**Per the Federal Facility Agreement for Iowa Army Ammunition Plant, Article X.B.1, the attached document is the final version of the submitted document.**

# PROPOSED PLAN

## PROPOSED PLAN FOR INTERIM ACTION
## SOILS OPERABLE UNIT
## IOWA ARMY AMMUNITION SITE

## MIDDLETOWN, IOWA

**Prepared for:**

**U. S. Army Environmental Center**
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## *INTRODUCTION*

Section 117 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, 42 U.S.C. 9617, requires the U. S. Army (Army), as lead agency, with support from the U. S. Environmental Protection Agency (EPA) to publish a notice and brief analysis of its proposed plans for remedial action. The Army hereby presents in this Proposed Plan an explanation of its proposed remedial action plans for cleanup of contaminated soils at various locations throughout the Iowa Army Ammunition Plant (IAAAP) site in Middletown, Iowa. This Proposed Plan has been developed for the Interim Remedial Action for the Soils Operable Unit (OU) at the site. This is one of the two OUs designated for cleanup of contamination at the site.

This Proposed Plan provides background information on the sites selected for interim remedial action, discusses the alternatives considered for remediation, presents the rationale for selecting the preferred remedial alternative, and outlines the community's role in helping the Army make a final decision on remedial action. After considering the public's comments, the Army, with support from EPA, will select a remedy for cleanup of contaminated soils at various locations throughout the facility. This Proposed Plan is based on the results of the following:

- Surface and subsurface soil data obtained from the site;
- Groundwater data obtained from the site and off-site locations;
- Evaluation of potential risk to human health resulting from contamination at the site; and
- Other information as presented in the Administrative Record.

This document has been prepared and published by the Army, the agency in charge of remedial activities at the IAAAP site. The Army is publishing this Proposed Plan as a part of its public participation responsibilities under CERCLA Section 117(a). The EPA, as the support agency, has indicated support for the preferred alternative identified in this Proposed Plan.

## *PURPOSE OF PROPOSED PLAN*

The primary purpose of the Proposed Plan is to present to the public a reasonable explanation of the Preferred Alternative and to summarize alternatives considered for the interim remedial action for the soils OU at the site. The public is encouraged to review and comment on the proposed remedy considered by the Army. The public is also encouraged to review supporting documents in the Administrative Record for selection of the remedial action. The Administrative Record includes, among other documents, the Revised Draft-Final Remedial Investigation (RI) (U. S. Army, 1996) and the Focused Feasibility Study (FFS) (U. S. Army,

1997) for the interim remedial action. The Proposed Plan summarizes many of the details provided in the RI and FFS reports.

A 30-day public review and comment period opens on May 22, 1997, and will close on June 21, 1997. A public meeting will be held on June 4, 1997, at the Danville Community Building, in Danville Iowa, to accept comments and address questions from the public concerning information presented in the Proposed Plan. The Proposed Plan and supporting documents in the Administrative Record are available for review during normal business hours at the following locations:

Iowa Army Ammunition Plant
Visitor Reception Area
Building 100-101
Iowa Army Ammunition Plant
Middletown, Iowa 52638-5000
(319) 753-7710

Burlington Public Library
501 N. Fourth Street
Burlington, Iowa 52601
(319) 753-1647

Danville City Hall
105 W. Shepard
Danville, Iowa 52623
(319) 392-4685

The Army, with support from the EPA, will prepare a Record of Decision (ROD) which specifies the cleanup action. The ROD will be based on information presented in this Proposed Plan and comments on the Plan received by the Army during the comment period. Included in the ROD will be a responsiveness summary responding to all significant comments from the public.

## *SITE LOCATION AND DESCRIPTION*

The IAAAP is a 20,000 acre Load, Assembly, and Pack (LAP) munitions facility in eastern Iowa, 10 miles west of Burlington. The IAAAP is owned by the U. S. Government and operated by a contractor (currently Mason & Hanger-Silas Mason Co. Inc.) for the Department of the Army. Since 1941, the IAAAP has produced projectiles, warheads, demolition charges, anti-tank weapons, primers, and fuses. Only a few of the production lines currently remain in operation. The primary source of contamination at the site may be attributed to past operating practices where explosives-contaminated wastewaters and sludges were discharged to uncontrolled lagoons and impoundments on-site.

The site was listed on the EPA's National Priorities List (NPL) in 1990. A Federal Facilities Agreements (FFA) was signed between the EPA and the Army for the cleanup of the site which was effective on December 10, 1990, following public comment. The FFA, which is also called an Interagency Agreement (IAG), provides a framework for the CERCLA response actions to be performed at the site, including the investigation and cleanup of contamination. The State of Iowa has declined to participate as a signatory party to this FFA.

The Department of Defense (DOD) has established the Defense Environmental Restoration Account (DERA) to address CERCLA sites within the responsibility of the DOD. The Army, as an agency within the DOD, is the lead agency for implementing the interim remedial action at the IAAAP site. As the support agency, the EPA oversees the cleanup activities conducted by the Army to ensure that the requirements of CERCLA and the National Contingency Plan (NCP) have been met.

The site has been divided into two OUs to facilitate management: a soils OU and a groundwater OU. These designations occurred following completion of the majority of the RI activities. The RI for the soils OU is effectively complete and has been followed by a FFS (U. S. Army, 1997). Additional data have been requested by EPA to complete the investigation of the groundwater OU. It is anticipated that these data gaps will be filled during the 1997 construction season to complete the groundwater characterization. A Feasibility Study, Proposed Plan, and ROD will be prepared and submitted for public review and comment for the groundwater OU. A Final ROD will be issued for the Site which encompasses all contaminated areas of concern, including those not addressed as a part of this interim remedial action.

Numerous investigations have been conducted at the site by the Army from 1975 to the present. The following briefly summarizes the investigations most recently conducted within the FFA.

The Army conducted Preliminary Assessments (PA) and Site Investigations (SI) to identify areas of potential contamination. As a result of the PAs, 43 subsites of known or suspected contamination were identified by the Army based on previous investigations or knowledge of operational and waste handling practices. In August 1991, a SI was conducted at each of the 43 subsites. Limited soil, sediment, groundwater, and surface water sampling was conducted in an effort to determine whether chemical constituents were present at levels of concern at suspected source areas and in associated migration pathways. Data obtained during the PA/SIs were used to supplement data previously obtained by the Army to develop the list of subsites to be investigated within the RI. The presence of chemical constituents above analytical reporting limits indicated a need for further evaluation.

