

# IOWA ARMY AMMUNITION PLANT

## PROPOSED PLAN FOR MILITARY MUNITIONS RESPONSE PROGRAM

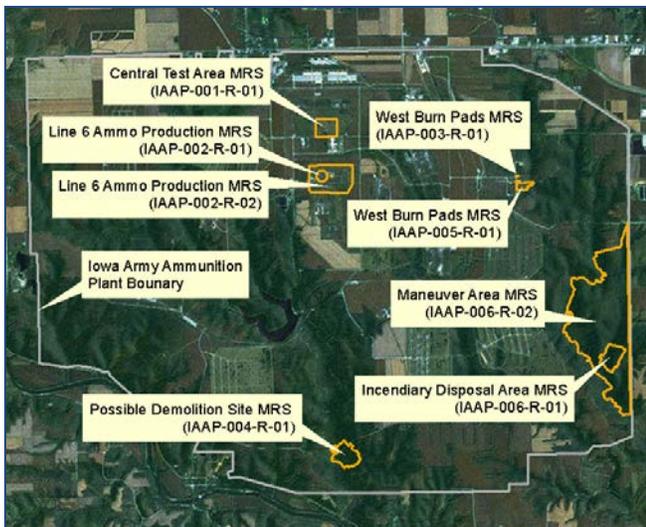
### OPERABLE UNIT FIVE

#### INTRODUCTION

This Proposed Plan identifies the Preferred Remedial Alternative for the following eight Munitions Response Sites (MRSs) at the Iowa Army Ammunition Plant (IAAAP) in Middletown, Iowa:

- Central Test Area;
- Line 6 Ammo Production (Inside Blast Radii);
- Line 6 Ammo Production (Outside Blast Radii);
- West Burn Pads;
- Possible Demolition Site;
- West Burn Pads Area South of the Road;
- Incendiary Disposal Area; and
- Maneuver Area.

The locations of these MRSs within IAAAP are shown on **Figure 1**, and collectively, these sites are referred to as Operable Unit 5.



**Figure 1- Location of Munitions Response Sites**

This work is being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the IAAAP Federal Facility Agreement (FFA). This document is issued by the U.S. Army, the owner of the IAAAP facility, and the U.S. Environmental Protection Agency (EPA). The State of Iowa is not a signatory to the IAAAP

#### Dates to Remember:

**A) Public Comment Period**  
May 6, 2013 to June 4, 2013

**B) Public Meeting**  
5:00 PM, May 28, 2013

The Army and EPA will accept written comments on the Proposed Plan during a 30-day public comment period. The Army will hold a public meeting to explain the Proposed Plan and the alternatives in the Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held at the Comfort Suites Hotel, 1780 Stonegate Center Drive, Burlington, Iowa, at 5:00 p.m.

For more information, see the Administrative Record File, which is located online at [www.iaaap.adminrecord.com](http://www.iaaap.adminrecord.com). A hard copy is located in the IAAAP Library. The Burlington Public Library has computers available to the public for those interested in viewing the electronic version of the Administrative Record.

Burlington Public Library  
501 North Fourth Street  
Burlington, Iowa 52601  
319-753-1647

FFA. The Army is the lead agency and the EPA is the primary regulatory agency.

The Army and EPA are issuing this Proposed Plan as part of the public participation responsibilities under Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan and Section 117(a) of CERCLA.

This Proposed Plan summarizes information that is presented in detail in the Remedial Investigation (RI) and the Feasibility Study (FS) and other documents in the IAAAP Administrative Record File (see above). The Administrative Record is a compilation of the information that was considered in making the proposal presented in this Proposed Plan, and presents a comprehensive description of the site investigation and proposed remediation activities.

IAAAP occupies approximately 19,011 acres adjacent to the town of Middletown in Des Moines County, Iowa. IAAAP is a government-owned, contractor-operated facility under the command of the United States Army Joint Munitions Command, Rock Island, Illinois. Production of munitions began in 1941, including loading, assembling, and packing a variety of conventional munitions. The facility currently remains in operation.

Past IAAAP munitions production and associated testing and disposal operations have resulted in areas where leftover explosively configured items, referred to as Munitions and Explosives of Concern (MEC), are present in the environment. These MEC pose a safety hazard. Additionally, the chemical components of munitions, referred to as Munitions Constituents (MC), may also pose a concern to human health and the environment.

Since 1990, IAAAP has been on the CERCLA National Priorities List (NPL), which drives environmental cleanup. The Department of Defense (DoD) addresses CERCLA sites through the Defense Environmental Restoration Program (DERP). Sites associated with military munitions are managed under DERP in the Military Munitions Response Program (MMRP).

In 2003, the Closed, Transferring, and Transferred Range/Site Inventory Report for IAAAP identified the first four IAAAP MRSs as the Central Test Area, Line 6 Ammo Production, West Burn Pads, and North Burn Pads.

In 2007, IAAAP completed a Historical Records Review (HRR), which identified four additional MRSs: the West Burn Pads Area South of the Road; Possible Demolition Site; Incendiary Disposal Area; and Maneuver Area. The HRR also determined that the previously identified North Burn Pads site was ineligible for the MMRP because soil remedial actions were completed under the Installation Restoration Program (IRP) in 1998, which removed MEC and MC in soil. Thus, seven MRSs were carried forward to the next phase, the Site Inspection (SI).

The purpose of the SI was to determine whether further investigation, immediate response, or No

Further Action (NFA) was required for each MRS. Prior to finalization of the SI, a USEPA dispute resolution, dated December 20, 2006, determined that six of the seven MRSs would be carried forward to the RI. This resolution superseded the recommendations of the SI. Thus, the SI was finalized in 2007 as a desktop SI without site-specific field data collection, and all seven MRSs were carried forward to the RI phase. An additional result of the 2006 USEPA dispute resolution was the requirement for an Interim Action consisting of fence installation at two MRSs (Possible Demolition Site and Incendiary Disposal Area). The purpose of perimeter fencing is to deter entry into the MRSs to mitigate risk to the public.

The RI was finalized in 2011 and fully delineated the nature and extent of contamination. As a result of the RI recommendations, the Line 6 Ammo Production MRS was split into two MRSs (Inside Blast Radii and Outside Blast Radii) due to explosives safety hazards limited to within the blast radii. The RI recommendations specified FS for four of the MRSs and NFA for the other four MRSs (see **Table 1**). An FS was completed in 2012 to identify and evaluate alternatives for remedial action for the four MRSs.

