FINAL

FUSRAP PROPOSED PLAN FOR THE IOWA ARMY AMMUNITION PLANT

MIDDLETOWN, IOWA

APRIL 22, 2011

U.S. Army Corps of Engineers
St. Louis District Office
Formerly Utilized Sites Remedial Action Program

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Prepared by:
U.S. Army Corps of Engineers, St. Louis District Office
Formerly Utilized Sites Remedial Action Program

with assistance from:
Science Applications International Corporation
Under Contract No. W912P9-06-D-0534, Task Order 0006

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ACRONYMS AND ABBREVIATIONS

$	U.S. dollars
%	percent
µg/L	micrograms per liter
AEC	U.S. Atomic Energy Commission
ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BRA	baseline risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	contaminant of concern
CR	carcinogenic risk
CY	cubic yard
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
DU	depleted uranium
ERA	ecological risk assessment
FFA	Federal Facilities Agreement
FS	Feasibility Study
FSA	Firing Sites Area
ft	feet
ft^2	square feet
FUSRAP	Formerly Utilized Sites Remedial Action Program
HI	hazard index
HQ	hazard quotient
HTRW	Hazardous, Toxic and Radioactive Waste
IAAAP	Iowa Army Ammunition Plant
IDNR	Iowa Department of Natural Resources
m	meter
MMR	Military Munitions Rule
mrem/year	millirem per year
mSv	millisievert
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl
pCi/g	picocuries per gram
PCOC	potential contaminant of concern
PP	Proposed Plan
PRG	preliminary remediation goal
RAO	remedial action objective
RDX	cyclotrimethylenetrinitramine
RESRAD	Residual Radioactivity

ACRONYMS AND ABBREVIATIONS (Continued)

RG	remediation goal
RI	remedial investigation
ROD	Record of Decision
TEDE	total effective dose equivalent
TNT	2,4,6-trinitrotoluene
U	uranium
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UUUE	unlimited use and unrestricted exposure
UXO	unexploded ordnance
y	year

Proposed Plan
for the Formerly Utilized Sites Remedial Action Program Areas at the
Iowa Army Ammunition Plant, Middletown, Iowa.

U.S. Army Corps of Engineers,
St. Louis District

U.S. ARMY CORPS OF ENGINEERS ANNOUNCES PROPOSED PLAN

This Proposed Plan (PP) identifies the preferred alternative for remediation of contaminated soil and structures, provides the rationale for the preferred alternative, and presents a summary of other remedial alternatives evaluated for the Formerly Utilized Sites Remedial Action Program (FUSRAP) areas at the Iowa Army Ammunition Plant (IAAAP) in Middletown, Iowa. This document is issued by the U.S. Army Corps of Engineers (USACE) under its authority to conduct response actions for releases related to the nation's early atomic energy program at the FUSRAP areas of the IAAAP. All such actions are subject to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). USACE, in coordination with the U.S. Environmental Protection Agency (USEPA), the Iowa Department of Natural Resources (IDNR), and the IAAAP, will select a final remedy for the FUSRAP areas of the IAAAP after reviewing and considering all comments submitted during the public comment period. Therefore, the public is encouraged to review and comment on all of the alternatives presented in this PP. The preferred alternative can change in response to public comment or the development of new information.

USACE is issuing this PP for public comment. This PP summarizes information that can be found in greater detail in the Remedial Investigation (RI) / Baseline Risk Assessment (BRA) Report and the Feasibility Study (FS), as well as in other documents contained in the Administrative Record File for the FUSRAP areas of the IAAAP. USACE and USEPA encourage the public to review these documents, available at the location shown below, to gain a more comprehensive understanding of the FUSRAP activities that have been conducted at the site. USACE and USEPA invite the public to provide questions and comments and to participate in a public meeting to be held during the public comment period.

Dates to remember:
MARK YOUR CALENDAR

PUBLIC COMMENT PERIOD:
April 22, 2011 – May 22, 2011

USACE will accept written comments on this PP during the public comment period of at least 30 days, which begins April 22, 2011

PUBLIC MEETING:
USACE will hold a public meeting to explain this PP and all of the alternatives presented in the FS. Oral and written comments will also be accepted at the meeting. The meeting will be held on May 17, 2011 (tentative)

For more information, see the Administrative Record File at the following location:

Burlington Public Library
210 Court Street
Burlington, Iowa 52601

INTRODUCTION

The U.S. Army Corps of Engineers (USACE), St. Louis District has prepared this Proposed Plan (PP), in accordance with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §117(a) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 *Code of Federal Regulations (CFR)* §300.430(f)(2), under its authority to implement the Formerly Utilized Sites Remedial Action Program (FUSRAP) at the Iowa Army Ammunition Plant (IAAAP). The IAAAP is currently an active, government-owned, contractor-operated facility that occupies approximately 19,000 acres in Des Moines County near Middletown, Iowa (Figure 1). This PP presents the preferred method for remediating soil and structures containing low concentrations of depleted uranium (DU) at the FUSRAP areas of the IAAAP. USACE is conducting investigations and response actions (i.e., cleanup) at the IAAAP under the legislative authority contained in Public Law 106-60, the Energy and Water Development Appropriations Act for Fiscal Year 2000. This law establishes USACE's authority to conduct response actions for releases related to the nation's early atomic energy program as the lead federal agency, subject to the CERCLA and the NCP. The U.S. Department of Energy (DOE) managed FUSRAP from 1977 until 1997. On October 13, 1997, the U.S. Congress transferred responsibility for FUSRAP from DOE to USACE through the 1998 Energy and Water Development Appropriations Act.

The FUSRAP areas addressed by this PP include several locations previously associated with U.S. Atomic Energy Commission (AEC) early atomic energy activities at the IAAAP. These areas are defined as Line 1 Structures, the Firing Sites Area [(FSA) consisting of five subareas], Yard C, Yard G, and Yard L (areas surrounding Warehouses L-37-1, L-37-2, and L-37-3), and Warehouse 3-01 (Figure 1).

Several CERCLA documents preceded the development of this PP. A summary of the remedial investigation (RI) and baseline risk assessment (BRA) previously conducted by USACE is documented in the *IAAAP FUSRAP Remedial Investigation Report for Firing Sites Area, Yards C, E, F, G, and L, and Warehouse 3-01 and Area West of Line 5B*. The RI defined the nature and extent of contamination based on soil and structure characterization activities that were conducted at the FUSRAP areas. The BRA estimated and described the potential risks to human health and the environment from exposures to DU and chemical contaminants of concern (COCs) in soil and to DU on structural surfaces under an industrial land use scenario. The IAAAP is currently an industrialized military installation with land use controls in place to limit access to the property (e.g., use restrictions and outgrants administered by the U.S. Army as part of its land management responsibilities). The expected future use of the property is a U.S. Department of Defense (DoD) military installation with industrial (and military) use. Consequently, the BRA evaluated the need for action by defining the potential risks associated with performing no remedial actions that would otherwise reduce or eliminate the source of the risks (i.e., exposures to COCs) to human receptors (i.e. industrial site worker and site construction worker) and the ecological receptor of concern, the Indiana bat (*Myotis sodalis*). The Indiana bat has been identified by the U.S. Fish and Wildlife Service as a Threatened and Endangered Species that has been identified as utilizing the IAAAP during summer roosting periods.

The RI and BRA concluded that potential human health risks for the site worker and construction worker were associated with DU and/or chemically contaminated soil and structures at the FUSRAP areas, with the site worker having been identified as the limiting receptor for radiological dose and risk evaluations of DU exposures. At the conclusion of the BRA, human

health COCs identified for soil included DU, explosives (cyclotrimethylenetrinitramine, commonly known as "RDX," and 2,4,6-trinitrotoluene, commonly known as "TNT"), and chromium. Human health doses and risks associated with exposures to DU in soil were evaluated in the BRA for the three main radionuclide constituents of DU [uranium (U)-234, U-235, and U-238], in areas where DU fragments were visually observed, as well as in areas where elevated readings were noted during gamma walkover surveys. During the RI, DU at the FUSRAP areas was found to be present in soil and on structural surfaces. In soil, DU was found as oxidized and non-oxidized fragments and particles (generically referred to hereafter as "DU" or "DU-contaminated soil"). Generally, fragments are visibly observable pieces of metallic DU found on the surface of the soil, or just below the surface of the soil. DU particles, however, are not readily observable in soil, unless made visible by a yellowish discoloration as an effect of chemical oxidation. On structures, DU particles were found by survey instrumentation to be embedded in or adhered to the surface, and were determined to pose potential risk to a site worker. The BRA identified no potential ecological risks or COCs for the Indiana bat in the FUSRAP areas.

The results from the RI/BRA were used by USACE to prepare a Feasibility Study (FS). The *FUSRAP Feasibility Study Report for the Iowa Army Ammunition Plant* identified, developed, and evaluated remedial action technologies and alternatives to identify a final remedy for the FUSRAP areas. During the FS, a total of 17 technologies/process options for soil cleanup and 5 technologies/process options for structural cleanup were considered and evaluated. From these, four remedial alternatives for soil and three remedial alternatives for structures were retained for detailed analysis in the FS. The FUSRAP area remedial alternatives for soil and structures evaluated during the FS included:

- **Remedial Alternatives for Soil:**
  - **Alternative 1:** No Action for Soil,
  - **Alternative 2:** Land Use Controls for Soil,
  - **Alternative 3:** Excavation of DU-Contaminated Soil with Off-Site Disposal, and
  - **Alternative 4:** Excavation of DU-Contaminated Soil with Physical Treatment and Off-Site Disposal.
- **Remedial Alternatives for Structures:**
  - **Alternative S1:** No Action for Structures,
  - **Alternative S2:** Land Use Controls for Structures, and
  - **Alternative S3:** Decontamination/Replacement of Structures.

As summarized in the "Summary of Remedial Alternatives" section of this PP, the FS Report presents the evaluation of each remedial action alternative based on the nine CERCLA evaluation criteria that are discussed in subsequent sections of the document. The FS criteria include both regulatory agency and public review of the alternatives.

The USACE recommends a preferred alternative for final remedial action for soil in the FUSRAP areas at the IAAAP, which is Alternative 4: Excavation of DU-Contaminated Soil with Physical Treatment and Off-Site Disposal. Additionally, the USACE recommends a preferred alternative for final remedial action for IAAAP structures in the FUSRAP areas, which is Alternative S3: Decontamination/Replacement of Structures. After evaluating these alternatives pursuant to the criteria described in the NCP, 40 *CFR* §300.430(e)(9)(iii), USACE considers

them to be protective of human health and the environment and cost effective. The preferred alternative for soil, Alternative 4, includes physical treatment (e.g., soil sorting and radiological scanning) of DU-contaminated soil to reduce the volume of soil requiring off-site disposal. The preferred alternative for structures, Alternative S3, includes the decontamination of one structural component (steel grate) and the replacement of another component (air filters) at Line 1 because decontamination of this component is not feasible or cost effective.