The Phase I RI was conducted by the Army from July 5 to November 23, 1992. The Phase I investigation included an expanded characterization of background levels of metals in soils, a soil gas sampling effort in order to discern the extent of contamination by volatile organic compounds (VOCs), base-wide surface water and sediment sampling, base-wide groundwater

sampling, the installation of temporary groundwater monitoring wells called piezometers, off-post residential well sampling, field screening analysis for metals and explosives in soils, and fixed laboratory analyses of approximately 20 percent of the field screening samples collected and analyzed. The results of the off-post residential well sampling effort indicated the presence of explosives in excess of the EPA Health Advisory Levels (HAL) in five of the wells sampled. Contaminated wells were located southwest of the site near the town of Augusta, and off-site in the Brush Creek watershed. As an interim action, the Army placed the affected residences on bottled water. The Army then contracted with the local public water supply company to have numerous potentially impacted residences located south of the IAAAP boundary connected to the rural water supply district.

Results of the Phase I RI were used to refine the soil and groundwater investigation in the Phase II RI which commenced April 12, 1993. During the Phase II RI, thirteen soil borings were advanced to depths of approximately 15 feet below ground surface (BGS) to obtain additional information regarding subsurface conditions at five subsites. A total of 80 groundwater monitoring wells were placed at the site during the RI. During the placement of each well, soil samples were obtained at the soil/groundwater interface and submitted for fixed laboratory analysis. Following placement of groundwater monitoring wells, each well was sampled for chemical constituents indicated by previous data obtained and knowledge of past operational and waste handling practices at that site. Surface and near-surface soil samples were collected at the Roundhouse Transformer Storage Yard (R28) in an effort to delineate the extent of polychlorinated biphenyl (PCB) contamination detected previously during the SI.

The Draft Remedial Investigation Report (RI Report) (U. S. Army, 1993) was submitted to the EPA for review and comment to present the data obtained during the Phase I and II RI. It was subsequently determined that the collection of additional data was necessary to complete the site characterization. Additional sampling was conducted in April through August 1995 to obtain data to better characterize the nature and extent of on-site contamination. This sampling consisted of the placement of 28 additional soil borings and 26 groundwater monitoring wells, soil sample collection adjacent to previously unsampled explosive wastewater sumps, shallow soil sampling to verify positive results from the soil gas sampling during the Phase I RI, and collection of stream gauging data and shallow groundwater levels in an effort to characterize the hydraulic interconnection between surface water and shallow groundwater. Following the additional field sampling effort, the Draft-Final RI Report was submitted on November 13, 1995. The Army received and incorporated comments from EPA on this document and the Revised Draft-Final RI Report dated May 21, 1996 was accepted as final according to the FFA.

## *SCOPE/ROLE OF THE RESPONSE ACTION*

Based on data collected at the site, the Army has initiated non-time critical removal actions at the IAAAP to address soil contamination at several areas across the IAAAP, including

the Pesticide Pit, the Explosives-Contaminated Sumps, the former Fire Training Pit, the Inert Landfill, and the Line 1 Impoundment and Line 800 Pink Water Lagoon subsites.

Approximately 150 cubic yards of pesticide-contaminated soil was excavated in the spring of 1995 from the former Pesticide Disposal Pit and disposed at an approved off-site waste disposal facility.

Explosive-contaminated soil associated with over 50 abandoned wastewater sumps was also excavated in the spring of 1995. These contaminated soils are currently being stored in a lined stockpile near the Inert Landfill at the IAAAP awaiting permanent disposal.

A non-time-critical removal action to address an estimated 5000 cubic yards of soils contaminated with VOCs from various fuel and solvent sources at the former Fire Training Pit will be implemented by the Army during the 1997 construction season. It is anticipated that soil-vapor extraction (SVE) will be the technology used to complete this clean-up.

In the fall of 1996, the Army began activities to construct an impermeable cover on the 14-acre Inert Landfill site. The cover will satisfy requirements of RCRA Subtitle C and will consist of several low permeability synthetic liners. The liners will prevent infiltration of precipitation into the landfill material and the subsequent transport of contaminants from wastes to groundwater. Industrial and municipal-type wastes had been disposed in the Inert Landfill by the Army prior to the advent of current-day waste management regulations. The migration of contaminants leaching from these wastes to groundwater represents a continuous source of contaminants which will be mitigated by the construction of the cover.

The Line 1 Impoundment and Line 800 Pink Water Lagoon are considered to be the greatest sources of explosives contamination at the site. As a part of the non-time critical removal actions for the Line 1 Impoundment and the Line 800 Pink Water Lagoon, soil will be sampled, analyzed, and segregated according to the risk or contaminant level detected. Depending on the concentration of explosives in soils to be removed, the soils will be placed in one of three areas: a Soil Repository constructed adjacent to the IAAAP Inert Landfill; a Corrective Action Management Unit (CAMU) also constructed adjacent to the Inert Landfill; or used as random fill beneath the RCRA cap at the Inert Landfill to achieve final grade. Contaminated soil placed in the Soil Repository will be covered by an extension of the RCRA cap to be constructed over the Inert Landfill and will remain on-site for long-term management. More highly contaminated soils will be placed in the CAMU for temporary management. Treatment of these soils will ultimately be specified in the Final ROD for the Soils OU. The CAMU may only be used to store CERCLA remediation wastes in accordance with 40 CFR 264.552, and as specified in the EPA Memorandum dated March 8, 1995 entitled "Designation of Corrective Action Management Unit, Iowa Army Ammunition Plant Site, Middletown, Iowa". Soils which contain contaminants at levels which do not exceed human health risk-based cleanup criteria but remain a potential threat to shallow groundwater, as predicted by a generally accepted model, may be used by the Army as random fill beneath the RCRA cap at the Inert Landfill or in the Soil Repository.

The Soil Repository meets RCRA requirements for hazardous waste landfills. The bottom liner system includes a low-permeability geosynthetic clay liner (GCL) and two 60 mil high-density polyethylene (HDPE) liners to eliminate the potential migration of contaminants to underlying soils and groundwater. The bottom liner also includes a geocomposite drainage layer for leak detection and additional drainage and leachate collection features. The Soil Repository will be covered by a RCRA cap, including a 40 mil HDPE liner and a GCL, which will be placed on the Inert Landfill after the trench has been filled.

The CAMU has been constructed to specifications similar to the Soil Repository. The bottom liner system of the CAMU consists of a low-permeability GCL, two 60 mil HDPE liners, a geonet leachate collection layer, and a leachate collection sump. The CAMU will be covered to prevent exposure of contaminants to the elements and to minimize the infiltration of precipitation. The cover will consist of a 40 mil HDPE geomembrane, a geonet collection layer, and a separation/filtration geotextile. The cover will also be secured with 18 inches of clean, graded soil, six inches of topsoil, and a stone protection toe-drain. The CAMU will serve only as a temporary storage facility until such time as a cost-effective treatment process is established for the contaminated soils stored therein.