**Table 1 - RI Recommendations**

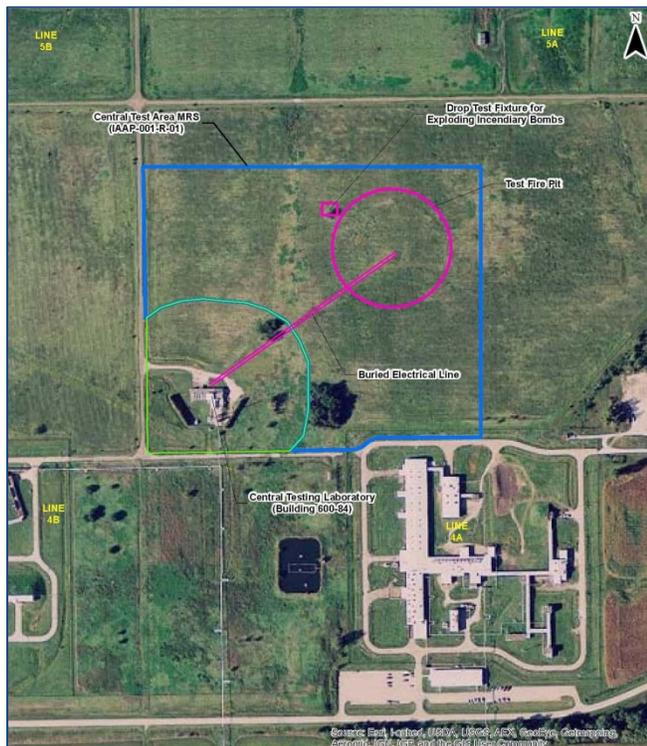
Munitions Response Site	Remedial Investigation Recommendation
Central Test Area	FS for MEC NFA for MC
Line 6 Ammo Production (Inside Blast Radii)	FS for MEC NFA for MC
Line 6 Ammo Production (Outside Blast Radii)	NFA for MEC NFA for MC
West Burn Pads	NFA for MEC NFA for MC
Possible Demolition Site	FS for MEC FS for MC
West Burn Pads Area South of the Road	NFA for MEC NFA for MC
Incendiary Disposal Area	FS for MEC NFA for MC
Maneuver Area	NFA for MEC NFA for MC

## SITE BACKGROUND AND CHARACTERISTICS

The eight MRSs addressed in this Proposed Plan are described in detail below.

### Central Test Area (IAAP-001-R-01)

The Central Test Area (CTA) is located in the north-central portion of IAAAP and covers 22.9 acres. The MRS boundary is shown in blue on **Figure 2**. From approximately 1943 through 1963, the CTA was used for research and development for the testing of hand grenades, mines, and adaptor boosters under static firing test conditions. The CTA included a test-fire pit and a concrete base for the drop test fixture for exploding incendiary bombs (tripod).



**Figure 2 - Central Test Area MRS**

The test-fire pit, located on the northeast portion of the MRS, was used to test-fire hand grenades, adaptor boosters, and mines. Adjacent to the test-fire pit was a concrete pad that supported the tripod used to hold components for test detonation.

During the RI, no MEC was found in the MRS, although many non-hazardous munitions items were recovered from the subsurface and certified

as Material Documented as Safe (MDAS). This included inert fuzes and M1A1 mines from the testfire pit and inert grenades near the Central Test Laboratory.

The MDAS were found in the shallow subsurface soil. The shallow depth and type of items recovered indicate munitions were likely detonated at the surface, consistent with the historical accounts that CTA was a munitions testing area.

Surface and subsurface soil samples were collected for analysis, but no MC was detected above human health or ecological screening criteria. No groundwater sampling was performed because no chemicals were detected in soil above screening criteria.

### Line 6 Ammo Production – Inside Blast Radii (IAAP-002-R-01)

Line 6, known as the “detonator line,” encompasses 95.21 acres near the center of IAAAP. The MRS boundary is shown in pink on **Figure 3**. Line 6 was constructed in 1941 and includes approximately 97 structures, with 34 buildings. Line 6 has been involved in production, storage, and shipping of detonators, primers, relays, delays, hand grenade fuzes, rocket igniters, and mines.

Explosions occurred in 1968 and 1970 at Building 6-34-2 and Building 6-92, respectively, which resulted in the dispersion of MEC to surrounding areas. MEC was identified and addressed at Line 6 after the 1968 and 1970 explosions. Debris was collected following both explosions. RI field activities were limited to within the two buildings’ explosion radii (shown on **Figure 3**) which total about 8.0 acres.

As a result of the RI, the footprint of the Line 6 Ammo Production (IAAP-002-R-01) was reduced to the 8.0 acres inside the blast radii, and a new Line 6 Ammo Production – Outside Blast Radii (IAAP-002-R-02) was created for the 87.21 acres outside the blast radii.

During the RI for the Line 6 Ammo Production – Inside Blast Radii (IAAP-002-R-01), five MEC items were recovered in the subsurface within the blast radii. MEC items recovered were located in

the shallow subsurface soil, consistent with the historical account of the explosions.



**Figure 3 - Line 6 Ammo Production Site**

Surface and subsurface soil samples were collected and analyzed, but no MC was detected above human health or ecological screening criteria. No groundwater sampling was performed because no MC was detected in soil above screening criteria.

#### **Line 6 Ammo Production – Outside Blast Radii (IAAP-002-R-02)**

The Line 6 Ammo Production – Outside Blast Radii (IAAP-002-R-02) encompasses 87.21 acres of the original Line 6 MRS described above. The MRS boundary is shown in orange on **Figure 3**. During the RI, no MEC or fragments of munitions were found outside the blast radii, and therefore, no MC sampling was performed.

#### **West Burn Pads (IAAP-003-R-01)**

The West Burn Pads (WBP) MRS is located in the northeast corner of IAAAP and was used from 1949 through 1982 for flashing metals contaminated with explosives. Flashing was done on earthen pads and within burn cages.

The WBP originally covered 6.98 acres. In March 1997, the WBP was cleared of all visible surface scrap metal and no MEC was reportedly found. The WBP was addressed under the Installation Restoration Program (IRP) as the WBP Area IRP

site (IAAP-032). Under the IRP, approximately 46,496 cubic yards of soil was excavated and removed from the WBP in 2000. Various types of inert and empty (flushed) munitions items were identified and removed, but no MEC was found. Three, non-contiguous portions of the IRP site totaling 0.9 acres were not remediated under the IRP and currently remain in the MMRP as the West Burn Pads MRS (IAAP-003-R-01), as shown in orange on **Figure 4**.

These three areas were investigated during the RI, and no MEC or fragments of munitions were encountered. Since no evidence of munitions was found, no sampling for MC was necessary. Soil and groundwater contamination at WBP are being addressed by the IRP.



**Figure 4 - West Burn Pad MRS and West Burn Pad South of the Road MRS**

#### **West Burn Pads Area South of the Road (IAAP-005-R-01)**

The West Burn Pads Area South of the Road (WBPS) is located in the northeast corner of IAAAP, immediately south of the WBP. The MRS boundary is shown in orange on **Figure 4**. The WBPS covers approximately 10.6 acres.

The WBPS reportedly consisted of two trenches used for approximately 1 year between the 1940s and 1950s for flashing of metals contaminated with explosives, as an extension of the WBP north of the road. An igniter box was found in the MRS, which indicated the possibility of a former burn

pad in the vicinity. An underground viewing bunker with a periscope aimed directly at the WBPS was also found.

During the RI, no MEC was encountered, although minor fragments of munitions were encountered. MC sampling was not required because there was little evidence of munitions related activities and soil and groundwater contamination at the WBPS are being addressed by the FUSRAP and IRP programs, respectively.