This PP is being used to solicit public and government agency comments, in compliance with Section 117(a) of CERCLA. USACE, in conjunction with the U.S. Environmental Protection Agency (USEPA), is requesting input from the public to select one remedial alternative each for soil and structures in the FUSRAP areas. The soil and structures alternatives (4 and S3, respectively) preferred by USACE are indicated in this document; however, the final remedies will not be selected until after receipt and full consideration of all public and government agency comments. The final remedies will be documented in a Record of Decision (ROD) for the FUSRAP areas at the IAAAP. The public is encouraged to review information presented in the RI/BRA and FS Reports, as well as in other documents contained in the Administrative Record File for the FUSRAP areas of the IAAAP.

SITE BACKGROUND

The IAAAP is an active, government-owned, contractor-operated facility that occupies approximately 19,000 acres in Des Moines County near Middletown, Iowa (Figure 1). The IAAAP is a U.S. Army installation, and, since 1941, has manufactured a wide variety of artillery and tank munitions as part of its load, assemble, and pack operations for the DoD. From 1947 to 1975, portions of the IAAAP facility were under AEC control for weapon-assembly operations.

The IAAAP was added to USEPA's National Priorities List in August 1990 pursuant to Section 105 of CERCLA and the Superfund Amendments and Reauthorization Act of 1986. In September of 1990, the U.S. Army and USEPA Region VII entered into a Federal Facilities Agreement (FFA) to define the roles and responsibilities for the U.S. Army's CERCLA activities at the IAAAP and the process for inter-agency coordination. The IAAAP was placed under the DoD Installation Restoration Program, which manages CERCLA activities to identify, investigate, and mitigate past hazardous waste disposal practices that may have contributed to the release of pollutants into the environment at U.S. Army installations/facilities. Past munitions production at the IAAAP has resulted in contamination of soil and ground water and discharges of wastewater containing explosives to surface water.

In March 2000, after performing historical research regarding AEC activities at the IAAAP, the DOE provided the USACE with a determination that portions of the IAAAP may contain contamination resulting from AEC activities. Beginning in 2000, the USACE began investigation and characterization of soil, sediment, and building contamination in the FUSRAP areas. In July 2002, several areas of the IAAAP previously used by AEC were designated by USACE to be under FUSRAP and therefore, were subsequently removed from the DoD Installation Restoration Program. The FUSRAP RI Report presents the findings of these characterization activities conducted by the USACE, as well as the results of the BRA. Summaries of the FUSRAP RI and BRA results for those areas are presented in the following sections of this PP: "Summary of RI Results," "Summary of Environmental Fate and Transport," and "Summary of the Baseline Risk Assessment."

SITE CHARACTERISTICS

The IAAAP is located near the city of Middletown, in the extreme southeast corner of Iowa in Des Moines County (Figure 1). Approximately 10 miles to the east of Middletown, is Burlington, Iowa, the county seat for Des Moines County. According to the 2000 Census, the population of Des Moines County was 42,351 and the population of Burlington was 25,579. The city of Middletown occupies a total area of 0.6 square miles and has a population of 535 residents or approximately one percent of the population of Des Moines County. The land use surrounding IAAAP is predominantly agricultural cropland and pastureland. Small businesses (general stores and gas stations) and low-density residential communities are also located around the periphery of the installation.

The IAAAP is an active, government-owned, contractor-operated facility that occupies approximately 19,000 acres. Less than one-third of the IAAAP property is occupied by active or formerly active munitions production or storage facilities. The remaining property is generally either forested (7,766 acres) or leased for agricultural use (7,107 acres) (Figure 1). All of the FUSRAP areas are located in developed areas of the IAAAP. Line 1 is approximately 173 acres (700,106 square meters) in size and encompasses over 250 buildings and related facilities. A number of the Line 1 buildings were used by AEC for weapons-production operations. Several Yard Areas (Yards C, G, and L) were used for the storage of raw explosive materials, component parts, or sealed radiological components. Warehouse 3-01 consists of a large brick building that may have been used by AEC.

The area referred to as the FSA is a fenced operational range located in the western portion of the IAAAP that encompasses 450 acres (1,821,085 square meters) and is approximately 1 mile from the nearest IAAAP boundary (Figure 1). The FSA was developed to support IAAAP operations, and portions continue to be routinely used for testing of ordnance. The FSA was used for AEC activities between 1948 and 1974. Most of the firing sites contain buildings used for offices or storage. The FSA is currently an operational testing range being used by the U.S. Army to test military munitions.

The IAAAP is located within the Southern Iowa Till Plains section of the Central Lowland Province Drift Plain Region, is gently undulating terrain due to continental glaciation, and is incised with dendritic drainage patterns. Site topography ranges from flat tier at the northern portion of the facility to steep-sloped drainageways down to creek beds at the southern portion of the facility. There are three main creeks (Brush, Long, and Spring Creeks) along with unnamed tributaries feeding these streams. The topographic elevation of the IAAAP ranges from a high point of 730 feet (ft) above mean sea level at the northern portion of the facility to a low of 530 ft above mean sea level at the creek beds to the south (USAEC 1996).

The facility is underlain by a sequence of unconsolidated Pleistocene deposits including loess and thick glacial tills overlying sedimentary bedrock units. The surface soil in the area is predominantly silt loams and silty clay loams derived from the underlying loess and till deposits. The surface soil generally consists of between 95 to 100 percent (%) fine-grained materials (silt and clay). The loess consists of fine-grained, poorly to well-sorted materials, and ranges in depth from approximately 6 to 15 ft. The Kellerville Till Member of the Glasford Formation underlies the loess and is comprised mostly of silty clay and clayey silt with thin sand seams and lenses. Sandy silt and silty sand lenses within the loess and tills make up the shallow drift aquifer underlying the IAAAP. The ground-water surface in the drift aquifer generally occurs within 10 ft of the ground surface.

During the RI and BRA, DU in soil, sediment, and structures, along with metals and explosives in soil, were identified as contaminants in these areas; however, as discussed in the "Scope and Role" section of this PP, the focus of this FUSRAP response is limited to the removal of source materials containing DU.

SCOPE AND ROLE

An additional FFA for the IAAAP was finalized on August 16, 2006, among the USACE, St. Louis District; the USEPA Region VII; the DOE; and the Iowa Department of Natural Resources (IDNR) to address FUSRAP investigatory and cleanup work at the IAAAP. The scope of this project, as defined in the 2006 FFA, "covers response actions at 7 areas associated with AEC activity." These seven areas were defined as Line 1; the FSA (consisting of five subareas); the West Burn Pads Area (South of the Road); Yard G; Yard C; Yard L (surrounding Warehouses L-37-1, L-37-2, and L-37-3); and Warehouse 3-01 (interior) (Figure 1). Non-FUSRAP actions are being conducted by the U.S. Army at other IAAAP areas and operable units. Discussions of these activities are outside the FUSRAP scope and are not presented in this document.

According to the 2006 FFA, the USACE shall respond to all releases and threats of releases of hazardous substances, pollutants, or contaminants, except for ground-water and surface-water contamination, at the areas associated with previous AEC activity. Ground-water and surface-water contamination existing on or migrating from the IAAAP, including such contamination associated with the seven areas identified in the 2006 FFA, are considered outside the scope of FUSRAP and shall be addressed pursuant to the 1990 (U.S. Army) FFA. The RI was conducted by USACE, beginning in 2006 to define the nature and extent of contaminants in soil and structures at the FUSRAP areas.

According to the 2006 FFA, other areas beyond those identified may be added to the list of FUSRAP areas if it is determined that they contain contamination resulting from AEC activities. The three additional areas, consisting of portions of Yard E, Yard F, and the Area West of Line 5B (Figure 1), were investigated during the FUSRAP RI and found to be radiologically non-impacted. As a result, these areas require no further FUSRAP action and the responsibility remains with the DoD Installation Restoration Program.

The results of the FUSRAP RI conducted by the USACE concluded that the soil at Line 1 and the West Burn Pads Area (South of the Road) was not DU-contaminated and, therefore, are addressed under two existing IAAAP RODs: *Interim Action Record of Decision, Soils Operable Unit, Iowa Army Ammunition Plant, Middletown, Iowa* and the *Record of Decision, Soils Operable Unit #1, Iowa Army Ammunition Plant, Middletown, Iowa*. Therefore, the soil at Line 1 and the West Burn Pads Area (South of the Road) is not included in the scope of the PP. Structures remaining at Line 1 and used by AEC were evaluated for radioactive surface contamination as part of the FUSRAP RI/FS.

All remaining FUSRAP areas are addressed by this PP and include the following areas:

- Line 1 (structures only),
- FSA (consisting of five subareas) soil and structures,
- Yard C soil and structures,
- Yard G soil and structures,
- Yard L soil (areas surrounding Warehouses L-37-1, L-37-2, and L-37-3), and
- Warehouse 3-01 structure (building interiors).

The FSA is an operational range currently being used by the U.S. Army to test military munitions. Historically, munitions containing DU were used by AEC at the FSA. AEC no longer tests munitions at the FSA, and munitions containing DU are no longer tested at the FSA. The five subareas that comprise the FSA include the following individual firing sites as shown in Figure 2: Firing Sites 1 and 2 are located at the entrance of the FSA; Firing Site 14 is located just north of the entrance area; Firing Sites 3, 4, and 5 are located on the east side; Firing Sites 6, 7, 8, and 15 are clustered in the central portion of the FSA and identified as the Firing Site 6 Area; and Firing Sites 9, 10, 11, and 12 are clustered in the northern portion of the FSA and identified as the Firing Site 12 Area.

The focus of this FUSRAP response is limited to the removal of source materials containing DU. DU is present on the FSA and will be included in the USACE response under FUSRAP in accordance with the December 2006 Dispute Resolution Agreement executed by the Department of the Army and the USEPA Regional Administrator for Region 7. That agreement reflects the application of the Military Munitions Rule [(MMR) See 40 *CFR* 266.200 et. seq.] to the determination of the scope of FUSRAP authority on the Firing Sites. That is, there is no requirement to respond to explosive constituents and metals contamination on an operational range associated with the range operations. However, because the DU that is present in the FSA is a product of historic AEC operations at this site which are no longer conducted, and DU is not currently used at the FSA on the IAAAP, it may be included in the USACE response in a manner that is consistent with USACE FUSRAP authority. As part of the 2006 Dispute Resolution Agreement, the U.S. Army and USEPA's approach to handling the FSA was outlined. The settlement agreement stated:

> "*FUSRAP will primarily be addressing the presence of depleted uranium (DU) at the Firing Site resulting from past testing operations conducted by the Atomic Energy Commission. The Firing Site is an operational testing range currently being used by the Army to test military munitions. DU rounds are no longer tested at the Firing Site by the Army. Any additional response actions at the Firing Site beyond those which will be addressed by FUSRAP will be addressed when the range ceases to be operational unless releases from the Firing Site require an immediate response to protect human health or the environment. If such a condition is determined to exist, response actions will be implemented consistent with provisions of the FFA.*"

Furthermore, conducting response actions to fully address chemical contamination at an operational range (e.g., the FSA) (where re-contamination is anticipated) is inconsistent with the need of the United States to maintain its military capabilities through training and testing until the site has been put to a new use that is incompatible with range activities.

The soils in the FSA may contain materials that if excavated as part of a remedial action may require handling as a hazardous waste pursuant to the MMR and therefore will be handled as hazardous substances. Any reference to handling/disposal of chemical, metal or explosive contamination in the FSA should be understood as part of this authorized activity. Thus, it is noted that the authorized remediation of DU may result in remediation of other materials. The incidental benefits of an authorized activity are necessarily within this authorization.