In addition to the subsites listed above for which non-time critical removal actions have been undertaken, the Army has identified 15 additional subsites with soils containing chemical constituents at concentrations greater than cleanup goals for the site. The evaluation of potential remedial alternatives and the identification of a preferred alternative to address these subsites is the subject of this Proposed Plan. A listing of the subsites proposed for cleanup within the scope of this interim remedial action and their respective contaminant types is presented in Table 1. Other subsites within the soils OU may ultimately require remedial actions to address soil contaminants. However, the nature of any such activities is not currently well defined due to the absence of definitive data and an accompanying risk evaluation. The cleanup of any additional subsites which may be found to pose unacceptable risk and which are not addressed by this proposed action will be specified as a part of the Final Soils OU ROD.

## *SITE CHARACTERISTICS*

The RI performed by the Army from 1992 through 1995 focused primarily on identifying sources of contamination resulting from previous facility operations and waste handling practices associated with the production of ammunition. The purpose of the RI was to determine the extent of the contamination in surface and subsurface soil, surface water, sediments, and groundwater. Results of the soils investigation indicate that, with the exceptions of the Line 1 Impoundment, Line 800 Pink Water Lagoon, Fire Training Pit, and Pesticide Pit areas, contamination at the site generally consists of explosives and lead found in soils adjacent to source areas at depths of approximately three feet below ground.

Groundwater has been found to exceed cleanup criteria at Lines 1, 2, 3, 3A, and 6; the Line 800 Pink Water Lagoon; the Explosives Demolition Area/East Burn Pads, the Firing Site, the

Inert Landfill, the Fire Training Area, and at locations south of the IAAAP. Surface water and sediment quality have been impacted by previous discharges of explosives-contaminated wastewater from washing down the ammunition load lines. It is suspected that the surface water and shallow groundwater along the three watershed areas are hydraulically interconnected. The relationship between these two media, and levels of chemical constituents in base-wide sediments, will be investigated as a part of the Supplemental Hydrogeologic Study for the groundwater OU to be conducted during the 1997 construction season.

As discussed above, 15 subsites have been identified with soils containing chemical constituents at concentrations greater than cleanup goals for the site. Within these 15 subsites, there are numerous areas which are represented by as few as one surface or subsurface soil sample result which exceeds the cleanup goals for the site. The extent of contamination has not been precisely defined in these isolated areas of contamination; therefore, the Army has calculated estimated volumes of contamination which may need to be removed based on the physical setting (e.g., boundaries formed by buildings and other adjacent structures) and knowledge of the site gained during previous removal actions, such as the Explosives-Contaminated Sumps removal action conducted in 1995. The extent of contamination will be further defined during the design phase for the interim remedial actions.

Table 1 provides a listing of the contaminant types and the estimated volumes of soils to be removed from the interim remedial action sites. A detailed description of the nature and extent of contamination at these sites is included in the IAAAP RI and FFS reports. A brief summary of the locations and types of contamination is described below:

Line 1. At Line 1, there are 25 separate areas from which contaminated soil will be removed. Soils to be removed are adjacent to explosives production buildings, a vacuum pump house, and a cooling tower. Contaminants include explosives, metals, and SVOCs. The radionuclides Actinium 228 and Bismuth 214 were detected at concentrations which exceed site cleanup criteria in soils along the north side of Building 1-155-1 (a cooling tower). Bismuth 214 was detected in soils at the southeast corner of Building 1-70-1 (a filter building).

Line 2. At Line 2, there are 18 areas adjacent to explosives production, assembly, and shipping areas which require remediation. Contaminants include explosives and lead.

Line 3. At Line 3, there are 22 areas of contamination surrounding a solvent storage building, the explosives production buildings, pump houses, and a filter house. Contaminants include explosives, metals, and SVOCs. Bismuth 214, a radionuclide, was detected in one sample collected south of the X-Ray Bay at Building 3-10.

Line 3A. At Line 3A, there are eight areas of contamination located adjacent to explosives production buildings and a pump house. Contaminants detected at concentrations which exceed cleanup criteria include explosives and lead.

Line 4A. At Line 4A, one sample obtained from a drainageway south of Building 4A-07, downgradient from a sump, contained lead at a concentration which exceeded cleanup goal for the site.

Lines 5A/5B. At Lines 5A and 5B, 10 areas of concern were identified. These areas are located adjacent to the tetryl screening and blending facility, the tetryl pelleting operations, the explosives assembly area, and pump house areas. Contaminants which exceed cleanup criteria include explosives, lead, and arsenic.

Line 6. At Line 6, soil samples collected adjacent to the Building 6-19 sump contained explosives at levels exceeding cleanup criteria for the site. Lead and antimony were detected at concentrations exceeding cleanup criteria in samples obtained from soils adjacent to the Building 6-96 sump.

Line 8. At Line 8, lead was detected at concentrations exceeding cleanup criteria adjacent to Foundation X and at the southwest corner of Building 8-81-4 (an ammonium nitrate kettle house).

Line 9. At Line 9, beryllium was detected from the excavation area of a former sump and lead was detected adjacent to Building 9-58 (a mixing building) at concentrations which exceeded cleanup criteria.

Line 800. There are four areas of contamination at Line 800 which exceeded the cleanup criteria for the site. These areas include the settling ponds associated with the Line 800 Pink Water Lagoon (explosives), the northwest corner of Building 800-04 (explosives), an area adjacent to east end of Building 800-04 (lead), and an area along the west side of Building 800-191 (lead).

Explosives Demolition Area. At the Explosives Demolition Area (EDA) and East Burn Pads, explosives were detected in sediment samples collected from drainageways on the east and west sides of the burn pads. Explosives were also detected in soils at 16 locations associated with the burn pads.

Demolition Area/Deactivation Furnace. Lead was detected at concentrations which exceed cleanup criteria at a location along the southeast corner of the deactivation furnace.

Burn Cages/West Burn Pads Area. Explosives and metals were detected at concentrations which exceeded cleanup criteria for the site in the Ash Disposal Landfill, the west burn pads and west burn pads landfill, and along the southeast corner of Building BG-13 along a truck loading dock.

North Burn Pads. Lead, arsenic, and antimony were detected at concentrations which exceed cleanup criteria for the site adjacent to Pad 1-N.

Roundhouse Transformer Storage Area. PCB 1260 was detected at concentrations greater than cleanup criteria for the site at two locations in the northeast corner of the former pad location.

## *SUMMARY OF SITE RISKS*

A Baseline Risk Assessment (BLRA) to assess the potential effects of the site upon human health and the environment was prepared by the Army, and is included in the Revised Draft-Final RI Report (U. S. Army, 1996). The BLRA was conducted in accordance with the EPA guidance ("Risk Assessment Guidance for Superfund Sites" - EPA, 1988). Within this BLRA, the reasonable maximum exposure to chemical constituents present at the site was evaluated. The following four steps were used to assess site-related human health risks:

- *Hazard Identification* - identifies the contaminants of concern (COCs) at the site based on several factors such as toxicity, frequency of occurrence, and concentration;

- *Exposure Assessment* - estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways of exposure (e.g., ingestion of contaminated well water) by which humans are potentially exposed;

- *Toxicity Assessment* - determines the type of adverse health effects associated with chemical exposures, and the relationship of the magnitude of exposure (dose) and the severity of adverse effects (response);

- *Risk Characterization* - summarizes and combines the outputs of the exposure and toxicity assessment to provide a quantitative (e.g., one-in-one million risk of developing cancer) assessment of site risk.