#### Possible Demolition Site (IAAP-004-R-01)

The Possible Demolition Site (PDS) is located in the south-central portion of IAAAP and covers approximately 40 acres. The MRS boundary is shown in orange on **Figure 5**.



**Figure 5 - Possible Demolition Site MRS**

The PDS was reportedly used during the 1940s and early 1950s as a demolition area for ammunition items and for demilitarizing white phosphorus rounds. It was reportedly located south of the K Road and east of Long Creek.

The PDS acreage was expanded during the RI by 25 acres, including the area north of K Road. An active small arms range is located north of K Road and within the PDS boundary, but the active small arms range is excluded from the MMRP and is not part of the PDS MRS. A Historical Small Arms Range is also found within the PDS, which is currently being addressed by the Army through an engineering evaluation /cost

analysis (EE/CA) and Removal Action to address lead in soil from small arms. During the RI, MEC, including fuzes and an M5A1 cartridge, was found in the shallow subsurface soil. Non-hazardous munitions debris was also found, such as pieces of M1A1 mines, 81mm mortars, and 75mm projectiles.

Surface soil, subsurface soil, and groundwater samples were collected and analyzed for explosive compounds and certain metals associated with munitions. No explosives were detected above screening criteria in soil except for RDX in one location at a depth of 0.5 to 2 feet below ground. The soil sample had an RDX concentration of 14 mg/kg, exceeding the 1.3 mg/kg Remedial Goal for the protection of groundwater. The sample location was adjacent to a fuze component, which was likely the source of the RDX. Copper and mercury were detected above ecological screening criteria in surface soil, but were not found to pose unacceptable ecological risks in the risk assessment.

As a result of the 2006 USEPA dispute resolution, fencing was installed around the perimeter of the MRS in 2012.

#### Incendiary Disposal Area (IAAP-006-R-01)

The Incendiary Disposal Area (INDA) is located north of K Road, near the east boundary of IAAAP, and covers approximately 34 acres. The MRS boundary is shown in orange on **Figure 6**.

The INDA was reportedly used as a high explosives (HE) demolition area and/or for burial of unknown materials. Historical drawings indicate that the INDA was small (approximately 40 feet by 60 feet) and surrounded by a barbed wire fence. Through various investigations, the boundary has expanded to the current 34 acres.

Four MEC items were recovered on the surface of the INDA, and 17 MEC items were recovered from the subsurface. MEC included 19 75mm projectiles and two M1A1 mines. Many fragments of these and other munitions were also recovered.



**Figure 6 - Incendiary Disposal Area MRS**

MEC items recovered from the INDA during the intrusive investigation were located in the shallow surface soil, and others likely remain. The depths, types, and conditions of items (i.e., unfuzed and unfired) was consistent with historical accounts that INDA was a munitions demolition area.

Surface and subsurface soil samples were collected and analyzed for MC. No chemicals were detected above human health screening criteria. Lead and mercury were detected at concentrations that exceeded ecological risk screening criteria in surface soil (0 to 0.5 feet below ground surface) in two distinct areas in the west-central and south-central portions of the MRS. No MC was detected above ecological screening criteria in subsurface soil. No groundwater sampling was performed because no MC was detected in subsurface soil above screening criteria.

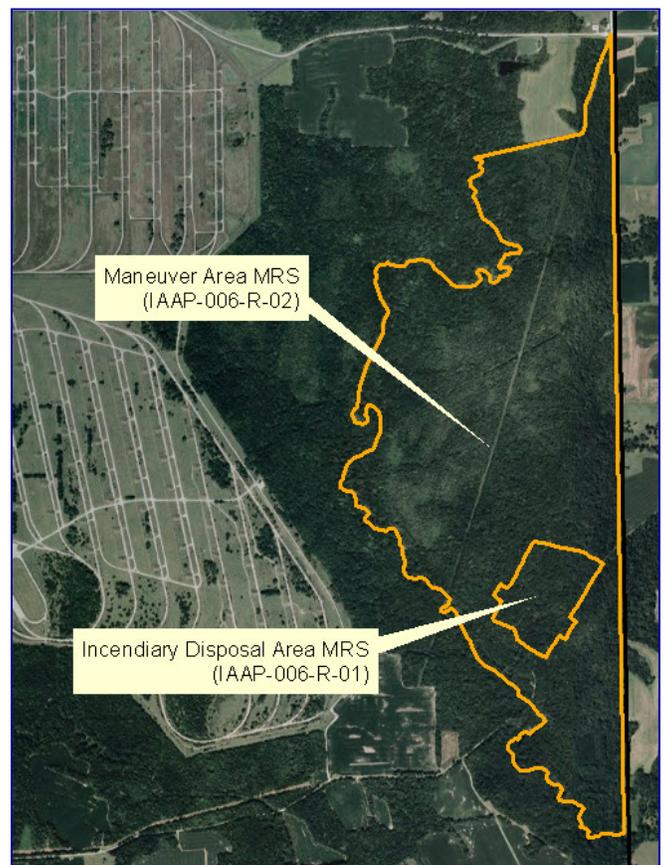
As a result of the 2006 USEPA dispute resolution, fencing was installed around the perimeter of the MRS in 2012.

**Maneuver Area (IAAP-006-R-02)**

The Maneuver Area (MA) is located along the east boundary of IAAAP. The MRS boundary is shown in orange on **Figure 7**. The MA MRS

covers approximately 486 acres, and does not include the separate Incendiary Disposal Area MRS that is within its boundary.

The Iowa Army National Guard (IA ARNG) was authorized to perform training exercises at the MA since at least 1969. Training exercises included dismounted movement, construction of bivouac sites, and night convoy operations. In addition, IA ARNG was authorized to use ammunition blanks and pyrotechnics during training activities. Troop training may have included emplacement and breaching of obstacles, inert minefield emplacement, inert demolition training, and simulated nuclear-biological-chemical training.



**Figure 7 - Maneuver Area MRS**

During the RI, no MEC or fragments of munitions were encountered at the MA MRS. Therefore, no sampling for MC was performed.

**SCOPE AND ROLE OF RESPONSE ACTION**

This Proposed Plan addresses eight MMRP MRSs collectively known as Operable Unit 5. The

actions selected will be the final actions for the MRSs. The overall cleanup strategy is to take appropriate action to remedy environmental contamination when there is an unacceptable risk to human health or the environment. Environmental contamination at the MMRP MRSs may consist of MEC or MC. Actions are selected after considering remedial alternatives involving land use restrictions, access restrictions, and MEC or contaminated soil removal, and applying cost-effective solutions.

## SUMMARY OF SITE RISKS

The Army assessed risk to determine current and future effects of contaminants on human health and the environment from MEC and MC.

### MEC Hazard Assessment

A MEC Hazard Assessment (MEC HA) was performed in accordance with the October 2008 guidance developed by the DoD and EPA to assess explosive hazards. The MEC HA model assigns a relative Hazard Level from 1 to 4, with 1 representing the highest level of hazard and 4 representing the lowest.

The MEC HA model evaluates MEC exposure pathways and potential explosives safety hazards based on three critical elements: 1) MEC presence (source); 2) Receptor; and 3) Interaction between source and receptor. A completed pathway, indicating a MEC hazard, can only exist if all three elements are present, and risk management response actions can be developed and implemented effectively based on eliminating any one of the three elements.