SUMMARY OF RI RESULTS

For each FUSRAP area, a detailed review of historical usage of the area was conducted to determine the potential contaminants of concern (PCOCs). The PCOCs included radiological

(DU) and chemical parameters [metals, explosives, and polychlorinated biphenyls (PCBs)]. The RI methods consisted of gamma walkover surveys, radiological structure (building) surveys, and surface and subsurface soil sampling for the PCOCs.

Industrial risk-based screening levels were selected for comparison with individual sample data acquired during the RI to define the nature and extent of contamination. The screening levels were selected to ensure that any response actions are protective under current and future land use scenarios. Screening levels for chemical PCOCs were selected as the lower of the USEPA Region 9 preliminary remediation goals (PRGs) for direct contact with soil in an industrial setting or for the protection of ground water. The screening levels for total gross alpha and total gross beta activity used for the radiological survey of structures were selected from Table 1 (*"Screening Levels for Clearance"*) in American National Standards Institute/Health Physics Society N13.12-1999. In addition to human health screening levels established for radiological and chemical PCOCs, ecological critical concentrations were derived during the streamlined ecological risk assessment (ERA) completed as part of the BRA for protection of the Indiana bat.

For soils, the exceedance of an industrial risk-based screening level by at least one soil sample resulted in a chemical PCOC being retained for further evaluation in the BRA. As a conservative measure, DU was retained for further evaluation in the risk and dose assessment of the BRA for all FUSRAP area soil. The results of the RI showed that DU contamination was only present in soil at the FSA. No DU or chemical contamination was found at Yards C, G, or L or at Warehouse 3-01 above the RI screening levels. At the FSA, DU contamination was present in soil to a depth of approximately 2 ft below ground surface (bgs) and was primarily associated with locations where DU fragments were also found. Explosives and metals contamination was detected at the Firing Site 6 Area, primarily in the top 2 ft bgs. No PCBs were detected in soils at the FSA.

Radiological surveys of structures were conducted at Line 1; the FSA; Yards L, C and G; and Warehouse 3-01. Gross alpha and beta (total) activity measurements from the surveys were compared to the structural screening levels. Any areas with exceedances were retained for further evaluation in the BRA. The established screening levels used for the radiological survey of structures during the RI were 600 and 6,000 disintegrations per minute per 100 square centimeters (dpm/100 cm^2) for gross alpha and gross beta, respectively, for total contamination and 60 and 600 dpm/100 cm^2 for removable contamination.

Forty-one interior building surveys were conducted at Line 1, which investigated for gross alpha/beta activities during the RI. Surveys indicated that small interior surfaces of some structural components at four buildings (Buildings 1-11, 1-63-6, 1-65-5, and 1-19-3) exhibited discrete areas of radiation that exceeded the conservative RI screening levels of 600 and 6,000 dpm/100 cm^2 for alpha and beta activity, respectively. No exceedances of screening levels were reported for surveyed structural surfaces at Yards L, C, and G and Warehouse 3-01. However, at the FSA, the FUSRAP RI Report indicated that all gross alpha and beta (total) readings were below the respective screening levels (600 and 6,000 dpm/100 cm^2, respectively) for all exposed interior surfaces (i.e., surfaces not covered by soil), except for the total beta counts measured at the vertical vent in the Firing Site 12 bunker basement.

Also, during the interior building survey conducted at the Firing Site 12 bunker, sediment was observed and investigated on the floor of the bunker basement. The sedimentation resulted from the seepage of soil (i.e., facilitated by precipitation events) through open cracks in the walls of the basement. A sediment sample collected from the basement floor was submitted for analysis of uranium isotopes via alpha spectroscopy and exhibited an elevated concentration of U-238

[i.e., above the DU soil screening level of 56 picocuries per gram (pCi/g)]. For purposes of the FS, the sediment was considered to be a soil medium, and any remedial decisions for soil at the Firing Site 12 Area will also apply to the sediment in the bunker.

SUMMARY OF ENVIRONMENTAL FATE AND TRANSPORT

On-site ground water is not a source of drinking water. However, domestic/agricultural wells are present in off-site areas. Ground-water monitoring data indicate that uranium has migrated to ground water at the FSA. Uranium was detected at a maximum concentration of 345 micrograms per liter (µg/L) in a shallow on-site monitoring well located at the Firing Site 12 Area. In November 2003, ground-water and surface-water sampling was conducted in off-site areas to address concerns about possible impacts to off-site ground water resulting from past AEC activities at IAAAP. All uranium levels were below the human health risk-based screening level. Therefore, DU contamination at the FSA has not resulted in the migration of uranium to off-site areas via ground-water.

During both the RI and FS, a ground-water fate and transport evaluation for RDX and TNT demonstrated that no significant off-site transport has occurred, or is expected to occur, from the FSA via ground-water migration. The concentrations reaching ground water are low primarily due to the following features of the Firing Site 6 Area:

- The extent of the explosives contamination is limited. The explosives-contaminated soil present at the Firing Site 6 Area is confined to the immediate area surrounding the concrete structure at the northern end of the area (an area of approximately 0.09 acres) and is limited to a depth of 2 ft.
- The presence of relatively impermeable (clay-rich) till.
- The average depth of the water table (approximately 8 ft bgs) is below the depth of the soil contamination (approximately 2 ft).

Therefore, the potential for RDX and TNT at the Firing Site 6 Area to leach from shallow soil into ground water at levels exceeding their health-based action level is minimal. The results of the ground-water fate and transport evaluation indicate that the projected concentrations at two downgradient locations, Long Creek and the boundary of the FSA, are below the health-based action levels. It is concluded that significant ground-water contamination is not occurring and is not likely to occur in the future as a result of the presence of the limited amount of RDX- and TNT-contaminated soil at the Firing Site 6 Area.

Additionally, in order to assess the possibility of overland migration of contaminants from the FSA, surface sediment samples (0 to 0.5 ft) were collected from depositional areas along Long Creek and its tributaries. Long Creek runs through the FSA, with a portion being downgradient of the Firing Site 6 Area. The sediment samples were analyzed for DU, explosives, and metals. The sediment sample results did not exceed the screening level values and indicated no surface migration or transport of DU, explosives, or metals from the FSA.

In summary, the ground-water fate and transport evaluation, along with the results of sediment sampling conducted in the depositional areas of Long Creek and its tributaries and sampling of off-site ground-water wells, indicate that off-site surface and subsurface migration of contaminants from the FSA is not occurring, and is not expected to occur.

SUMMARY OF THE BASELINE RISK ASSESSMENT

As part of the BRA, a conceptual site model was developed to identify the human population groups and ecological species that are the most likely to be exposed or sensitive (respectively) as receptors to contaminants under current and future land use scenarios. The IAAAP serves as a military installation; therefore, the current land use is industrial in nature due to ongoing ordnance-production activities. It is expected that these activities would continue into the future; therefore, it is reasonable to assume that the IAAAP property would not be redeveloped for residential use in the foreseeable future.

The most likely populations to be exposed to soil contamination include the current and future site worker and the future construction worker. The current and future site worker is an IAAAP employee or contractor conducting ordnance production/testing activities. While performing these duties, the site worker could be exposed to residual contamination present in surface soil (0 to 1 ft bgs) but would not be expected to have regular contact with subsurface soil (i.e., depths greater than 1 ft bgs). The site worker may also be exposed to DU contamination on structures at Line 1 and the FSA and was evaluated as the maximally exposed individual for this pathway. During the BRA, the site worker (and not the construction worker) was determined to be the limiting receptor for further evaluations of radiological exposures during the FS. Below-grade structural surfaces exist at the FSA that could potentially be in direct contact with DU-contaminated soil (e.g., Firing Site 12 bunker). Because these surfaces are below grade and have not been surveyed, there are no data to determine if they are indeed contaminated; however, there are currently no complete pathways for human exposures. Because of exceedances of structural screening levels noted during the RI as previously described, the greatest potential for exposures to structures, the site worker was retained for further evaluations in the FS.

It is reasonable to assume that construction activities could occur within FUSRAP areas; therefore, the adult construction worker was also identified as a potential receptor. The construction worker could be exposed to residual contamination present in soil within the depth interval of 0 to 10 ft bgs.

The occurrence of potential trespassing and recreational use (e.g., hunting) at the IAAAP property was considered in the BRA, but these activities occur infrequently because of access restrictions, as well as the physical characteristics of each area therein. The potential for rancher/farmer exposures to FUSRAP area soil contaminants was considered. It is known that commercial agricultural activities occur within the IAAAP, but are only allowed at Yard C of the FUSRAP areas. The current commercial agricultural use of Yard C is the seasonal growing/cutting of hay. Because these operations at Yard C are commercial, soil concentrations were compared to USEPA's risk-based PRGs for direct soil contact under industrial land use and were found to be less than the PRGs. Therefore, exposures to commercial ranchers/farmers in Yard C were determined to be insignificant. Based on these considerations, the most likely on-site potential receptors for evaluation in the BRA were identified as the current and future IAAAP site worker and the future construction worker.

Potential exposures to off-site individuals were also considered in the BRA. However, as previously discussed in the "Summary of Environmental Fate and Transport", the ground-water evaluation, along with the results of sediment sampling conducted in the depositional areas of Long Creek and its tributaries, indicate that off-site surface and subsurface migration of contaminants from the FSA is not occurring, and is not expected to occur. Additionally, exposures to off-site individuals (e.g., via air transport, runoff, etc.) are considered insignificant due to the large distances of the FUSRAP areas from potential off-site receptor locations. Also,

because of the presence of heavy vegetation, airborne migration of contaminants to off-site areas is minimized and insignificant.

Human health risks and doses were calculated in the BRA for DU and chemical contaminants that exceeded the screening levels and showed a complete soil or structure exposure pathways, as presented in the conceptual site model. Doses and carcinogenic risks (CRs) presented in the BRA for DU represent the maximum total values estimated over a 1,000-year evaluation period using DOE's Residual Radioactivity (RESRAD) Model (version 6.4). Potential CRs and noncarcinogenic hazard quotients (HQs) associated with chemical exposures were determined using USEPA-approved methods and assumptions. HQs were estimated for individual noncarcinogenic chemicals. The sum of all individual chemical HQs estimated for a receptor results in a hazard index (HI).

All maximum total radiological doses were compared to the dose limit of 25 millirem per year (mrem/year), as established by *CFR, Title 10, Part 20: Standards for Radiological Protection Against Radiation* (*10 CFR 20*). All estimated radiological and chemical CRs were compared to USEPA's target CR range of 1×10^{-6} to 1×10^{-4}, with emphasis being on comparisons to the lower limit of the range (1×10^{-6}), as this represents USEPA's lowest target risk value (i.e., considered the "point of departure" for all risk-based evaluations). A CR estimate of 1×10^{-6} represents the probability of the occurrence of one additional cancer case over baseline in a population of 1,000,000 individuals. HIs for chemicals were compared to USEPA's target HI of 1.0, with exceedances of that value indicating a potential for adverse effects (other than cancer) following exposures, based on the conservative assumptions used in the BRA. For both the DU and chemical dose and risk assessments, assumptions regarding exposure and toxicity were incorporated that were conservatively designed to not underestimate potential doses and risks to individuals at the IAAAP. An exceedance of the dose limit, target CR, or target HI does not mean that adverse effects are imminent upon exposure. Rather, they are meant to be used only as tools for determining the presence of contamination that warrants cleanup. The target dose, CR, and HI values are also used as the basis for determining health-based cleanup levels [i.e., remediation goals (RGs)], if necessary.