The BLRA began with the identification of COCs from the surface and subsurface soils, groundwater, surface water, and sediment data previously collected at the site. Any chemical constituent detected was initially considered a potential COC. Chemical constituents were eliminated from consideration if they were detected infrequently or if they are essential nutrients and are nontoxic at the levels encountered at the IAAAP. Eighty-eight COCs were identified.

Based on a review of site conditions, including current and anticipated future land use, contaminant distribution, and human activity patterns, the current populations most likely to be exposed to chemical constituents at the site are on-site workers, off-post residents (both adults and children), and on-site visitors. The most important exposure pathways were judged to be:

- Ingestion of contaminated groundwater, soils, surface water, and sediments;

- Dermal contact with groundwater, soils, surface water, and sediments;

- Inhalation exposure to VOCs released from groundwater to indoor air.

As an addendum to the BLRA, exposure scenarios were evaluated to address future land use conditions at the site. Future land use at the IAAAP is anticipated to be commercial/industrial in nature. Risks associated with future land use are similar in nature but greater in magnitude than risks associated with current use. The leaching of contaminants to shallow groundwater and potential human consumption of the contaminated groundwater by workers in an commercial/industrial land use scenario represents the greatest human health risk associated with the site.

The risk of cancer from exposure to a chemical is described in terms of the probability that an individual exposed for his or her lifetime will develop cancer. Cancer risks representing a probability of 1 excess cancer case in one million, or a risk of $10^{-6}$ or lower are considered to represent acceptable exposure levels, as discussed in the NCP. Cleanup goals for the site have been set consistent with the NCP, assuming a cancer risk of $10^{-6}$ for contaminants of concern under a commercial/industrial land use. Estimated cancer risks from exposure to the chemical constituents present at the site for current off-post residents using groundwater from supply wells for household purposes range from $10^{-5}$ to $5x10^{-5}$. Explosives have been detected in off-post supply wells at levels exceeding HALs. Cancer risks for workers at various IAAAP areas exceed $10^{-4}$, which is the threshold for which a remedial action is typically required. Risks for IAAAP visitors range from $10^{-8}$ to $4x10^{-7}$.

Evaluation of noncarcinogenic risk is accomplished by comparing a calculated intake with an acceptable intake for each chemical constituent and for each pathway that contributes to a population's exposure. The ratio of the calculated intake to the acceptable intake is the hazard index (HI). An HI value exceeding one indicates a potential for negative noncarcinogenic effects. No HI values were greater than one for any current off-post residential or on-site visitor population evaluated at the IAAAP, indicating that exposures of these populations to chemical constituents do not appear to be significant. For workers, the HI values range as high as 30. Chemicals that contribute to these HIs in excess of one include 2,4,6-trinitrotoluene (2,4,6-TNT) and 1,3,5-trinitro-1,3,5-triazacyclohexane (RDX). On this basis, exposed site workers may be at risk from the noncarcinogenic effects of these chemical constituents.

An ecological risk evaluation was also conducted for the site. In this ecological risk assessment, a qualitative evaluation of contaminant release, migration, and fate was conducted using the contaminants of potential concern identified for the site as discussed above. Possible exposure pathways and receptors were evaluated, as well as known ecological effects of the contaminants of concern. A qualitative determination of the ecological populations most at risk was developed and endpoints were recommended for further study. Endangered or threatened species and associated habitats known or suspected to be present at the site were evaluated.

The ecological risk assessment concludes that the potential exists for toxic effects in terrestrial plants, invertebrates, wildlife, and aquatic benthic organisms. Because these conclusions were derived based on screening evaluations using known levels of chemical

constituents at the site, the report suggests that further quantitative toxicity testing and tissue sample collection be conducted to support remediation decisions. Further evaluation of the potential ecological risks associated with the site will be conducted as a part of the additional investigations associated with the groundwater OU.

## *DETERMINATION OF PRELIMINARY SOIL CLEAN UP GOALS*

Chemical-specific preliminary remediation goals (PRG) are concentration goals for individual chemicals and for specific medium and land use combinations. PRGs represent protective levels for human exposure to contaminants in specific media. Chemical-specific PRGs can be derived from two general sources: 1) concentrations based on applicable or relevant and appropriate requirements (ARARs), and 2) concentrations based on risk assessment or risk-based calculations that set concentration limits using carcinogenic and/or noncarcinogenic toxicity values under specific exposure conditions.

PRGs for IAAAP (Table 2) have been established based on risk considerations. These include criteria associated with ingestion and dermal contact with contaminated soils by the reasonably maximum exposed individual, as well as criteria to evaluate possible leaching of contaminants from soils to groundwater at unacceptable levels.

The process for determining PRGs for contaminated soils is outlined in the Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals) (EPA/540/R-92-003). Specific variables which impact the determination of PRGs are:

- The target risk level (for carcinogens) or HI (for non-carcinogens);
- The toxicity of the contaminant;
- The degree of exposure of a receptor to the contaminant.

For the IAAAP, PRGs were established at a target carcinogenic risk of $10^{-6}$, consistent with the NCP. The NCP states that PRGs should be established for individual constituents within the risk range of $10^{-4}$ to $10^{-6}$, with a preference for the most protective values.

Toxicity data for contaminants found at the IAAAP was obtained from EPA's "Integrated Risk Information System" (IRIS) database and from the "Health Effects Assessment Summary Tables" (HEAST), which are also compiled by EPA.

Commercial/industrial land use is the current and reasonably anticipated future land use at the site. EPA guidance (OSWER Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: "Standard Defaults Exposure Factors") supplies standard default

exposure factors associated with such land use, which were utilized in the calculation of PRGs for the IAAAP.

In addition to risk-based soil remediation goals for protection of human health, impact to groundwater from residual soil contamination has been evaluated. The Summers' model was utilized to estimate the point at which contaminant concentrations in the soils will produce groundwater contamination at concentrations above acceptable levels. The resultant soil concentrations can then be used as a guideline in estimating boundaries or extent of soil contamination and specifying soil cleanup goals for remediation.

The Summers' model assumes that a percentage of rainfall at the site will infiltrate the surface and desorb contaminants from the soils, based on equilibrium soil:water partitioning. It is further assumed that this contaminated infiltration will mix completely with the groundwater below the site, resulting in an equilibrium groundwater concentration with all contaminants in the final mixture from the infiltration.