The RI concluded that there was little or no evidence of residual MEC present posing a hazard to human health for the following four MRSs:

- Line 6 Ammo Production (Outside Blast Radii);
- West Burn Pads;
- West Burn Pads Area South of the Road; and
- Maneuver Area.

No MEC was encountered at these MRSs, indicating incomplete exposure pathways for receptors to interact with MEC (i.e., no MEC sources). Therefore, there is no MEC hazard and

the MEC HA Hazard Level Category ratings are not applicable for these MRSs.

The RI found that there is a potential for MEC to be present at the following four MRSs:

- Central Test Area;
- Line 6 Ammo Production (Inside Blast Radii);
- Possible Demolition Site; and
- Incendiary Disposal Area.

A MEC source is conservatively considered present at the Central Test Area due to the high number of munitions fragments recovered during the RI and due to the nature of historical munitions use. More evidence of a MEC source is available at the other three MRSs, as MEC was definitively found during the RI.

MEC can be present either in the surface or subsurface soil, although the MEC surface clearance activities completed at these MRSs during the RI has led to a reduction of MEC items on the surface. However, subsurface MEC sources may migrate to the surface (i.e., via erosion or frost heave) over time. Thus, the probability of encountering residual surface MEC at the four MRSs still exists but is considered low.

Access to these MRSs by the general public is limited, as IAAAP is a secure facility that is completely fenced. Entry points to IAAAP are manned by security personnel and security personnel patrol the facility 24 hours a day. Additionally, secondary fences with locked gates surround all four MRSs within IAAAP. Potential receptors to MEC include site workers (IAAAP personnel), construction workers, trespassers, hunters, and ecological receptors.

The potential for interaction between source and receptor is limited, given the controlled access to the IAAAP and correspondingly few people that traffic these MRSs. Land use controls implemented at IAAAP limit construction activities and require site work permits. The types of receptor activity at this time are most likely to be related to potential construction activities and permitted hunting activities.

Application of the MEC HA resulted in the lowest Hazard Level score of 4 for the Central Test Site and a slightly higher Hazard Level of 3 for the

Line 6 Ammo Production (Inside Blast Radii), Possible Demolition Site, and Incendiary Disposal Area.

It is the Army's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from MEC at the following MRSs:

- Central Test Area;
- Line 6 Ammo Production (Inside Blast Radii);
- Possible Demolition Site; and
- Incendiary Disposal Area.

### Human Health Risk Evaluation

At all MRSs, no chemicals were detected at concentrations that would pose the potential for unacceptable human health risk based on direct contact exposures to media that were evaluated. The human health risk screening results indicated all potential risks were below  $1 \times 10^{-6}$ ; therefore, further evaluation in a baseline human health risk assessment was not required for any of the MRSs.

However, at the Possible Demolition Site, the explosive compound RDX was detected in soil at a concentration of 14 mg/kg, exceeding the 1.3 mg/kg soil leaching screening level for the protection of groundwater at IAAAP. The elevated RDX was detected in soil at a depth of 0.5 to 2 feet below ground.

It is the Army's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of RDX at the Possible Demolition Site.

### Ecological Risk Evaluation

At the Central Test Area and Line 6 Ammo Production (Inside Blast Radii), no chemicals were detected at concentrations exceeding ecological risk screening criteria, indicating that no action is warranted.

At the PDS and INDA, metals such as copper, lead, and mercury were detected above ecological screening criteria. However, after completing the

food chain modeling for the Indiana bat, all hazard quotients were less than 1, indicating that these chemicals do not pose potential unacceptable risks to the Indiana bat.

### REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) describe what the proposed cleanup alternative is expected to accomplish and serves as the basis for development and evaluation of the selected remedial alternatives.

No RAOs are necessary for the following MRSs because investigations have identified no unacceptable risk:

- Line 6 Ammo Production (Outside Blast Radii);
- West Burn Pads;
- West Burn Pads Area South of the Road; and
- Maneuver Area.

The development of RAOs for MEC focuses on addressing the physical hazards to human receptors. Thus, the RAO for MEC is to *reduce explosives safety hazards to human receptors associated with potential MEC commensurate with current and reasonably anticipated future land use* for the following MRSs:

- Central Test Area;
- Line 6 Ammo Production (Inside Blast Radii);
- Possible Demolition Site; and
- Incendiary Disposal Area.

The development of RAOs for MC is driven by the elevated level of RDX in soil at the Possible Demolition Site that may affect groundwater. Thus, the RAO for MC is to *reduce RDX concentrations in subsurface soil to below the IAAAP OU-1 Remedial Goal of 1.3 mg/kg for the protection of groundwater from soil leaching*, applicable to the following Site:

- Possible Demolition Site.

### SUMMARY OF REMEDIAL ALTERNATIVES

In the FS, three remedial alternatives were developed to address MEC hazards:

- MEC Alternative 1 – No Action;
- MEC Alternative 2 – Land Use Controls; and

- MEC Alternative 3 – MEC Subsurface Clearance.

Three remedial alternatives were also developed to address RDX in soil at the Possible Demolition Site:

- MC Alternative 1 – No Action;
- MC Alternative 2 – Land Use Controls; and
- MC Alternative 3 – Removal with Off-Site Disposal.

The No Action alternatives are required by the National Oil and Hazardous Substances Pollution Contingency Plan for baseline comparison purposes (40 CFR 300.430[e][6]).

Several of the alternatives require Land Use Controls (LUCs) such as access restrictions, educational awareness, and fencing to limit the use of portions of the property or to ensure that groundwater is not used for drinking water purposes. These resource use restrictions are discussed in each alternative as appropriate. Monitoring to ensure the effectiveness of the remedy is also a component of each alternative except the “no-action” alternative.

The three MEC and three MC alternatives are described below along with estimated capital, operations and maintenance (O&M) and present worth costs. Present worth cost is the amount of money that would need to be invested in the current year to sufficiently fund the alternative for its duration with a fixed discount rate.

**MEC Alternatives**

**MEC Alternative 1 – No Action**

*Estimated Capital Cost: \$0*  
*Total 30-Year O&M Cost: \$0*  
*Total Present Worth Cost: \$0*

The No Action alternative assumes no remedial action would be taken to address MEC hazards. No administrative or engineering land use controls would be implemented and existing fencing would not be maintained.

**MEC Alternative 2 – Land Use Controls**

*Central Test Area*  
*Estimated Capital Cost: \$323,913*  
*Total 30-Year O&M Cost: \$107,880*

*Total Present Worth Cost: \$400,637*

Line 6 Ammo Production (Inside Blast Radii)

*Estimated Capital Cost: \$134,115*  
*Total 30-Year O&M Cost: \$105,330*  
*Total Present Worth Cost: \$209,012*

Possible Demolition Site

*Estimated Capital Cost: \$39,675*  
*Total 30-Year O&M Cost: \$177,000*  
*Total Present Worth Cost: \$165,935*

Incendiary Disposal Area

*Estimated Capital Cost: \$39,675*  
*Total 30-Year O&M Cost: \$176,310*  
*Total Present Worth Cost: \$165,441*

Alternative 2 includes LUCs at each MRS. LUCs consist of administrative and engineering controls that prevent or reduce the hazards associated with MEC. The alternative would not allow unrestricted use and unlimited exposure.