In the BRA, contaminants attributable to the exceedances of target criteria were DU, TNT, RDX, and chromium at the FSA. Site worker exposures to DU-contaminated soil at the FSA (i.e., containing the DU constituents of U-234, U-235, and U-238) were estimated to result in a maximum total CR (4.0×10^{-4}) and radiological dose (27 mrem/year) that exceed both the upper limit of USEPA's target CR range (1.0×10^{-4}) and the 25-mrem/year radiological dose limit. For the construction worker at the FSA, the maximum total CR (2.0×10^{-5}) for DU exceeds the lower limit (1.0×10^{-6}) of USEPA's target CR range, but is still within the USEPA's target range of CRs (1×10^{-6} to 1×10^{-4}). The maximum total dose estimated for construction worker (36 mrem/year) exposures to DU exceeds the 25-mrem/year radiological dose limit. Based on a qualitative risk and dose evaluation conducted for DU fragments located at the FSA, the CR and dose associated with DU exposures to soil are likely to be less than the CR and dose that would be estimated for exposures to DU fragments. Therefore, the evaluation of alternatives in the FS is inclusive of both DU fragments and DU-contaminated soil.

CRs and HIs were calculated for exposures to chemicals at the Firing Site 6 Area, the only location where RI screening levels were exceeded for the chemical PCOCs. For the site worker, the CRs exceeding the lower limit of USEPA's range of target CRs (1.0×10^{-6}) were estimated for RDX (4.0×10^{-6}) and TNT (1.2×10^{-5}), with TNT contributing 71% of the total CR (1.7×10^{-5}) for this receptor. The total CR is within USEPA's target CR range (1×10^{-6} to

1×10^{-4}). The only noncarcinogenic contaminant resulting in a HQ of greater than 1.0 for the site worker is TNT (2.5), which contributes 78% of the total HI (3.2). For the site construction worker in the Firing Site 6 Area, only the CR for TNT (2.0×10^{-6}) exceeds 1.0×10^{-6} and contributes 74% of the total CR (2.7×10^{-6}) for this receptor. The total CR to this receptor is within USEPA's target CR range of 1×10^{-6} to 1×10^{-4}. The noncarcinogenic contaminants resulting in individual HQs greater than USEPA's benchmark of 1.0 for the construction worker are TNT (10) and chromium (2.2). Again, TNT is the predominant contributor (76%) to the total HI (12.5).

A streamlined ERA was also performed as part of the BRA and refined in the FS. The most sensitive receptor and pathway were the soil chemical exposures to the Indiana bat, a federally listed endangered species found to be utilizing habitats at IAAAP during the summer months. Potential risks to the Indiana bat were determined by exposure point concentration exceedances of ecological critical concentrations derived specifically for the Indiana bat, based on a model that assumes the bat ingests insect prey that have bioaccumulated chemical contaminants from Firing Site 6 Area. Based on the results of the evaluations conducted as part of the streamlined ERA, it has been concluded that chemicals in soil at the FUSRAP areas do not pose potential risks to the Indiana bat or other ecological receptors.

In summary, based on the evaluated human health (radiological and chemical) and ecological exposure scenarios that assumed current and reasonable/foreseeable future industrial land use in the BRA, chemical and radiological COCs in soil or on structural surfaces have been identified for the following FUSRAP areas, with the potentially affected receptors presented in parentheses:

- Line 1 Structures:
  - DU (site worker and construction worker).
- Firing Sites 1 and 2 (soil):
  - DU (site worker and construction worker).
- Firing Sites 3, 4, and 5 (soil):
  - DU (site worker and construction worker).
- Firing Site 6 Area (soil):
  - DU (site worker and construction worker),
  - Chromium (site worker and construction worker),
  - RDX (site worker), and
  - TNT (site worker and construction worker).
- Firing Site 12 Area (soil and structures):
  - DU (site worker and construction worker).

Based on the evaluated human health (radiological and chemical) and ecological exposure scenarios that assumed current and reasonable/foreseeable future industrial land use, no potential risks exceeding USEPA target risk criteria were determined for the FUSRAP areas presented in the following set of bullets. The remedial alternatives proposed in the FS include continued industrial land use at these areas as a component of the action-based alternatives. The land use at all FUSRAP areas is expected to remain industrial and therefore, is not expected to become compatible with conditions allowing for unlimited used and unrestricted exposure (UUUE).

- Firing Site 14 soil,
- FSA structures (except the Firing Site 12 Area),

- Yard C soil and structures,
- Yard G soil and structures,
- Yard L (areas surrounding Warehouses L-37-1, L-37-2, and L-37-3), and
- Warehouse 3-01 structure.

Basis for Remedial Action

It is the USACE's current judgment that the Preferred Alternatives identified in this PP are necessary to protect public health or welfare or the environment from actual or threatened releases of DU into the environment.

REMEDIAL ACTION OBJECTIVES

Based upon the human health risks identified for the IAAAP site worker and construction worker at the FUSRAP areas, the following remedial action objectives (RAOs) were developed:

- Prevent ingestion, dust inhalation, and external gamma radiation exposures to isotopes of DU in the FSA soil that could otherwise result in cumulative CRs exceeding 1×10^{-4} and radiological doses exceeding 25 mrem/year for receptors under the current (industrial) and expected future (industrial) land use scenarios.
- Prevent radiation exposures from DU particles embedded in and/or adhered to structural surfaces or components of the Line 1 buildings that could otherwise result in cumulative CRs in exceedance of 1×10^{-4} and a total effective dose equivalent (TEDE) exceeding 25 mrem/year.

The following subsections discuss the identification of applicable or relevant and appropriate requirements (ARARs) and development of RGs for soil and structural surfaces in order to facilitate attainment of the above-stated RAOs.

Applicable or Relevant and Appropriate Requirements

ARARs were identified for the FUSRAP areas in order to facilitate the development of FS remedial action alternatives. Section 121(d)(2) of CERCLA establishes an ARAR standard for remedial action with respect to any hazardous substance, pollutant, or contaminant that would remain on-site. Remedial actions, upon completion, must achieve a level or standard of control that at least attains legally applicable or relevant and appropriate standards, requirements, criteria, or limitations under federal environmental law. The actions must also meet any promulgated standard, requirement, criteria, or limitation under a state environmental or facility siting law proposed by the state that is more stringent than any federal standard, requirement, criteria, or limitation. These standards apply unless such standard, requirement, criteria, or limitation is waived in accordance with Section 121(d)(4). ARARs established for the FUSRAP areas of the IAAAP represent chemical-, location-, and action-specific requirements and are presented in detail in the FS Report and are presented here.

Chemical-Specific ARARs:

The following ARARs have been identified for DU-contaminated soil and structural surfaces.

Title 10, *CFR*, Part 20, Subpart E, Sections 20.1403(b) and 20.1403(e):

These standards are generally applicable to U.S. Nuclear Regulatory Commission (NRC) licensed facilities. The FUSRAP residuals were generated from AEC activities that occurred

prior to the establishment of NRC licensing requirements. In addition, the IAAAP does not have an NRC license. The fabrication of DU shells at the IAAAP was originally conducted under an NRC source material license (SUC-1381), but the license was transferred from NRC jurisdiction to the State of Iowa (Iowa Department of Public Health license 0290-1-29-SM1) in 2000. Therefore, these standards are not applicable at the IAAAP. However, USACE has identified these standards as relevant and appropriate because the constituents, the activities, and the type of place regulated by these standards are sufficiently similar to the FUSRAP areas containing radiological constituents (i.e., DU). The standards in 10 *CFR* Part 20 Subpart E that are relevant and appropriate include Sections 20.1403(b) and 20.1403(e), which define standards for release under restricted conditions, noting that release under restricted conditions is acceptable if:

- 20.1403(b): "The licensee has made provisions for legally enforceable institutional controls that provide reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group will not exceed 25 mrem [0.25 millisievert (mSv)] per year";
- 20.1403(e): "Residual radioactivity at the site has been reduced so that if the institutional controls were no longer in effect, there is reasonable assurance that the TEDE from residual radioactivity distinguishable from background to the average member of the critical group is as low as reasonably achievable (ALARA) and would not exceed either–

  (1) 100 mrem (1 mSv) per year; or

  (2) 500 mrem (5 mSv) per year provided that the licensee–

  (i) Demonstrates that further reductions in residual radioactivity necessary to comply with the 100 mrem/y [year] (1 mSv/y) value of paragraph (e)(1) of this section are not technically achievable, would be prohibitively expensive, or would result in net public or environmental harm.

  (ii) Makes provisions for durable institutional controls;

  (iii) Provides sufficient financial assurance to enable a responsible government entity or independent third party, including a governmental custodian of a site, both to carry out periodic rechecks of the site no less frequently than every 5 years to assure that the institutional controls remain in place as necessary to meet the criteria of Sec. 20.1403(b) and to assume and carry out responsibilities for any necessary control and maintenance of those controls."

ALARA involves making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical, taking into account the state of technology as well as societal and economic factors.

Location-Specific ARARs:

The Endangered Species Act [16 U.S. Code §1538(a)(1), (1973)]: This act provides for the conservation of threatened and endangered plants and animals and the habitats upon which they depend. A federally listed endangered species, the Indiana bat, has been documented as utilizing areas within the geographic boundary of the IAAAP during the summer months. Therefore, the following requirements are relevant and appropriate for remedial actions within the FUSRAP areas of the IAAAP:

- 16 U.S. Code §1538(a)(1), which identifies the Endangered Species Act-prohibited acts for endangered species.

Action-Specific ARARs:

Title 10, *CFR* Part 20, Subpart B, Radiation Protection Programs, Section 20.1101(d): The provisions of Section 20.1101(d) are relevant and appropriate to actions involving releases of airborne radioactive materials during remediation. These provisions impose a constraint on air emissions of radioactive material to the environment, excluding Radon-222 and its daughters, such that the highest individual dose to the public will not exceed 10 mrem (0.1 mSv) per year.

Development of Remediation Goals

For the FUSRAP areas, RGs are soil or structural surface concentrations for DU that, if allowed to remain in place, would not result in adverse human health or environmental impacts under the exposure scenarios evaluated in the BRA. Based on the results of the BRA, RGs were developed for protection of human health under an industrial land use scenario, based on potential industrial site worker exposures to DU in soil at the FSA and DU for FUSRAP structures 1 (i.e., "industrial RGs"). These scenarios are consistent with the two existing IAAAP RODs.