The Summers' model was used to determine acceptable levels for explosive COCs in soils (RDX, and 2,4,6-TNT), which are found in on- and off-site groundwater. The model was not used for metals as metals are relatively immobile in the clay soils found at the IAAAP. The site-specific PRGs for the major contributing explosives are:

**Preliminary Soil Remediation Goals**
**Leaching**

| *Chemical* | *PRG (µg/g)* |
|---|---|
| RDX | 1 |
| 2,4,6-TNT | 47 |

These concentrations of RDX and 2,4,6-TNT represent contaminant levels in soils which are considered protective of human health and protective of groundwater. These values are utlilized as the PRGs for RDX and 2,4,6-TNT as presented in Table 2.

## *SUMMARY OF THE ALTERNATIVES IN THE FS REPORT*

Three remedial action alternatives were developed in the IAAAP Focused Feasibility Study for the Soils OU to address the contaminants and threats previously described. These alternatives are:

Alternative 1

- Excavation of contaminated soils at levels exceeding PRGs;

- Verification sampling;
- Incineration of soils containing explosives, SVOCs, and PCBs;
- Solidification/stabilization of metals- and radionuclides-containing materials, including soils and ash;
- On-site disposal of treatment residues in the Soil Repository.

Alternative 2

- Excavation of contaminated soils at levels exceeding PRGs;
- Verification sampling;
- Bioremediation of soils containing explosives and SVOCs;
- Solidification/stabilization of metals- and radionuclides-containing materials, including biotreatment residues containing explosives exceeding LDR criteria;
- On-site disposal of PCB-containing soils and all treatment residues in the Soil Repository.

Alternative 3

- Excavation of contaminated soils at levels exceeding PRGs;
- Verification sampling;
- Segregation of soils according to contaminant type and risk level;
- Temporary storage of soils with risk levels above $10^{-5}$, or that fail Land Disposal Restrictions (LDR) criteria, in the CAMU;
- Permanent disposal of soils with risk levels between $10^{-5}$ and $10^{-6}$ in the Soil Repository;
- Permanent disposal of soils with risk levels below $10^{-6}$ and above leaching PRGs in the Soil Repository or the Inert Landfill;

- Solidification/stabilization of metals-containing soils at levels exceeding LDR criteria, and disposal in the Soil Repository.

## *EVALUATION OF THE ALTERNATIVES AND THE PREFERRED ALTERNATIVE*

The NCP requires the evaluation of the selected remedial alternatives against nine criteria. A selected, or preferred alternative must satisfy all nine criteria before it can be implemented. The first step is to ensure that the alternative satisfies the threshold criteria. The two threshold criteria are overall protection of public health and the environment and compliance with ARARs. In general, alternatives that do not satisfy these two criteria are rejected and not evaluated further. However, compliance with ARARs may be "waived" if site-specific circumstances warrant such a "waiver as described in Section 300.430(f)(1)(ii)(C) of the NCP.

The second step is to compare the alternative against a set of balancing criteria. The NCP establishes five balancing criteria which include long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; implementability; short-term effectiveness; and cost. The third and final step is to evaluate the alternative on the basis of modifying criteria. The two modifying criteria are state and community acceptance. These final two criteria cannot be evaluated fully until the state and public have commented on the alternative and their comments have been analyzed.

THRESHOLD CRITERIA

1. Overall Protection of Human Health and Environment

This criterion addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with ARARs

This criterion addresses whether a remedy will meet applicable or relevant and appropriate federal and state environmental laws. Compliance with chemical-specific, location-specific, and action-specific ARARs is required of the preferred alternative unless a waiver of an ARAR is justified.

BALANCING CRITERIA

1. Long-Term Effectiveness and Permanence

This criterion addresses the ability of a remedy to maintain protection of human health and the environment over time, after remedial action goals have been attained. Factors that are considered include both the magnitude of residual risk remaining after implementation as well as the adequacy and reliability of controls used to manage treatment residuals or untreated wastes.

2. Reduction in Toxicity, Mobility, or Volume Through Treatment

This criterion addresses the degree to which a remedy employs recycling or treatment to reduce toxicity, mobility or volume of the contaminants present at the site. This also includes how treatment is used to address the principal threats posed by the site.

3. Implementability

This criterion addresses the technical and administrative feasibility of the proposed remedy, including the availability of materials and services. The difficulty of undertaking additional action, if necessary, is also assessed.

4. Short-Term Effectiveness

This criterion addresses the period of time needed to achieve the remedial action, and any adverse impacts to human health and the environment that may be posed during implementation of the remedy.

5. Cost Effectiveness

This criterion addresses the direct and indirect capital cost of the proposed remedy. Operation and maintenance costs incurred over the life of the project, as well as present worth costs, are also evaluated.

MODIFYING CRITERIA

1. State / Support Agency Acceptance

This criteria addresses the state and supporting agency's preferences or concerns about the site remedial action alternatives. The Army is the lead agency for the CERCLA clean-up activities at the IAAAP. EPA is considered the support agency for this clean-up and provides technical and regulatory oversight of the Army's activities as specified in the IAAAP FFA. The State of Iowa has declined to participate as a signatory party to the IAAAP FFA.

2. Community Acceptance

This criteria reflects the Army's perception of the community's preferences or concerns about the selected alternative. The degree of community acceptance of the Preferred Alternative will be assessed by the Army in its review of comments received on this Proposed Plan.

## *COMPARATIVE ANALYSIS OF ALTERNATIVES*

This section compares the performance of the 3 alternatives relative to the nine evaluation criteria previously outlined. The purpose of this analysis is to identify the relative advantages and disadvantages of each alternative.

### Overall Protection of Human Health and the Environment

All of the alternatives evaluated would satisfy the threshold criterion of protecting human health and the environment. Each alternative would utilize the same remediation goals to achieve the remedial action objectives and would thereby achieve the same level of protectiveness. Alternatives 1 and 2 would utilize treatment to attain the clean-up objectives, while Alternative 3 would employ a combination of containment and treatment to achieve these objectives. For Alternative 3, a smaller volume of contaminated soils would be treated relative to Alternatives 1 and 2. This treatment would not be accomplished as a part of this action, but would be specified as a part of the final remedy for the soils OU.

### Compliance with ARARs

All of the alternatives considered would comply with the respective applicable or relevant and appropriate requirements of federal and state environmental laws. Alternative 3 complies with RCRA LDRs by utilizing a CAMU for temporary management of remediation wastes. Treatment of these remediation wastes will ultimately be required to satisfy LDRs.

