbondale, IL 62901
(618) 457-0354

Crab Orchard National Wildlife Refuge
RR 3 Box 328
Marion, IL 62959
Contact: Leanne Moore
(618) 997-5491

Public Comment Invited
A public meeting is scheduled for **7:00 pm on October 19, 1995 at the Refuge Visitors Center.** The date, location, and time for this meeting will be announced in local newspapers. USACE will present the findings of the FS Report and summarize each of the remedial alternatives presented in the Proposed Plan. The rationale for selecting the Preferred Alternative will also be discussed. Interested citizens will have an opportunity to ask questions and provide comments.

The formal public comment period begins on **September 29, 1995** and runs for 30 days unless a request for an extension is made. USACE encourages citizens to review site-related documents and submit written comments to the following:

Mr. Kevin Quinn
U.S. Army Corps of Engineers
215 N. 17th Street
Omaha, NE 68102
(402) 221-3917

Please note that written comments must be postmarked on or before October 30, 1995.

Please place my name on the mailing list for the Crab Orchard National Wildlife Refuge Superfund Investigations. Please send information to the following address:

Name/Title _____
Organization _____
Street Address _____
City/State/Zip _____
Phone Number (Optional) (Work) _____ **(Home)** _____
Date_____

If you want to be placed on the mailing list for the Superfund activities at the Crab Orchard National Wildlife Refuge, please complete this form and mail to:

Leanne Moore • (618) 997-5491
Crab Orchard National Wildlife Refuge • RR 3, Box 328, Marion, IL 62959