Administrative controls would consist of access restrictions, legal notices, requirements for construction support, educational awareness, and health and safety program. Construction support would include specialized unexploded ordnance (UXO) technicians for stand-by support during installation of fencing and signage to ensure the safety of construction personnel from the harmful effects of MEC. The alternative includes the development of an LUC Plan and a Land Use Control Implementation Plan to establish specific controls and to implement and monitor the specific procedures for LUCs.

Engineering controls for MEC hazards would consist of fencing and signage to restrict access and inform people of the presence of MEC.

O&M costs include maintenance of fencing and signage, periodic future assessments regarding changes to land use, and five-year reviews to evaluate the continued effectiveness and permanence of the alternative. LUCs are anticipated to be required for the foreseeable future, however, for the purposes of comparing costs of alternatives, the alternative duration is assumed to be 30 years.

### **MEC Alternative 3 – MEC Subsurface Clearance**

#### Central Test Area

*Estimated Capital Cost: \$693,807*  
*Total 30-Year O&M Cost: \$18,630*  
*Total Present Worth Cost: \$706,568*

#### Line 6 Ammo Production (Inside Blast Radii)

*Estimated Capital Cost: \$332,510*  
*Total 30-Year O&M Cost: \$18,630*  
*Total Present Worth Cost: \$345,272*

#### Possible Demolition Site

*Estimated Capital Cost: \$1,399,495*  
*Total 30-Year O&M Cost: \$18,630*  
*Total Present Worth Cost: \$1,412,257*

#### Incendiary Disposal Area

*Estimated Capital Cost: \$1,023,188*  
*Total 30-Year O&M Cost: \$18,630*  
*Total Present Worth Cost: \$1,035,950*

MEC Alternative 3 includes a MEC subsurface clearance to site-specific depth at each MRS. RI results indicated all MEC and MD were recovered within 2 feet below ground at all MRSSs, and the response action would generally be completed to this depth. MEC subsurface clearances would significantly reduce the risk of explosives safety hazards associated with MEC at each MRS, by removing MEC and MPPEH remaining within subsurface soil.

The MEC subsurface clearance activities will utilize the existing comprehensive RI analog and digital geophysical data identifying potential MEC locations. Potential MEC items would be removed using manual removal techniques (e.g., shovels, hand equipment). Recovered MEC will be destroyed and non-hazardous munitions material will be handled, stored, demilitarized, and recycled in accordance with DoD requirements.

MEC subsurface clearances would exclude developed areas such as roads and building footprints. Approximate MRS response action acreages are 22.6 acres for the Central Test Area, 8 acres for the Line 6 Ammo Production (Inside Blast Radii), 40 acres for the Possible Demolition Site, and 34 acres for the Incendiary Disposal Area.

The total number of potential MEC items to be investigated, based on anomalies in geophysical data collected during the RI, was estimated for each MRS. Anomaly estimates for each MRS are 5,199 for the Central Test Area, 1,866 for the Line 6 Ammo Production (Inside Blast Radii), 11,233 for the Possible Demolition Site, and 6,371 for the Incendiary Disposal Area. The vast majority of these anomalies are not MEC, but must be excavated to determine if it represents a hazardous item, significantly driving costs.

O&M includes five-year reviews to evaluate the continued effectiveness and permanence of the alternative.

### **MC Alternatives**

#### **MC Alternative 1 – No Action**

##### Possible Demolition Site

*Estimated Capital Cost: \$0*  
*Total 30-Year O&M Cost: \$0*  
*Total Present Worth Cost: \$0*

The No Action alternative assumes no remedial action would be taken. No administrative or engineering LUCs would be implemented and existing fencing would not be maintained.

#### **MC Alternative 2 – Land Use Controls**

##### Possible Demolition Site

*Estimated Capital Cost: \$175,501*  
*Total 30-Year O&M Cost: \$221,910*  
*Total Present Worth Cost: \$333,357*

MC Alternative 2 includes LUCs consisting of administrative and engineering controls.

Administrative controls would consist of groundwater access restrictions and legal notices.

Engineering controls consists of the installation and annual sampling of two groundwater monitoring wells to verify that RDX is not migrating from the Site.

O&M would include annual groundwater sampling and maintenance of monitoring wells, periodic future assessments regarding changes to land use, and five-year reviews to evaluate the continued effectiveness and permanence of the alternative. LUCs are anticipated to be required for the foreseeable future, however, for the

purposes of comparing costs of alternatives, the alternative duration is assumed to be 30 years.

**MC Alternative 3 – Removal with Off-Site Disposal**

Possible Demolition Site

*Estimated Capital Cost: \$231,029*

*Total 30-Year O&M Cost: \$37,260*

*Total Present Worth Cost: \$256,552*

MC Alternative 3 involves removal and off-site disposal of surface and subsurface soil with RDX concentrations above the IAAAP Remedial Goal of 1.3 mg/kg for the protection of groundwater.

Based on RI results, an estimated 200 cubic yards of soil would require excavation and transportation to an approved off-site Resource Conservation and Recovery Act (RCRA) Subtitle D landfill.

MC sampling would be conducted prior to excavation to further define the extent of contamination. Soil would be excavated by heavy equipment (e.g., backhoe) from 0 to 3 feet below ground. Soil removal would be extended laterally and vertically until confirmation results are below the Remedial Goal for RDX in soil. Site restoration including backfill, compaction, and re-vegetation would be performed in accordance with ARARs.

LTM would include five-year reviews to evaluate the continued effectiveness and permanence of the alternative.

**EVALUATION OF ALTERNATIVES**

In accordance with CERCLA regulations, the Army and EPA used the nine CERCLA Evaluation Criteria to determine the best alternative for each MRS.

**CERCLA EVALUATION CRITERIA FOR REMEDIAL ALTERNATIVES**

**Threshold Criteria:**

- 1) **Overall Protection of Human Health and the Environment:** Does the alternative protect human health and the environment from exposure to risks above acceptable threshold levels?
- 2) **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs):** Does the alternative comply with all required laws, statutes, and regulations?

For an alternative to be selected, it must meet the two Threshold Criteria.

**Balancing Criteria:**

- 3) **Long-Term Effectiveness and Permanence:** Is the alternative effective and permanent for the contamination at the site?
- 4) **Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment:** Does the alternative reduce the toxicity, mobility, and volume of the contaminants?
- 5) **Short-Term Effectiveness:** What is the risk to the community, workers, and the environment during implementation of the response action?
- 6) **Implementability:** How difficult is it to implement the alternative?
- 7) **Cost:** What are the relative costs associated with the alternative?

**Modifying Criteria:**

- 8) **State / Support Agency Acceptance:** Do the regulatory agencies involved accept the remedy?
- 9) **Community Acceptance:** Does the community accept the remedy as viable option?

Modifying criteria will be evaluated in the Record of Decision following agency and public comments on the Proposed Plan.