### Long-Term Effectiveness and Permanence

Alternative 1 provides the highest degree of permanence, as the majority of the contaminants would be permanently destroyed via incineration. Alternative 2 provides permanence by utilizing composting to stabilize explosive-contaminated soils in combination with long-term management of the treatment residuals. The degree to which composting may be considered a long-term irreversible process for stabilizing explosive-contaminated soils requires additional evaluation. Alternative 3 provides for effective containment of contaminated soils by utilizing conservative design measures, and when combined with the final remedy will provide for significant permanent contaminant reduction of the principal threat via treatment. Alternatives 2 and 3 rely on adequate maintenance of the CAMU and Soil Repository to ensure long-term effectiveness in the management of treatment residuals and remediation wastes.

Reduction of Toxicity, Mobility, or Volume Through Treatment

The alternatives evaluated utilize treatment to reduce contaminant toxicity, mobility, or volume in varying degrees. Alternative 1 utilizes incineration to permanently destroy the toxicity and mobility of the contaminants of concern. Alternative 2 reduces the toxicity and mobility of contaminants via stabilization/composting, but actually increases the volume of the contaminated media. Alternative 3 specifies containment for permanent disposal of low-level threat materials, while the principal threat materials are temporarily stored pending the Final Soils OU ROD. Alternative 3, in conjunction with the final remedy for the site, proposes to utilize treatment to reduce the toxicity and mobility of the principal threat.

Short-Term Effectiveness

Each of the alternatives requires excavation and ex-situ management of contaminated soils. Short-term risks associated with Alternative 3 are attributed to such excavation and subsequent transport of these soils to the on-site management facilities. Alternatives 1 and 2 specify additional handling of the soils to accomplish treatment objectives. Risks associated with emissions due to incineration specified by Alternative 1 would be managed by emission abatement technologies. It would be necessary to demonstrate to the local community the effectiveness of the emissions control equipment associated with Alternative 1.

Implementability

Alternative 3 is the most readily implementable alternative, as the on-site containment structures have been constructed as a component of other response actions at the site and are presently available to receive contaminated material. Alternatives 1 and 2 are implementable, however, would require construction of treatment facilities. The time frame to implement Alternative 3 would be much less than either Alternatives 1 or 2, which are estimated at 1.5 to 2 years for completion. Each of the alternatives will require coordination with IAAAP operations to ensure that access is available to the areas of concern and to ensure that conflicts with IAAAP production schedules are minimized.

Cost

The estimated costs to implement each alternative are as follows:

Alternative 1: $24,086,000

Alternative 2: $26,408,000

Alternative 3: $2,513,000

State / Support Agency Acceptance

EPA, as the support agency, has expressed support for Alternative 3 as the preferred alternative for this remedial action. The State of Iowa has not indicated a preference among the remedial alternatives.

Community Acceptance

Community acceptance of the preferred alternative outlined in this Proposed Plan will be assessed at the completion of the public comment period and documented in the responsiveness summary in the ROD.

## *SUMMARY OF THE PREFERRED ALTERNATIVE*

Based on information included in the Administrative Record, information presented in this Proposed Plan, and criteria set forth in CERCLA and the NCP, the Army identifies Alternative 3 as the preferred alternative to address soil contamination as an Interim Action for the IAAAP Soils OU. Alternative 3 consists of the following primary elements:

- Excavation of soils at levels exceeding PRGs from contaminated areas;
- Segregation of these soils according to contaminant type and concentration;
- Temporary storage of the most highly contaminated soils on-site at the CAMU located at the IAAAP Inert Landfill;
- Permanent disposal of soils contaminated at lesser levels in the on-site Soil Repository or in the Inert Landfill located at the IAAAP;
- Solidification/stabilization of metals-contaminated soils at levels exceeding LDR criteria, and permanent disposal in the on-site Soil Repository.

Soils which will be temporarily stored in the CAMU will ultimately be treated to reduce the contaminant toxicity, mobility, or volume to satisfy requirements of CERCLA Section 121(b). The nature of this treatment will be specified in the Final Soils OU ROD according to the schedule and procedures outlined in the IAAAP FFA.

Alternative 3 utilizes a combination of containment and treatment technologies to address unacceptable risks. The most highly contaminated soils will be temporarily stored in a secure containment structure which will effectively eliminate potential human exposures and minimize the migration of contaminants. It is estimated that 6% of the total volume of contaminated soil to be

addressed by this Interim Action, or a total of approximately 2500 cubic yards of soil, will be stored in the CAMU in the implementation of the preferred alternative. Nearly 70% of the total contaminant mass addressed by the preferred alternative is contained in this volume. Treatment of the most-highly contaminated soils provides a cost-effective approach to permanently and significantly mitigating the principal threat.

Lower level contaminated soils will be permanently disposed on-site in either of two containment structures, the Soil Repository or the Inert Landfill. Maintenance of the containment structures will determine the effectiveness and permanence of this component of the preferred alternative.

While all of the alternatives considered satisfy the 9 criteria set forth in CERCLA, Alternative 3 is the most cost-effective alternative, providing a remedy that meets the evaluation criteria at a cost substantially less than the other alternatives evaluated. Alternative 3 utilizes existing facilities at the IAAAP to the maximum extent practical to achieve these significant cost advantages.

The Army is proposing selection of Alternative 3 because it provides the best balance of tradeoffs among the alternatives with respect to this evaluation. Excavation and containment of contaminated soils from the various areas at the IAAAP will eliminate the contaminant source, thereby reducing mobility of the contaminants. Both landfills, the CAMU and the Soil Repository, have liner systems consisting of several hydraulic barriers and a leachate collection system. This will virtually eliminate the potential for contaminant migration. Solidification/stabilization of soils contaminated with metals and radionuclides also will eliminate the potential for exposure by direct contact, and effectively decrease or eliminate their mobility.

Based on the information available at this time, the Army and the EPA believe that the preferred alternative would be protective of human health and the environment, would comply with ARARs, would be cost-effective, and would utilize permanent solutions to the maximum extent practical. The preferred alternative meets the statutory requirement for the use of a remedy that involves treatment as a principal element.

A five-year review will be performed following implementation of the preferred alternative to ensure that the principal threats to human health and the environment, as discussed above, are addressed. The five-year review is required to document that the interim remedial action has effectively minimized the potential for human exposure to contamination and have eliminated the contributions of these 15 subsites to shallow groundwater contamination.

## *COMMUNITY PARTICIPATION*

The Army relies on public input to make sure that the alternative proposed to address contaminants in the IAAAP Soils OU are not only effective, but also meet the needs of the local

community. The Army therefore encourages public review and comment on all of the alternatives considered in this Proposed Plan, including the preferred remedial alternative identified. In order to provide the community with an opportunity to submit written or oral comments, the Army has established a public comment period from May 22, 1997 to June 21, 1997. A public meeting will also be held on June 4, 1997, at 7:00 p.m. at the Danville Community Building, Danville Iowa, to present the Proposed Plan, accept written and oral comments, and to answer questions concerning the preferred alternative. A remedy will be selected based on the information presented in the Administrative Record for the site and on public comments. The remedy ultimately selected will be documented in a Record of Decision which summarizes the decision-making process and responds to the public comments received.