Table 1 presents a summary of RGs for industrial soil and structures derived for the FUSRAP areas of the IAAAP. The industrial RGs listed in Table 1 comply with ARARs, are protective of human health and environment, and are consistent with the NCP. All industrial RGs proposed are risk-, or ARAR-based concentrations. Soil and structural industrial RGs for DU were derived using the RESRAD model (Version 6.4) and RESRAD-BUILD model (Version 3.4), respectively, and selected as the lower of risk-based and dose-based values. Both the risk- and dose-based values were derived based on the known activity percentages of the uranium isotopes in DU. Industrial RGs were derived for DU-contaminated soil at the FSA and FUSRAP structures. Due to the natural variability in activity percentages present in DU, all confirmatory soil samples will be processed by alpha spectroscopy analysis to determine the isotopic concentrations of all three uranium isotopes present in DU (U-238, U-235, and U-234). The actual concentrations reported in each survey unit will be used to calculate the actual dose/risk associated with the residual DU. During the RI, only two structural components were found to exhibit elevated survey measurements above the industrial RG: the grate in Building 1-11 and the air filters in Building 1-63-6, both of which are currently located within inactive areas at Line 1.

In the FS Report, the development of the DU RGs provided a tool for direct comparison of RGs to corresponding samples acquired for each FUSRAP area in order to determine the sample locations at which RGs are exceeded. Knowing the extents of the contamination allowed for the estimation of soil volumes and structural surface area to facilitate evaluations of general response actions and remedial alternatives in the FS.

Table 1. Soil and Structural Remediation Goals for the Formerly Utilized Sites Remedial Action Program Areas

COC	Soil RG (pCi/g)	Structures RG (dpm/100 cm^2)
DU	150	23,000

Estimated Volume of Material Exceeding Remediation Goals

Site conditions, the nature and extent of contamination, and DU RGs were taken into consideration to estimate the volumes of each medium (soil and structures) at each affected area to be addressed by the remedial actions.

The primary media of concern at the FSA are surface and subsurface soil that are DU-contaminated as a result of AEC activities. The estimated volumes of soil exceeding the RG are presented in Table 2 and shown in Figure 3. Surface soil was assumed to be the total volume of soil from 0 to 1 ft in depth. Subsurface soil is estimated to be the total volume of soil greater than 1 ft in depth to an approximate depth of 2 ft as defined by the extent of contamination. For locations where isolated DU fragments were found (i.e., Firing Sites 1 and 2), soil volumes were conservatively estimated as 1 cubic yard (CY). At the Firing Site 12 Area, volume estimates were based on the horizontal and vertical extents of contamination with a graded approach due to the presence of many isolated DU fragments and non-contiguous DU-contamination at greater distances from the testing pad (Figure 3). The total volume calculated for the Firing Site 12 Area consists of 100% of the soil to a depth of 1 ft and 25% of the soil between 1 and 2 ft within a 100-meter (m) radius from the testing pad. For distances greater than 100 m from the testing pad (up to a 175 m radius), the total volume includes an estimate of 5% of the soil to a depth of 1 ft.

Table 2. Estimated In-situ Volume of Soil Exceeding the RG for DU

Location	Surface Soil Volumes 0 to 1 ft (CY)	Subsurface Soil Volumes 1 to 2 ft (CY)	Total Soil Volumes (CY)
Firing Sites 1 and 2	1	0	1
Firing Sites 3, 4, and 5	1	0	1
Firing Sites 6, 7, 8, and 15	1	0	1
Firing Site 12	13,809	3,129	16,938
Total Volume	**13,812**	**3,129**	**16,941**

During soil remediation, any below-grade building surfaces that are exposed would be surveyed to assess whether decontamination is necessary. An estimated 475 square feet (ft^2) of surface area may be radiologically contaminated and require cleaning.

The primary medium of concern at Line 1 is structures that have become radiologically contaminated as a result of prior AEC activities at the IAAAP. The specific structures with surface radioactivity above the RG are a steel grate covering a floor sump located at Building 1-11 and the air filters in an air-handling unit at Building 1-63-6. The estimated area of structural material requiring remediation at Line 1 is approximately 46 ft^2.

SUMMARY OF REMEDIAL ALTERNATIVES

The purpose of the FS was to develop and evaluate remedial alternatives in order to meet the FUSRAP RAOs. The development of remedial alternatives included the identification of potential remedial technologies and process options of both conventional and innovative technologies. Process options are specific types of remedial technologies that can be applied as part of a general response action. Examples of general response actions would be No Action, Land Use Controls, Removal, and Treatment (among others). Using treatment as an example, types of remedial technologies used for treatment include physical/chemical treatment and biological treatment. Each treatment technology can be implemented by any of a number of process options. Examples of process options for physical/chemical treatment include soil sorting, and solidification/stabilization, among others. Process options for biological treatment include enhanced bioremediation and phytoremediation (removal of contaminants by plant uptake). In the FS, identified remedial technologies and process options were subjected to an initial screening based on their ability to satisfy the RAOs and the feasibility of technical

implementation at the IAAAP. Several technologies and process options were screened out as a result of this initial evaluation.

The retained technologies and process options were combined to form four remedial action alternatives for soil and three remedial action alternatives for structures. Emphasis was placed on the development of remedial alternatives that ensure adequate protection of human health and the environment; achieve ARARs; and permanently and significantly reduce the volume, toxicity, mobility, or exposure of site-related contaminants. The FUSRAP area alternatives are as follows:

- **Remedial Alternatives for Soil:**
  - **Alternative 1:** No Action for Soil,
  - **Alternative 2:** Land Use Controls for Soil,
  - **Alternative 3:** Excavation of DU-Contaminated Soil with Off-Site Disposal, and
  - **Alternative 4:** Excavation of DU-Contaminated Soil with Physical Treatment and Off-Site Disposal.
- **Remedial Alternatives for Structures:**
  - **Alternative S1:** No Action for Structures,
  - **Alternative S2:** Land Use Controls for Structures, and
  - **Alternative S3:** Decontamination/Replacement of Structures.

Following a detailed evaluation of the above alternatives, as described in the next section ("Detailed Evaluation of Alternatives"), pursuant to the criteria described in the NCP [40 *CFR* §300.430(e)(9)(iii)], the USACE recommends a preferred alternative for final remedial action for soil in the FUSRAP areas at the IAAAP, which is Alternative 4: Excavation of DU-Contaminated Soil with Physical Treatment and Off-Site Disposal. Additionally, the USACE recommends a preferred alternative for final remedial action for IAAAP structures in the FUSRAP areas, which is Alternative S3: Decontamination/Replacement of Structures. USACE considers these alternatives to be protective of human health and the environment and cost effective. The preferred alternative for soil, Alternative 4, includes physical treatment (e.g., soil sorting and radiological scanning) for DU-contaminated soil to reduce the volume of soil requiring off-site disposal. The preferred alternative for IAAAP structures in the FUSRAP areas, Alternative S3, includes the decontamination of one structural component (steel grate) and the replacement of another component (air filter) at Line 1 because decontamination of this component is not feasible or cost effective.

Remedial Alternatives for Soil

The following alternatives were evaluated to address the contamination in soil. Each alternative would need to be combined with one of the alternatives for structures to create a remedial action addressing soil and structural surface contamination at the FUSRAP areas.

Alternative 1: No Action for Soil

Under Alternative 1, no remedial actions would be implemented at the FUSRAP areas. The NCP requires a no action alternative be evaluated as a baseline for comparison to other remedial alternatives. Contaminated soil would be left in place, the existing IAAAP land use controls (e.g., use restrictions and outgrants administered by the U.S. Army as part of its land

management responsibilities) would not be maintained, and no additional measures would be implemented to control exposures to the contaminated soil.

Alternative 2: Land Use Controls for Soil

Alternative 2 includes land use controls to reduce the potential for exposure to contaminated soil. This alternative involves leaving contamination in place above the industrial RG for soil and is protective of human health as long as industrial land use continues. Land use controls, including access and use restrictions, would be used in areas where DU is present in soil at concentrations exceeding the RG. Existing controls include use restrictions and outgrants administered by the U.S. Army as part of its land management responsibilities. Under this alternative, additional land use controls would be implemented, which would include specific prohibitions against any actions that would disturb the soil at the FSA. Alternative 2 is one of the least costly alternatives because the contaminated soil would be left on-site. Five-year reviews would be conducted, pursuant to CERCLA, for areas that are contaminated at levels not allowing for UUUE. Each five-year review would verify the continued industrial land use of the IAAAP and FUSRAP areas.

Alternative 3: Excavation of DU-Contaminated Soil with Off-Site Disposal

The specific components of Alternative 3 include excavation of DU-contaminated soil where it exceeds the industrial RG for DU (i.e., Firing Sites 1 and 2; Firing Sites 3, 4, and 5; the Firing Site 6 Area; and the Firing Site 12 Area). The estimated total volume of soil that would be excavated is 16,941 in-situ CY. There is no physical treatment of DU prior to off-site disposal. Soil exceeding the industrial RG would be disposed of by transfer to a properly permitted off-site disposal facility.

If co-mingled contamination is found during waste characterization sampling/analysis, chemical contaminants would be disposed of by transfer to a properly permitted off-site disposal facility. Personnel qualified in the removal of unexploded ordnance (UXO) will provide the required equipment and instruments as necessary to properly address any UXO encountered during remediation in accordance with Engineer Pamphlet 75-1-2, *UXO Support During Hazardous, Toxic and Radioactive Waste (HTRW) and Construction Activities*. All waste transport for off-site disposal will be compliant with existing Department of Transportation regulations.

No excavation activities would be required at Yards C, G, and L and Firing Site 14.

Industrial land use would be continued for the foreseeable future and verified with the CERCLA 121(c) five-year reviews, which are required under this alternative for those areas that do not achieve UUUE.

Alternative 4: Excavation of DU-Contaminated Soil with Physical Treatment and Off-Site Disposal

Alternative 4 includes excavation of only DU-contaminated soil (as identified above). DU-contaminated soil would be treated using the physical method of soil sorting (e.g., soil sorting and radiological scanning). An on-site pilot-scale demonstration of the physical treatment system would be conducted prior to full-scale remediation activities. Soil exceeding the industrial RG would be disposed of by transfer to a properly permitted off-site disposal facility. Materials meeting the DU RG could be used as backfill, as appropriate.

If co-mingled contamination is found during waste characterization sampling/analysis, chemical contaminants would be disposed of by transfer to a properly permitted off-site disposal facility.

Personnel qualified in the removal of UXO will provide the required equipment and instruments as necessary to properly address any UXO encountered during remediation in accordance with Engineer Pamphlet 75-1-2. All waste transport for off-site disposal will be compliant with existing Department of Transportation regulations.

No excavation activities would be required at Yards C, G, and L and Firing Site 14.

Industrial land use would be continued for the foreseeable future and verified with the CERCLA 121(c) five-year reviews, which are required under this alternative for those areas that do not achieve UUUE.

Remedial Alternatives for Structures

The following alternatives were evaluated to address the DU contamination on structures. Each alternative would need to be combined with one of the previously identified alternatives for soil contamination to create a remedial action addressing soil and structural surface contamination at the FUSRAP areas.

Alternative S1: No Action for Structures

Under Alternative S1, no remedial actions would be implemented for the contaminated structures exceeding the industrial RG at the FUSRAP areas. The NCP requires a no action alternative be evaluated as a baseline for comparison to other remedial alternatives. The contaminated structures would be left in place, the existing IAAAP land use controls (e.g., use restrictions and outgrants administered by the U.S. Army as part of its land management responsibilities) would not be maintained, and no additional measures would be implemented to control exposures to the contaminated structures.