The evaluation of MEC and MC alternatives using the nine CERCLA criteria are as follows.

### **Threshold Criteria:**

#### **1. Overall Protection of Human Health and the Environment**

MEC Alternative 1 (No Action) would not be protective of human health and the environment because there would be no mechanism in place to prevent receptors from interacting with MEC. MEC Alternative 2 (Land Use Controls) provides moderate protection by removing or reducing the potential for exposure to MEC through access restrictions and administrative and engineering controls. MEC Alternative 3 (MEC Subsurface Clearance) provides the greatest protection to human health and the environment because the MEC source is removed, although residual explosives safety hazards associated with unidentified MEC at greater depths would remain at the MRSs.

MC Alternative 1 (No Action) does not address the potential for MC contamination of groundwater through soil leaching processes and may not be protective of human health and the environment. MC Alternative 2 (Land Use Controls) provides moderate protection to human health and the environment by monitoring of groundwater annually, thus providing awareness and restriction of groundwater use in the event that migration through soil leaching occurs. MC Alternative 3 (Removal with Off-Site Disposal) provides the greatest protection to human health and the environment by removing contaminants and the potential for migration to groundwater.

#### **2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)**

MEC Alternative 1 (No Action) may not comply with ARARs because explosives safety hazards associated with MEC would remain and would continue to present an endangerment to human health and the environment. MEC Alternative 2 (Land Use Controls) and MEC Alternative 3 (MEC Subsurface Clearance) would comply with ARARs.

MC Alternative 1 (No Action) may not comply with ARARs due to the potential for MC

contamination of groundwater through soil leaching processes. MC Alternative 2 (Land Use Controls) complies with ARARs, but leaves potential for MC contamination of groundwater through soil leaching processes. Additional remedial actions would have to be implemented if groundwater is found to be contaminated during future groundwater monitoring activities to comply with ARARs. MC Alternative 3 (Removal with Off-Site Disposal) complies with ARARs.

### **Balancing Criteria:**

#### **3. Long-Term Effectiveness and Permanence**

MEC Alternative 1 (No Action) does not provide long-term effectiveness because no action would be taken to address the explosives safety hazards. MEC Alternative 2 (Land Use Controls) would provide moderate long-term effectiveness by implementing controls to restrict access, completing five-year reviews, and incorporating construction support during future intrusive activities. MEC Alternative 3 (MEC Subsurface Clearance) would provide the highest level of long-term effectiveness when compared with all other alternatives. Removal of MEC significantly reduces explosives safety hazards. A residual risk of MEC would remain.

MC Alternative 1 (No Action) does not provide long-term effectiveness because the potential for groundwater contamination through soil leaching remains. MC Alternative 2 (Land Use Controls) offers more long-term effectiveness than MC Alternative 1, by monitoring and restricting use of the groundwater. Ongoing monitoring and review is required to maintain continued effectiveness and permanence. MC Alternative 3 (Removal with Off-Site Disposal) offers the best long-term effectiveness by removing contaminated soil.

#### **4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment**

MEC Alternative 1 (No Action) and MEC Alternative 2 (Land Use Controls) do not provide any additional reduction in mobility or volume of MEC. However, it should be noted that these alternatives build on the previous work done at the MRSs which included the removal of all MEC exposed at the surface accomplished during the

Remedial Investigation. MEC Alternative 3 (MEC Subsurface Clearance) reduces the volume and mobility of MEC.

MC Alternative 1 (No Action) and MC Alternative 2 (Land Use Controls) include no active reductions in toxicity, mobility, or volume of RDX, although Alternative 2 does monitor for mobility into groundwater. MC Alternative 3 (Removal with Off-Site Disposal) reduces toxicity of soil to below the IAAAP Remedial Goal, decreases the volume of MC in soil, and removes the potential for migration of contaminants.

**5. Short-Term Effectiveness**

MEC Alternative 1 (No Action) includes no additive short-term impacts to the community, workers, or environment associated with the implementation of this alternative, because no action will be taken. MEC Alternative 2 (Land Use Controls) involves a relatively low risk of explosives safety hazards to workers during installation of fencing and signage due to limited worker interaction with media containing MEC. MEC Alternative 3 (MEC Subsurface Clearance) would require more hazardous exposure to field personnel than MEC Alternatives 1 and 2.

MC Alternative 1 (No Action) includes no additive short-term impacts to the community, workers, or environment associated with the implementation of this alternative, because no action will be taken. MC Alternative 2 (Land Use Controls) involves a very low risk of explosives safety hazards to workers during construction of monitoring wells due to the potential presence of MEC at the Possible Demolition Site, but this risk is reduced with anomaly avoidance and the limited scope of intrusive activities. MC Alternative 3 (Removal with Off-Site Disposal) involves more explosives safety hazards than Alternative 2 due to workers performing soil removal activities. This risk is reduced with stand-by construction support and the limited scope of intrusive activities. The time to achieve RAOs is potentially within 1 year.

**6. Implementability**

MEC Alternative 1 (No Action) does not include an action to implement. MEC Alternative 2 (Land

Use Controls) is considered moderately difficult to technically and administratively implement. MEC Alternative 3 (MEC Subsurface Clearance) is technically and administratively more difficult to implement than MEC Alternatives 1 and 2 in light of challenges associated with the MEC subsurface clearance.

MC Alternative 1 (No Action) does not include an action to implement. MC Alternative 2 (Land Use Controls) is moderately difficult to implement due to the technical and administrative challenges associated with specialized personnel for anomaly avoidance, management and operation of annual groundwater sampling, and annual O&M of monitoring wells. MC Alternative 3 (Removal with Off-Site Disposal) is more difficult to implement than Alternatives 1 and 2 in light of the technical and administrative challenges associated with the operation and management of the soil construction activities.

**7. Cost**

The total present worth for each alternative by Site is summarized in **Table 2**.

**Table 2 - Total Present Worth Cost Summary**

Site	MEC Alternatives		
	1	2	3
Central Test Area	\$0	\$401K	\$707K
Line 6 Ammo Production (Inside Blast Radii)	\$0	\$209K	\$345K
Possible Demolition Site	\$0	\$166K	\$1,412K
Incendiary Disposal Area	\$0	\$165K	\$1,036K
Site	MC Alternatives		
	1	2	3
Possible Demolition Site	\$0	\$333K	\$257K

MEC Alternative 1 (No Action) has no associated costs. MEC Alternative 2 (Land Use Controls) costs include capital costs for fencing and signage, and O&M costs for annual maintenance of fencing and signage, and five-year reviews. Alternative 2 overall costs are significantly less than Alternative 3. MEC Alternative 3 (MEC Subsurface Clearance) costs are the highest due

primarily to capital costs for the MEC subsurface clearance. O&M costs are for five-year reviews.

*MC Alternative 1 (No Action)* has no associated costs. *MC Alternative 2 (Land Use Controls)* costs are the highest of all alternatives, primarily due to ongoing O&M costs for annual sampling and maintenance of wells. Other costs include capital costs for installation of monitoring wells and five-year reviews. *MC Alternative 3 (Removal with Off-Site Disposal)* costs include capital costs for soil removal/disposal and O&M costs for five-year reviews. Alternative 3 overall costs are less than Alternative 2 because annual monitoring is not required.