The Proposed Plan and Administrative Record for this action, which contains all information on which the decisions regarding the proposed interim remedial action are based, is available for review during normal business hours at the Iowa Army Ammunition Plant, Visitor Reception Area, Building 100-101; the Burlington Public Library; and the Danville City Hall.

## *ADDITIONAL INFORMATION*

Written comments, questions, and requests for information may be sent to:

**Mr. Leon Baxter**
**Chief Engineer**
**Attn: SIOIA-PPE**
**Iowa Army Ammunition Plant**
**Middletown, Iowa 52638-5000**
**(319)753-7210**

Questions or requests for additional information about the site may also be directed to:

**Ms. Diane Huffman**
**U. S. Environmental Protection Agency**
**Office of Public Affairs**
**726 Minnesota Avenue**
**Kansas City, Kansas 66101**
**(913) 551-7003**
**Toll Free 1-800-223-0425**

# TABLE 1

## Targeted Areas
## Contamination Type and Volume ($yd^3$)

| Site | Metals | Explosives | Metals/ Explosives | SVOCs | Radionu-clides | Explosives/ SVOCs | PCBs | TOTAL |
|---|---|---|---|---|---|---|---|---|
| Line 1 (R01) | 219 | 4,853 | 1,486 | 587 | 266 | | | 7,411 |
| Line 2 (R02) | 885 | 769 | 294 | | | | | 1,948 |
| Line 3 (R03) | 546 | 1,884 | 835 | | 119 | 109 | | 3,493 |
| Line 3A (R04) | | 1,352 | 684 | | | | | 2,036 |
| Lines 4A & 4B (R05) | 153 | | | | | | | 153 |
| Lines 5A & 5B (R06) | 80 | 626 | 25 | | | | | 731 |
| Line 6 (R07) | 445 | | | | | | | 445 |
| Line 8 (R09) | 476 | | | | | | | 476 |
| Line 9 (R10) | 469 | | | | | | | 469 |
| Line 800 (R11) | 117 | 1,208 | | | | | | 1,325 |
| EDA/East Burn Pads (R12) | | 21,411 | | | | | | 21,411 |
| Demo Area / Deact Furnace (R15) | 753 | | | | | | | 753 |
| W. Burn Cages / W. Burn Cages Landfill (R24) | 423 | 339 | 689 | | | | | 1,451 |
| North Burn Pads (R25) | 41 | | | | | | | 41 |
| Roundhouse Transformer Area (R28) | | | | | | | 599 | 599 |
| TOTAL | 4,607 | 32,442 | 4,013 | 587 | 385 | 109 | 599 | 42,742 |

# TABLE 2

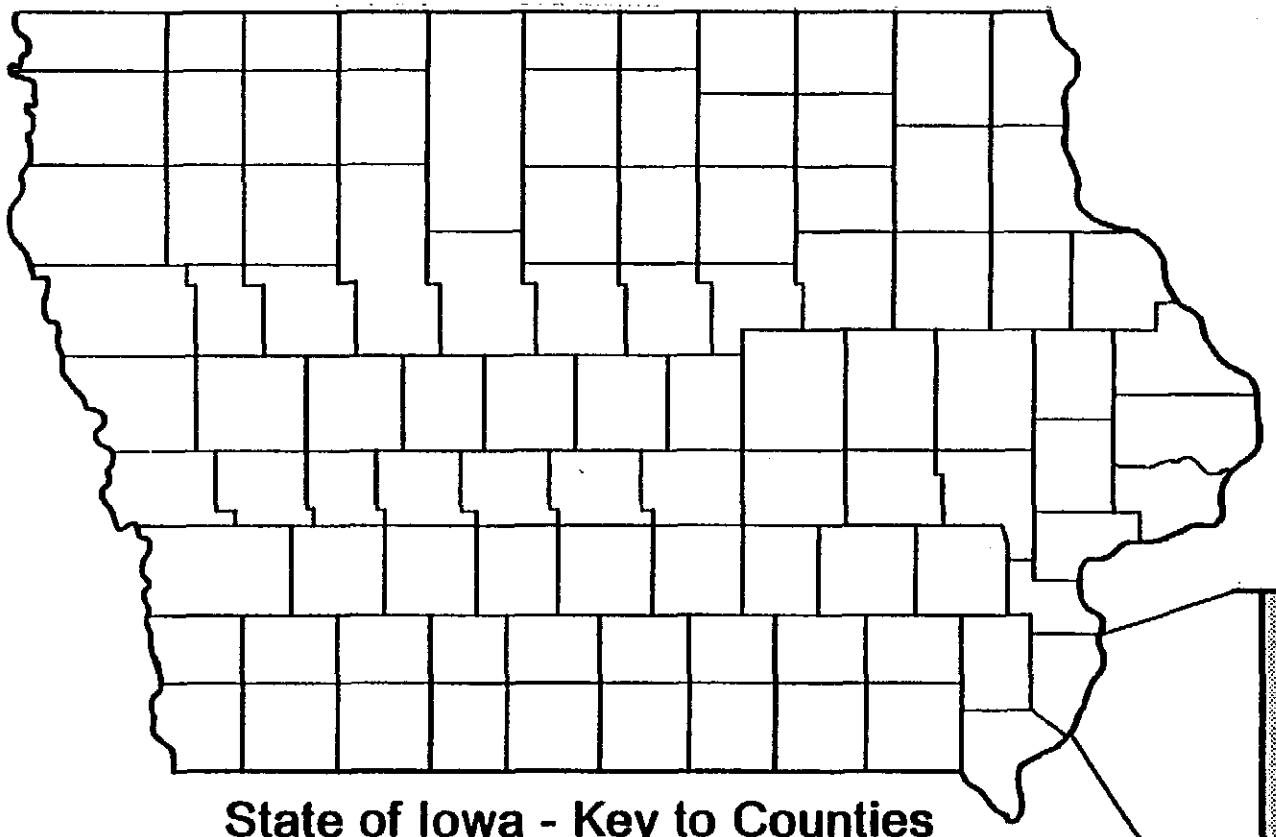
## Remediation Goals
## Iowa Army Ammunition Plant

| *Chemical Constituents* | *PRG (µg/g)* |
|---|---|
| Antimony | 816 |
| Arsenic | 30.0 |
| Beryllium | 5.0 |
| Cadmium | 1000 |
| Chromium VI | 10,000 |
| Lead | 1000.0 |
| Thallium | 143 |
| Benzo(a)anthracene | 8.1 |
| Benzo(a)pyrene | 0.81 |
| Benzo(b)fluoranthene | 8.1 |
| Dibenz(a,b)anthracene | 0.81 |
| PCB 1260 | 10 |
| Total PCBs | 10 |
| 1,3,5-Trinitrobenzene | 102 |
| 2,4-DNT | 8.7 |
| 2,4,6-TNT | 47 |
| RDX | 1 |
| HMX | 51,000 |
| *Radionuclides*[1] | |
| Actinium 228 | 0.014 |
| Bismuth 214 | 0.008 |
| Potassium 40 | 0.74 |