Alternative S2: Land Use Controls for Structures

Alternative S2 includes the use of land use controls for structures and is protective as long as the controls are in place. This alternative involves leaving contamination in place above the industrial RG. It imposes additional land use controls to reduce the potential for exposure to contaminated structures (as well as maintaining existing industrial land use). Under this alternative, land use controls would be added, which would include restricted use of structures or establishment of no-entry zones.

Five-year reviews would be conducted in accordance with CERCLA 121(c) for areas where contaminants are left above levels acceptable for UUUE. Industrial land use would be verified during each five-year review.

Alternative S3: Decontamination/Replacement of Structures

Alternative S3 includes using physical methods (such as high pressure washing, cleansing, grit blasting, or scabbling) to remove contamination from structural surfaces and/or the replacement of the structural components. Structural surfaces would be decontaminated until residual radioactivity meets the industrial RG. Structural surfaces would be surveyed after remediation to measure residual radioactivity. Industrial land use would continue for the foreseeable future.

Based on elevated gross alpha and beta activities, a grate over a sump in Building 1-11 and the air filters in an air handling unit in Building 1-63-6, both of which are currently located within inactive areas of Line 1, exceeded the DU RG for structures. Under Alternative S3, the contaminated air filters would be removed and replaced and the steel floor grate covering the sump would be decontaminated and, if methods fail to successfully decontaminate the grate, it

would be replaced. Structural components (such as the air filters) that are contaminated with DU would be disposed of in a method consistent with DU-contaminated soil.

Structures would be included in five-year reviews if they exceed levels appropriate for UUUE. Industrial use would be verified during the five-year reviews.

DETAILED EVALUATION OF ALTERNATIVES

The FUSRAP area alternatives were evaluated using the nine CERCLA evaluation criteria established in 40 *CFR* §300.430(e)(9)(iii) of the NCP. The nine criteria are grouped into three categories (i.e., threshold, balancing, and modifying criteria) based on their level of relative importance [40 *CFR* §300.430(f)(1)(i)]. Table 3 summarizes the results of the comparative analysis of the seven criteria for the four remedial action alternatives for soil. Table 4 summarizes the results of the comparative analysis of the seven criteria for the three remedial action alternatives for structures.

Threshold Criteria

Threshold criteria include *Overall Protection of Human Health and the Environment* and *Compliance with ARARs* and must be satisfied for a remedial action alternative to be considered a viable remedy. On the basis of the detailed evaluation, each of the soil alternatives, except Alternative 1, is protective of human health. Alternatives 3 and 4 rely on soil removal to provide an effective and permanent remedy for the FUSRAP areas. For Alternatives 2, 3, and 4, human health is protected as long as land use remains industrial. Alternatives 1 and 2 result in the highest levels of contamination remaining on-site. Alternatives 3 and 4 provide the greatest long-term protection to human health because soil is removed to achieve the DU RG. Alternatives 3 and 4 comply with all ARARs; however, Alternatives 1 and 2 do not comply with chemical-specific ARARs. Alternative 2 does not comply with 10 CFR 20.1403(e)(1), which requires that residual radioactivity at the site be reduced so that if the institutional controls were no longer in effect, the annual dose to an average member of the critical group is ALARA and would not exceed 100 mrem/year.

Each of the remedial alternatives for structures, except Alternative S1, is protective of human health. Alternative S1 does not prevent potential exposures to contaminated structures. Alternative S2 involves the use of land use controls and is effective in reducing potential human exposure to DU-contaminated structures through access restrictions. Alternative S3 (decontamination/replacement of structures) provides the greatest overall protection to human health and the environment because contamination on structural surfaces is removed. Two of the remedial alternatives for structures, S1 (no action) and S2 (land use controls), do not comply with ARARs. Alternative S2 does not comply with the ALARA requirement of 10 CFR 20.1403(e)(1), as some decontamination activities have been demonstrated to be cost effective for reducing residual radioactivity on structural surfaces. Alternative S3 (decontamination/replacement of structures) would reduce potential future doses below the 25-mrem/year level and would achieve doses that are ALARA.

Primary Balancing Criteria

Primary balancing criteria include *Long-Term Effectiveness and Permanence; Short-Term Effectiveness and Environmental Impacts; Reduction of Toxicity, Mobility, or Volume through Treatment; Implementability;* and *Cost.* The primary balancing criteria identify major trade-offs among alternatives.

Table 3. Summary of Detailed Analysis of Alternatives for Soil

Criteria	Alternative 1: No Action for Soil	Alternative 2: Land Use Controls for Soil	Alternative 3: Excavation of Depleted Uranium Contaminated Soil with Off Site Disposal	Alternative 4: Excavation of Depleted Uranium Contaminated Soil with Physical Treatment and Off Site Disposal
Overall Protection				
Human Health	Not protective.	Protective. Land use controls provide protectiveness for those areas where contamination remains in place above the RG.	Protective. Removal of DU-contaminated soil provides protectiveness.	Protective. Removal of DU-contaminated soil provides protectiveness.
Environment	Protective.	Protective.	Protective.	Protective.
Compliance With ARARs				
Chemical-Specific	Not compliant.	Not compliant. Does not achieve the restricted release conditions given in 10 CFR 20.1403.	Compliant.	Compliant.
Action-Specific	NA	NA	Compliant.	Compliant.
Location-Specific	NA	NA	Compliant.	Compliant.
Long-Term Effectiveness and Permanence				
Magnitude of Remaining Risk	Medium. Residual risk exceeds USEPA risk range due to waste remaining in current configuration, thereby allowing for potential exposure.	Medium. Land use controls would limit exposures to residual contamination for current anticipated land uses.	Low. Remaining risks at the FUSRAP areas are controlled by continuation of industrial land use.	Low. Remaining risks at the FUSRAP areas controlled by continuation of industrial land use.
Adequacy of Controls	None provided.	Good. Long-term expected use as military installation.	Very good – limited areas require long-term controls.	Very good – limited areas require long-term controls.
Reliability of Controls	None provided.	Land use controls are reliable over the long term under continued industrial land use.	Land use controls are reliable over the long term under continued industrial land use.	Land use controls are reliable over the long term under continued industrial land use.

Table 3. Summary of Detailed Analysis of Alternatives for Soil (Continued)

Criteria	Alternative 1: No Action for Soil	Alternative 2: Land Use Controls for Soil	Alternative 3: Excavation of Depleted Uranium Contaminated Soil with Off Site Disposal	Alternative 4: Excavation of Depleted Uranium Contaminated Soil with Physical Treatment and Off Site Disposal
Long-Term Effectiveness and Permanence (Continued)				
Long-Term Management	None provided.	Five-year review, maintenance of existing installation land use controls, and implementation of additional land use controls at FUSRAP areas.	Continued industrial land use, along with five-year reviews, during which industrial land use would be verified.	Continued industrial land use, along with five-year reviews, during which industrial land use would be verified.
Reduction of Contaminant (Overall)				
Toxicity, Mobility, or Volume by Treatment	None.	None.	None.	Volume of soil requiring disposal would be reduced by soil sorting.
Protection of Community	No additional short-term risk to community due to no action taken.	No additional short-term risk to community.	Slight potential for an increase in short-term risk from excavation and transportation activities. However, risks could be controlled by mitigative measures.	Slight potential for an increase in short-term risk from excavation, treatment, and transportation activities. However, risks could be controlled by mitigative measures.
Protection of Site Workers	No additional short-term occupational risk to site workers.	No additional short-term occupational risk to site workers.	Short-term occupational risk to site workers from excavation and transportation activities could be reduced by mitigative measures.	Short-term occupational risk to site workers from excavation, treatment, and transportation activities could be reduced by mitigative measures.
Environmental Impacts	No additional impacts in the short-term.	No additional short-term impacts to ecosystem.	Short-term impacts to ecosystem. Long-term benefit.	Short-term impacts to ecosystem. Long-term benefit.
Geology and Soil	No impacts to soil.	No impacts to soil.	Short-term soil disturbance during excavation.	Short-term soil disturbance during excavation.
Implementability				
Technical Feasibility	Feasible.	Feasible.	Feasible.	Feasible.
Administrative Feasibility	Feasible.	Feasible.	Feasible.	Feasible.
Cost (Present Worth)				
Total Cost Over 30-Year Period	$0	$2,332,013	$50,401,517	$45,172,033

NA = Not applicable
$ = U.S. dollars

Table 4. Summary of Detailed Analysis of Alternatives for Structures

Criteria	Alternative S1: No Action for Structures	Alternative S2: Land Use Controls for Structures	Alternative S3: Decontamination/ Replacement of Structures
Overall Protection			
Human Health	Not protective.	Protective. Land use controls provide protectiveness for those areas where contamination remains in place above levels that would allow UUUE.	Protective. Decontamination or removal and replacement of structural components as necessary will reduce or eliminate potential exposures to radiological contamination.
Environment	Protective.	Protective.	Protective.
Compliance With ARARs			
Chemical-Specific	Not compliant.	Not compliant. Does not achieve the restricted release conditions given in 10 *CFR* 20.1403.	Compliant.
Action-Specific	NA	NA	NA
Location-Specific	NA	NA	Compliant.
Long-Term Effectiveness and Permanence			
Magnitude of Remaining Risk	Medium. Residual risk exceeds USEPA risk range due to waste remaining in current configuration, thereby allowing for potential exposure.	Low. Land use controls would limit exposures to residual contamination for current anticipated land uses.	Very low to none. Decontamination is expected to reduce radiological surface contamination to background levels. Removal and replacement would also eliminate radiological risk.
Adequacy of Controls	None provided.	Good. Long-term expected use as military installation.	Very good. No additional controls would be needed for structures.
Reliability of Controls	None provided.	Very reliable.	Very reliable.
Long-Term Management	None provided.	Continued industrial land use, along with five-year reviews, during which industrial land use would be verified, and implementation of additional land use controls at FUSRAP areas.	Continued industrial land use, along with five-year reviews, during which industrial land use would be verified.

Table 4. Summary of Detailed Analysis of Alternatives for Structures (Continued)

Criteria	Alternative S1: No Action for Structures	Alternative S2: Land Use Controls for Structures	Alternative S3: Decontamination/ Replacement of Structures
Reduction of Contaminant (Overall)			
Toxicity, Mobility, or Volume by Treatment	None.	None.	None.
Short-Term Effectiveness			
Protection of Community	No additional short-term risk to community due to no action taken.	No additional short-term risk to community.	Slight potential for an increase in short-term risk from construction and transportation activities. However, risks could be controlled by mitigative measures.
Protection of Site Workers	No additional short-term occupational risk to site workers.	No additional short-term occupational risk to site workers.	Radiological risks to site workers could be reduced by mitigative measures.
Environmental Impacts	No additional impacts in the short-term due to no action taken.	No additional short-term impacts to ecosystem.	No short-term or long-term impacts. Long-term benefit.
Geology and Soil	NA	NA	No expected impacts to soil.
Implementability			
Technical Feasibility	Feasible.	Feasible.	Feasible.
Administrative Feasibility	Feasible.	Feasible.	Feasible.
Cost (Present Worth)			
Total Cost Over 30-Year Period	$0	$285,772	$102,961

NA = Not applicable

Alternatives 3 and 4 are the most effective and permanent soil remedies because they involve the removal of DU-contaminated soil. Alternative 2 relies solely on land use controls to reduce exposures and has a lesser degree of long-term effectiveness and permanence. The least permanent alternative is Alternative 1 because contaminated soil would not be removed or treated and no additional land use controls would be implemented. The most permanent alternative for structures is Alternative S3. DU-contamination on surfaces would be removed to levels below the RG. Alternatives S1 and S2 for structures are less permanent and effective because contaminated surfaces would not be decontaminated or removed.