### **Modifying Criteria:**

The modifying criteria State / Support Agency Acceptance and Community Acceptance will be evaluated in the Record of Decision following agency and public comments on the Proposed Plan.

## **CONSIDERATION OF GREEN AND SUSTAINABLE REMEDIATION PRACTICES**

Pursuant to the DERP Manual (March 9, 2012), Green and Sustainable Remediation (GSR) expands on DoD's current environmental practices and employs strategies for environmental restoration that:

- Use natural resources and energy efficiently;
- Reduce negative impacts on the environment;
- Minimize or eliminate pollution at its source; and
- Reduce waste to the greatest extent possible.

Green and sustainable remediation uses strategies that consider all environmental effects of remedy implementation and operation and incorporates options to maximize the overall environmental benefit of environmental response actions. The Manual further states that "*the DoD Component should consider and implement green and sustainable remediation opportunities in current and future remedial activities when feasible.*"

A 2012 GSR Evaluation for IAAAP sites included GSR Evaluation for the Central Test Area, Line 6

Ammo Production (Inside Blast Radii), Possible Demolition Site, and Incendiary Disposal Area.

The GSR evaluation concluded that MEC Alternative 2 (Institutional Controls) is estimated to cost substantially less than MEC Alternative 3 (MEC Subsurface Clearance) for each MRS. The GSR footprint results indicate that MEC Alternative 2 also has lower footprints for nearly all the GSR parameters. Most notable footprint advantages for MEC Alternative 2 relative to MEC Alternative 3 are:

- Energy use is lower;
- Greenhouse gas emissions are lower;
- Criteria pollutant emissions are lower; and
- Risk of injury/fatality is lower.

The only significant footprint advantage for MEC Alternative 3 is that refined materials are not used, whereas, steel and concrete for signs are needed for Alternative 2.

The GSR evaluation also concluded MC Alternative 3 (Removal with Off-Site Disposal) for the Possible Demolition Site is estimated to cost substantially less over the life-cycle than MC Alternative 2 (Land Use Controls). The GSR footprint results indicate that MC Alternative 3 also has lower footprints for nearly all of the GSR parameters other than cost. Most notable footprint advantages for MC Alternative 3 relative to MC Alternative 2 are:

- Energy use is lower;
- Greenhouse gas emissions are lower;
- Criteria pollutant emissions are lower;
- Unrefined materials use is lower; and
- Risk of injury/fatality is lower.

The only significant footprint advantage for MC Alternative 2 is that there is no off-site waste disposal, whereas there is for MC Alternative 3.

## **PREFERRED ALTERNATIVES**

### **No Further Action Sites**

As discussed previously, there are no unacceptable risks and no RAOs for the following MRSs:

- Line 6 Ammo Production (Outside Blast Radii);
- West Burn Pads;

- West Burn Pads Area South of the Road; and
- Maneuver Area.

No MEC was encountered during the RI and there are no known risks associated with these MRSs. Therefore, No Further Action (NFA) is preferred for these four MRSs.

### MEC Sites

**MEC Alternative 2 (Institutional Controls)** is the preferred alternative to address MEC at the following four MRSs:

- Central Test Area;
- Line 6 Ammo Production (Inside Blast Radii);
- Possible Demolition Site; and
- Incendiary Disposal Area.

Under MEC Alternative 2, the installation of signage and O&M of fencing and signage would be required around the perimeter of the MRSs. Fencing is already in place for all MRSs except at the Central Test Area and Line 6 Ammo Production around the blast radii. Under this alternative, an interior fence around the blast radii will be installed.

The RI activities previously removed MEC from the surface at all four MRSs, which is the most accessible MEC. Residual MEC may remain in the subsurface, however, which can migrate to the surface over time. Existing security fencing around the IAAAP, combined with secondary fencing around each MRS reduces the presence of human receptors. Signage would educate the public and further reduce MEC interaction with human receptors.

Since there is no planned use for these sites, fencing and restriction of land use under the Institutional Controls alternative would not interfere with future land use plans for the IAAAP.

This alternative meets the MEC RAO by reducing explosives safety hazards to human and ecological receptors associated with potential MEC commensurate with current and reasonably anticipated future land use.

This alternative is protective of human health and the environment, complies with ARARs, is effective in the short and long term, is

implementable, and provides a lower cost than other acceptable alternatives.

Furthermore, the 2012 Green and Sustainable Remediation (GSR) Evaluation performed for the IAAAP supports the recommendation of MEC Alternative 2 at each MRS.

### MC Site (Possible Demolition Site)

In addition to MEC hazards, the Possible Demolition Site contains MC hazards associated with RDX in soil. The preferred alternative to address RDX in soil is **MC Alternative 3 (Removal with Off-Site Disposal)**.

MC Alternative 3 consists of removal and off-site disposal of soil containing RDX above the IAAAP Remedial Goal for protection of groundwater. After off-site disposal of contaminated soil, the area would be backfilled using clean soil and restored to original condition. The alternative would be in accordance with ARARs and would meet the MC RAO by reducing RDX concentrations in subsurface soils to below the IAAAP Remedial Goal of 1.3 mg/kg for the protection of groundwater from soil leaching.

This alternative is protective of human health and the environment, complies with ARARs, is effective in the short and long term, is implementable, and provides a lower cost than other acceptable alternatives.

Furthermore, the 2012 GSR Evaluation for IAAAP supports the recommendation of MC Alternative 3 for the Possible Demolition Site.

**Preferred Alternative Summary**

**Table 3** provides a summary of the preferred alternatives for each MMRP Site.

**Table 3 – Preferred Alternatives**

Munitions Response Site	Preferred Alternative
Central Test Area	MEC Alternative 2 – Institutional Controls
Line 6 Ammo Production (Inside Blast Radii)	MEC Alternative 2 – Institutional Controls
Line 6 Ammo Production (Outside Blast Radii)	No Further Action
West Burn Pads	No Further Action
Possible Demolition Site	MEC Alternative 2 – Institutional Controls and MC Alternative 3 – Removal with Off-Site Disposal
West Burn Pads Area South of the Road	No Further Action
Incendiary Disposal Area	MEC Alternative 2 – Institutional Controls
Maneuver Area	No Further Action

The Army and EPA support the Preferred Remedial Alternatives stated above and believe they provide the best remedial alternatives with respect to the evaluation criteria. The Army and EPA expect the Preferred Remedial Alternative to satisfy the following statutory requirements of CERCLA Section 121(b): 1) be protective of human health and the environment; 2) comply with Applicable or Relevant and Appropriate Requirements; 3) be cost effective and 4) utilize permanent solutions and alternative treatment technologies to the maximum extent practicable.

The Preferred Alternative can change in response to public comment or new information.

**COMMUNITY PARTICIPATION**

Detailed information regarding this proposed action is available in the Administrative Record File, which is located online at [www.iaaap.adminrecord.com](http://www.iaaap.adminrecord.com). A hard copy is located at the IAAAP Library. The Burlington

Public Library has computers available to the public for those interested in viewing the electronic version of the Admin Record. An announcement of the availability of this Proposed Plan was published in the Hawk Eye newspaper on May 5, 2013, in accordance with CERCLA.