1 - Units are in Units are pCi/g

**TABLE 3**
**ALTERNATIVE 3: COST ESTIMATE**

| *Activity* | *Unit* | *Quantity* | *Unit Cost* | *Cost* |
|---|---|---|---|---|
| Earth Moving | | | | |
| Excavation & transport to treatment facility. Backfill | $yd^3$ | 42,742 | $25.50 | $1,090,000 |
| Treatment | | | | |
| Solidification/Stabilization | $yd^3$ | 3,860 | $154.00 | $594,000 |
| Analytical: 122 sites, 8 samples/site | sample | 976 | $420.00 | $410,000 |
| Subtotal | | | | $2,094,000 |
| Contingency (20%) | | | | $419,000 |
| Total | | | | $2,513,000 |



State of Iowa - Key to Counties

Not to Scale

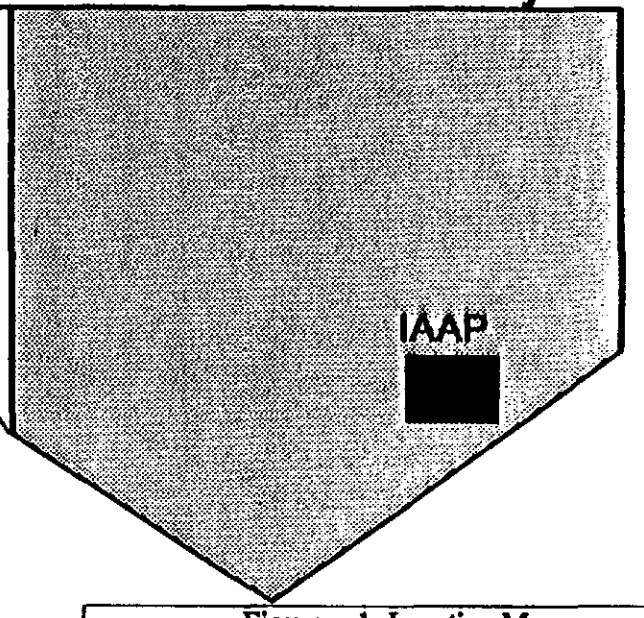



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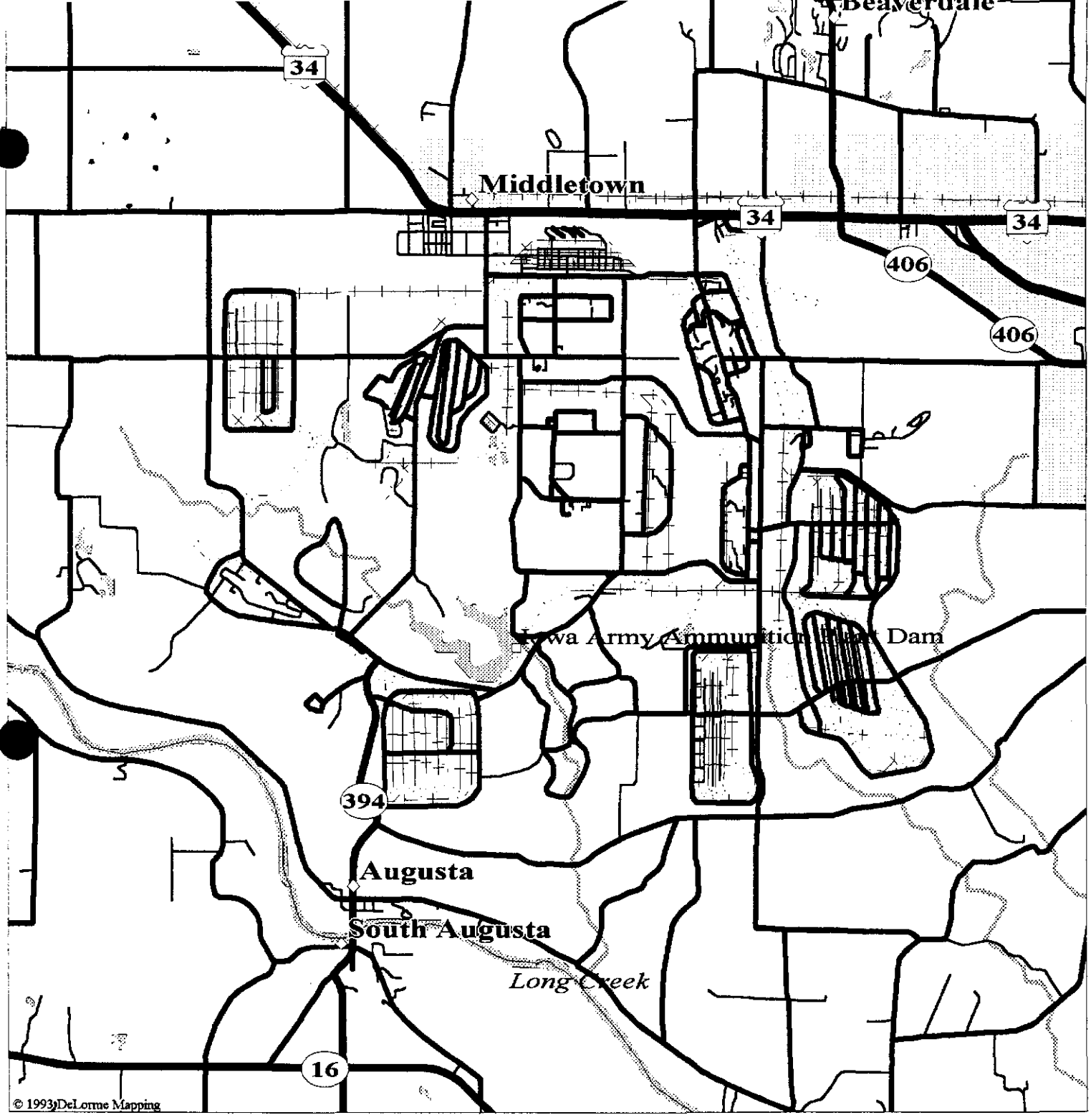
Figure 1: Location Map

Iowa Army Ammunition Plant

Middletown, Iowa




LEGEND

- Population Center
- State Route
- Geo Feature
- Town, Small City
- US Highway
- County Boundary
- Street, Road
- Hwy, Ramps
- Major Street, Road
- State Route
- US Highway
- Railroad
- PP Underpassing
- Pier
- Open Water

Scale 1:62,500 (at center)

1 Miles

2 KM

Mag 12.65
Wed May 14 08:51:19 1997

Figure 2