Alternative 4 provides a reduction in contaminant volume and mobility through treatment. The remaining alternatives (Alternatives 1, 2, 3, S1, S2, and S3) do not use treatment to reduce the toxicity, mobility, or volume of contaminants in the media.

With respect to short-term effectiveness, Alternatives 1 and 2 rate higher than Alternatives 3 and 4 because no remedial activities would be conducted that have the potential to impact the health and safety of workers, the surrounding communities, or the environment. Alternatives 3 and 4 include the excavation and disposal of contaminated soil off-site and therefore, have increased short-term risks to the workers conducting the excavation, transport, and disposal activities. Worker safety could be managed using appropriate personal protection and safety measures. Off-site migration of airborne contaminants could be minimized by using dust suppression controls and monitoring. Short-term risks to the public as a result of airborne contamination would be minimal under Alternatives 3 and 4.

Short-term negative impacts to the environment may occur as a result of soil excavation conducted for Alternatives 3 and 4. Excavation potentially destroys animals and plants present at the location, potentially destroys habitat or food available to animals, and may temporarily create non-point source surface-water discharges. All of these impacts would be managed in compliance with the substantive requirements of applicable laws and regulations and, therefore, are not considered to be significant obstacles to the implementation of these remedial alternatives. Alternatives 3 and 4 are also not expected to impact the habitat used by the Indiana bat. Some noise disturbance due to construction activities is likely to occur, but it is not expected to disturb the Indiana bat during critical periods of roosting.

Alternatives S1 and S2 would not involve any remedial actions; therefore, there would be no short-term impacts to workers or to the environment. Alternative S3 would involve some short-term risks associated with worker safety during decontamination activities. Worker safety would be managed in compliance with the substantive requirements of applicable laws and regulations and using appropriate personal protection and safety measures.

All four remedial alternatives for soil are technically feasible to implement. Alternative 1 is the easiest alternative to implement from a technical standpoint, while Alternative 2 is rated higher than the remaining alternatives in technical implementability because no active remediation would be required. Alternatives 3 and 4 are rated lower in technical implementability due to the technical difficulties that are associated with the excavation, treatment (Alternative 4 only), transportation, and disposal of soil and the time/coordination involved in implementing these alternatives. There would be a slightly higher degree of difficulty in implementing Alternative 4 due to the additional technical requirements for conducting the treatment activities. Alternative 2 involves the implementation of additional land use controls and so is administratively more complex than the other alternatives. However, no significant difficulties are anticipated in implementing and obtaining approvals for the land use controls so it is rated high in administrative implementability. Alternatives 3 and 4 are rated lowest in administrative

implementability because they involve the remediation of DU-contaminated soil at the FSA. There is limited access to the FSA (particularly the Firing Site 6 Area) because it is an operational range. There could be administrative challenges in scheduling and coordinating remediation activities to avoid causing significant delays or cancelation of essential operational range activities.

All three remedial alternatives for structures are technically feasible. Alternatives S1 and S2 are the easiest to implement because no active remediation is performed. Although Alternative S3 has a slightly higher degree of difficulty, it is highly implementable. The materials and services for removal of surface contamination as part of Alternative S3 are readily available. Alternative S2 involves the implementation of land use controls and so is administratively more complex than the other remedial alternatives for structures.

The estimated total 30-year costs for the alternatives, developed during the FS, are listed in Table 5.

Table 5. Comparison of Costs for Remedial Alternatives for the Formerly Utilized Sites Remedial Action Program Areas

Alternatives for Soil	
Alternative	**Estimated Cost**
1	$0
2	$2,332,013
3	$50,401,517
4	$45,172,033
Alternatives for Structures	
S1	$0
S2	$285,772
S3	$102,961

Modifying Criteria

State and community acceptance of the alternatives will be established as part of the CERCLA public participation process. A summary of the remedial alternatives and the preferred remedy is presented in this PP, which will be available for public review during the public comment period. Community acceptance will be evaluated following review of comments on the FS and PP received during the public comment period.

PREFERRED ALTERNATIVE

USACE recommends Alternative 4, Excavation of DU-Contaminated Soil with Physical Treatment and Off-Site Disposal, along with Alternative S3, Decontamination/Replacement of Structures. Alternative 4 includes the excavation of DU-contaminated soil to an approximate depth of 2 ft to achieve the radiological industrial soil RG at the Firing Sites 1 and 2, Firing Sites 3, 4, and 5, the Firing Site 6 Area, and the Firing Site 12 Area. The estimated total volume of DU-contaminated soil that would be excavated and treated is approximately 16,941 in-situ CY.

The DU-contaminated material would be treated using physical treatment technologies (e.g., soil sorting and radiological scanning). Physical treatment is expected to achieve a 20% volume reduction in soil requiring off-site disposal. The reduction in soil requiring off-site disposal results in cost savings that more than offset the cost of the treatment. An on-site pilot-scale demonstration of the physical treatment technology would be conducted prior to full-scale remediation activities. Sampling would be performed to determine the proper disposition of the

waste and to verify removal of soil exceeding the RG. Soil exceeding the RG would be disposed of in a properly permitted off-site disposal facility. Materials meeting the RG may be used as backfill, as appropriate.

Excavation of soil at the FSA would successfully reduce the potential human health risks associated with potential exposures to DU by site workers and construction workers at the IAAAP. The use of physical treatment as part of the remedial component of Alternative 4 complies with CERCLA in regard to the preference for treatment as a principal element for remedial actions. Physical treatment by soil sorting and radiological scanning of DU-contaminated soil would reduce the volume of soil proposed for off-site disposal and thereby reduce the overall cost for remediation.

Because DU may remain on-site and chemical soil contamination will remain on-site at concentrations not allowing for UUUE, this alternative also includes CERCLA five-year reviews to ensure protectiveness of human health under industrial land use. Alternative 4 is protective of the environment as no risks to potential ecological receptors were identified and COCs are not migrating off-site.

The preferred alternative for FUSRAP structures at Line 1 is Alternative S3, which includes physical decontamination of DU-contaminated structural surfaces and/or replacement of the structural components. Alternative S3 is more cost-effective than Alternative S2 due to the cost of implementing and supporting the land use controls. DU-contaminated surfaces resulting from soil and air particulates contamination would be decontaminated using high pressure water methods, or other additional methods including cleansers, grit blasting, or scabbling, until residual radioactivity meets the industrial RG. Under Alternative S3, the contaminated air filters at Line 1 Building 1-63-6 would be removed and replaced. Decontamination of DU-contaminated components such as air filters is not feasible and, for some components, is not cost effective. The steel floor grate covering the sump at Line 1 Building 1-11 would be decontaminated and, if methods fail to successfully decontaminate the grate, it would be replaced. Structural components (such as the air filters) that are contaminated with DU would be disposed of in a method consistent with DU-contaminated soil.

After evaluating these alternatives pursuant to the criteria described in the NCP [40 *CFR* Section 300.430(e)(9)(iii)], USACE believes it is protective of human health and the environment because the removal of DU-contaminated soil and decontamination or removal of DU-contaminated structures would permanently reduce the volume, toxicity, and mobility of the contaminated media. All site risks will be reduced to levels protective of industrial land use. Alternatives 4 and S3 achieve the previously stated RAOs:

- Prevent ingestion, dust inhalation, and external gamma radiation exposures to isotopes of DU in the FSA soil that could otherwise result in cumulative CRs exceeding 1×10^{-4} and radiological doses exceeding 25 mrem/year for receptors under the current (industrial) and expected future (industrial) land use scenarios.
- Prevent radiation exposures from DU particles embedded in and/or adhered to structural surfaces or components of the Line 1 buildings that could otherwise result in cumulative CRs in exceedance of 1×10^{-4} and a TEDE exceeding 25 mrem/year.

Additionally, Alternatives 4 and S3 provide the best balance of trade-offs among the other alternatives with respect to the balancing and modifying criteria. USACE expects the preferred alternative to satisfy the following statutory requirements of CERCLA 121(b):

1) be protective of human health and the environment,

2) comply with ARARs (or justify a waiver),

3) be cost-effective,

4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and

5) satisfy the preference for treatment as a principal element or justify not meeting the preference.

The final selection and implementation of the preferred alternatives for soil and structures (Alternatives 4 and S3, respectively) is subject to change based on public comment and the receipt of new information by USACE.

COMMUNITY PARTICIPATION

USACE is issuing this PP for public comment and encourages public input to ensure that the remedy selected for the FUSRAP areas at the IAAAP meets the needs of the local community. USACE invites members of the public to review and comment on all the alternatives described in this PP and the FS. Written comments on the proposed remedial action will be accepted for at least 30 days following the date of issuance of the FS and PP (April 22, 2011). USACE will respond to all significant comments submitted during the comment period in a Responsiveness Summary. After considering these comments, USACE, in coordination with USEPA, the IDNR, and the IAAAP, will make a final decision on the cleanup remedy for the site, which would be outlined in the ROD. The Responsiveness Summary will be an attachment to the ROD.