The Army is seeking comments on the action recommended in this Proposed Plan. A public comment period running from May 6, 2013 to June 4, 2013 is open during which comments will be accepted and considered prior to a final decision on the eight MMRP MRSs. In addition, a public meeting will be held at the Comfort Suites Hotel, 1780 Stonegate Center Drive, Burlington, Iowa, on May 28, 2013, to explain this proposed action and to answer questions and accept comments. A comment form has been included at the end of this document to submit input on the Proposed Plan.

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**ACRONYMS AND ABBREVIATIONS**

ARAR .....Applicable or Relevant and Appropriate Requirement

CERCLA.....Comprehensive Environmental Response, Compensation, and Liability Act

CTA.....Central Test Area

DERP .....Defense Environmental Restoration Program

DoD.....Department of Defense

EE/CA.....Engineering Evaluation/Cost Analysis

EPA.....U.S. Environmental Protection Agency

FFA .....Federal Facility Agreement

FS .....Feasibility Study

FUSRAP .....Formerly Utilized Sites Remedial Action Program

GSR.....Green and Sustainable Remediation

HE .....High Explosives

HRR .....Historical Records Review

IA ARNG .....Iowa Army National Guard

IAAAP .....Iowa Army Ammunition Plant

INDA.....Incendiary Disposal Area

IRP .....Installation Restoration Program

LUC.....Land Use Control

MA .....Maneuver Area

MC .....Munitions Constituents

MDAS .....Material Documented as Safe

MEC HA .....MEC Hazard Assessment

MEC.....Munitions and Explosives of Concern

mg/kg .....milligrams per kilogram

MMRP.....Military Munitions Response Program

MRS .....Munitions Response Site

NFA.....No Further Action

NPL.....National Priorities List

O&M.....Operations & Maintenance

PDS .....Possible Demolition Site

RAO .....Remedial Action Objective

RCRA.....Resource Conservation and Recovery Act

RI.....Remedial Investigation

SI.....Site Inspection

UXO.....Unexploded Ordnance

WBP.....West Burn Pads

WBPS.....West Burn Pads Area South of the Road

## GLOSSARY OF TERMS

***Administrative Record File*** – A compilation of documents that serve as the basis for the decision in selecting a response action to be taken at a site.

***Anomaly*** – Any item that is seen as a subsurface irregularity after geophysical investigation. This irregularity will deviate from the expected subsurface ferrous and non-ferrous material at a site (i.e., pipes, power lines, etc.).

***Applicable or Relevant and Appropriate Requirements (ARARs)*** – The federal and state environmental laws that a selected remedy will meet. These requirements may vary among sites and alternatives.

***Comprehensive Environmental Response Compensation, and Liability Act (CERCLA)*** – The federal law that addresses problems resulting from releases of hazardous substances to the environment.

***Discarded Military Munitions (DMM)*** – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance (UXO), military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations.

***Feasibility Study (FS)*** – This CERCLA document develops and evaluates options for remedial action. The FS emphasizes data analysis and is generally performed concurrently in an interactive fashion with the Remedial Investigation (RI), using data gathered during the RI.

***Land Use Controls (LUCs)*** – Physical, legal, or administrative mechanisms that restrict the use of, or limit access to, contaminated property to reduce risk to human health and the environment. Physical mechanisms encompass a variety of engineered remedies to contain or reduce contamination and physical barriers to limit

access to property, such as fences or signs. The legal mechanisms are imposed to ensure the continued effectiveness of land use restrictions imposed as part of a remedial decision. Legal mechanisms include restrictive covenants, negative easements, equitable servitudes, and deed notices. Administrative mechanisms include notices, adopted local land use plans and ordinances, construction permitting, or other existing land use management systems that may be used to ensure compliance with use restrictions.

***Military Munitions*** – Ammunition products and components produced for or used by the armed forces for national defense and security. The term includes confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes and incendiaries, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof.

***Munitions Constituents (MC)*** – Any materials originating from UXO, discarded military munitions, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions.

***Munitions and Explosives of Concern (MEC)*** – A specific category of military munitions that may pose unique explosives safety risks, and includes: (a) Unexploded Ordnance; (b) Discarded Military Munitions; or (c) Munitions Constituents (e.g., TNT, RDX) present in high enough concentrations to pose an explosive hazard.

***Munitions Debris*** – Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal.

**Munitions Response** – Response actions, including investigation, removal and remedial actions to address the explosives safety, human health, or environmental risks presented by unexploded ordnance (UXO), discarded military munitions (DMM), or munitions constituents (MC).

**Munitions Response Site** – A discrete location that is known to require a munitions response.

**National Priorities List (NPL)** – EPA’s list of uncontrolled or abandoned waste sites that present the greatest potential threat to human health or the environment.

**Operable Unit** – A portion of a site separately considered for remedial or corrective action.

**Operations and Maintenance (O&M)** – Measures required to operate and maintain remedial systems to ensure the effectiveness of the response action.

**Part per Million (ppm)** – A unit of concentration equal to one part in one million (ppm) and one milligram per gram (mg/g).

**Preferred Remedial Alternative** – The remedial alternative selected by the Army and EPA, based on a comparison of various remedial alternatives using specific evaluation criteria.

**Present Worth** – The amount of money that would need to be invested in the current year, at a particular discount rate, to sufficiently evaluate criteria.

**Proposed Plan** – CERCLA document that summarizes evidence to support the selection of a preferred remedial alternative at a CERCLA site. The document is intended for public distribution to solicit comments on the proposed action(s).

**Record of Decision (ROD)** – The CERCLA decision document that presents the cleanup remedy selected by the Army and EPA.

**Remedial Action Objectives (RAOs)** – Site-specific goals to protect human health and the environment.

**Remedial Investigation (RI)** – A process under CERCLA to determine the nature and extent of the problem presented by a contaminant release. The RI includes sampling, monitoring, and gathering of sufficient information to determine the necessity for remedial action.

**Remediation Goals (RGs)** – Contaminant concentrations used to identify the soil requiring excavation, treatment, and disposal to meet the RAOs and provide protection for human health and the environment.

**RDX (Royal Demolition Explosive)** – Hexahydro-1,3,5-trinitro-1,3,5-triazine. A common military munitions explosive; considered a possible human carcinogen.

**Target Risk Range** – EPA-established acceptable risk range for carcinogens of  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ . Estimated excess cancer risks within this range are generally considered unlikely in the general population. If calculated risks fall within the risk range, risk managers must determine whether remedial action is warranted to reduce the risk. If the risks are less than  $1 \times 10^{-6}$  (less than 1 in 1 million), no remedial action is required. If the risks are greater than  $1 \times 10^{-4}$  (1 in 10 thousand), remedial action is generally required.

**Unexploded Ordnance (UXO)** – Military munitions that: (a) Have been primed, fuzed, armed, or otherwise prepared for action; (b) Have been fired, dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (c) Remain unexploded either by malfunction, design, or any other cause.