A copy of the Administrative Record File for actions at the IAAAP FUSRAP areas has been maintained by USACE. The Administrative Record File and the documents describing the results of the IAAAP FUSRAP RI/FS have been made available to the public for review and comment at the:

Burlington Public Library
210 Court Street
Burlington, Iowa 52601

All written comments should be addressed to

Ms. Sharon Cotner, Program Manager
U.S. Army Corps of Engineers,
St. Louis District
8945 Latty Avenue
Berkeley, Missouri 63134

FIGURES

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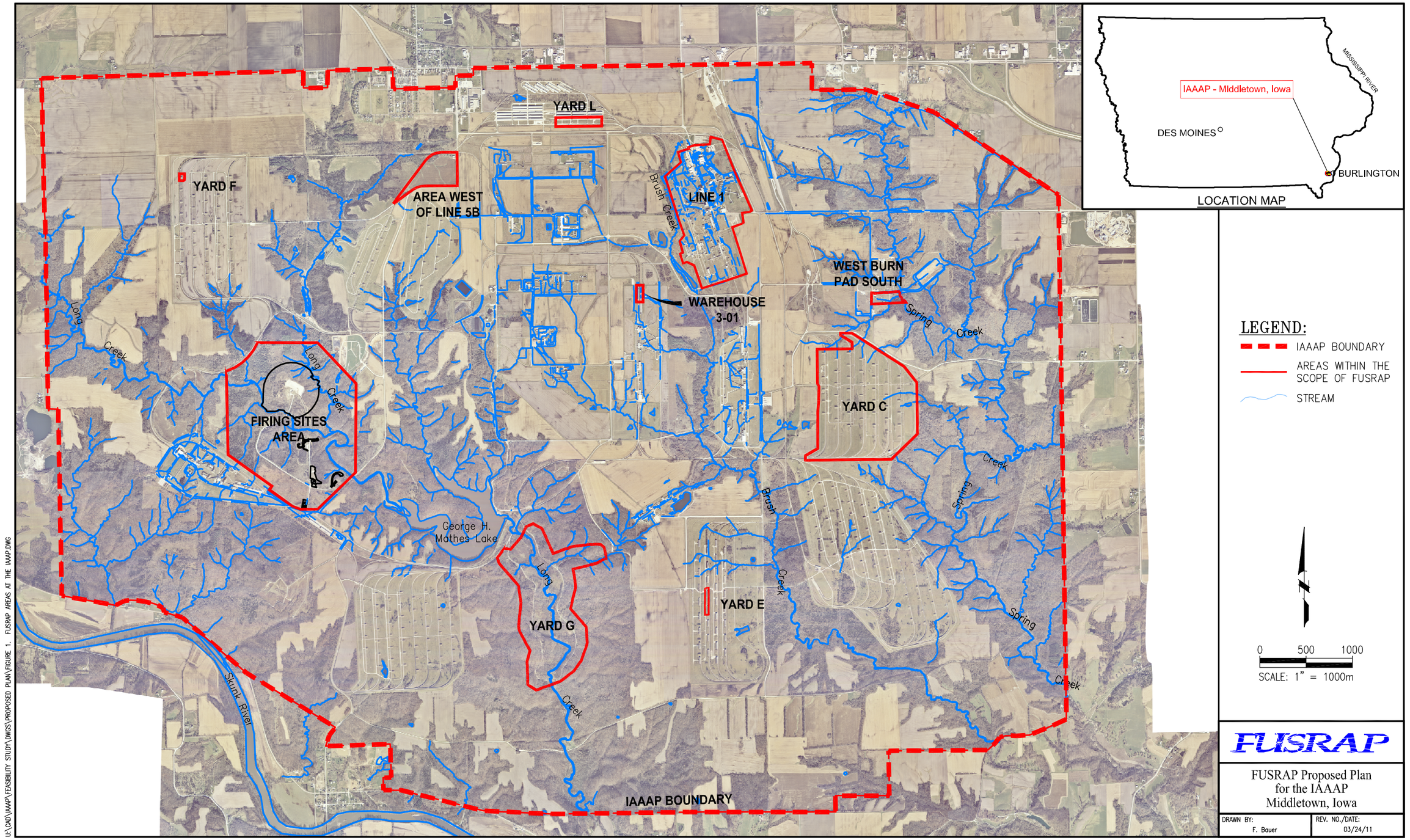
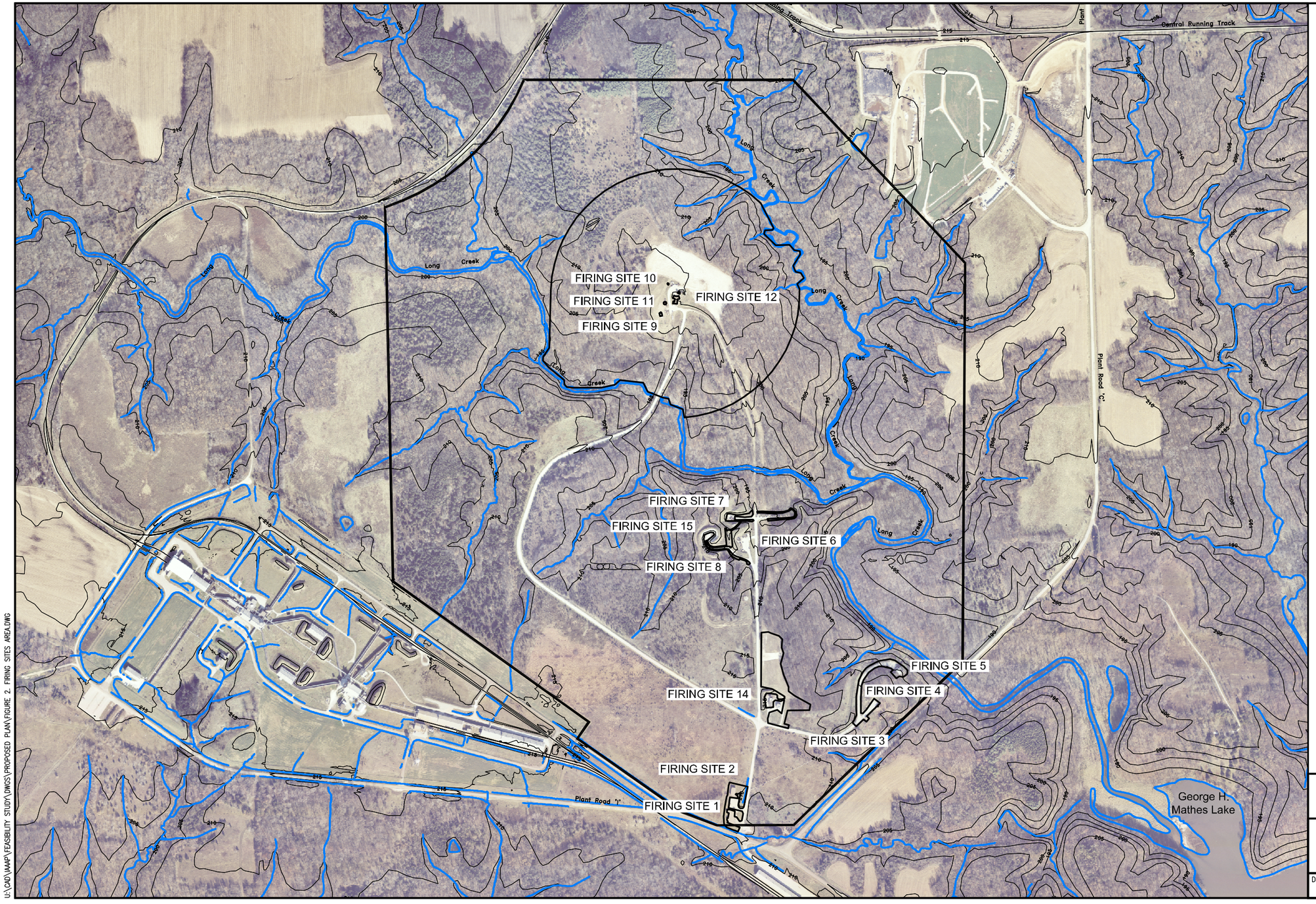


Figure 1. FUSRAP Areas at the IAAAP



LEGEND:

- RAILROAD
- STREAM
- SURFACE FEATURE
- 200 TOPOGRAPHIC CONTOURS
- AREA WITHIN THE SCOPE OF FUSRAP

N

0 120 240

SCALE: 1" = 240m

FUSRAP

FUSRAP Proposed Plan
for the IAAAP
Middletown, Iowa

DRAWN BY:	REV. NO./DATE:
F. Bauer	12/07/10

U:\CAD\IAAAP\FEASIBILITY STUDY\DWGS\PROPOSED PLAN\FIGURE 2. FIRING SITES AREA.DWG

Figure 2. Firing Sites Area

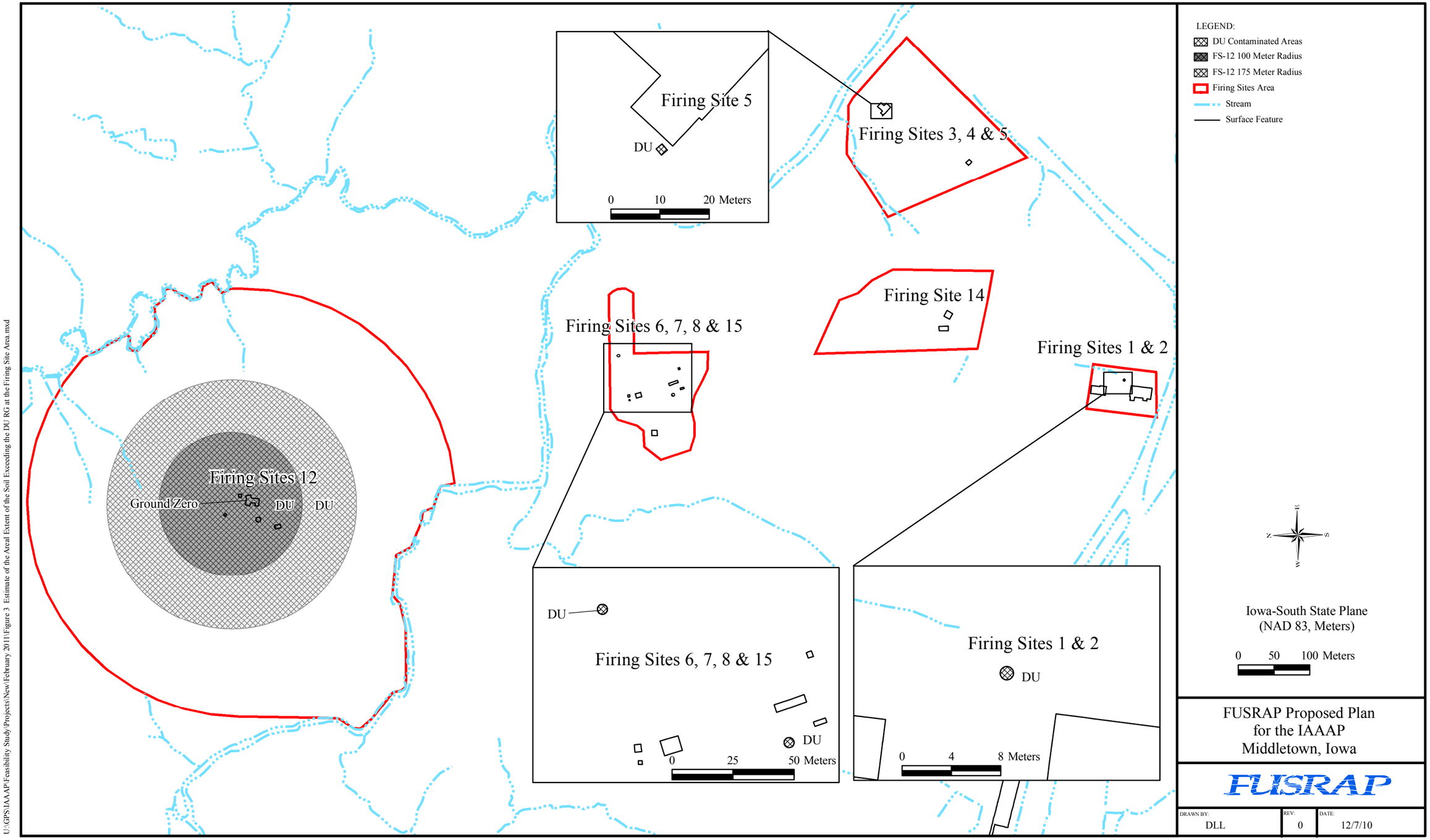


Figure 3. Estimate of the Areal Extent of Soil Exceeding the DU RG at the Firing Site Area

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